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(54) **Processing method of light-sensitive silver halide photographic material having good color reproducibility and whiteness**

Verfahren zur Behandlung eines photographischen lichtempfindlichen Silberhalogenidmaterials, das eine gute Farb- und Weisswiedergabe besitzt

Méthode de traitement de matériau photographique à l'halogénure d'argent sensible à la lumière ayant une bonne reproduction de couleur et de blanc

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(73) Proprietor: **KONICA CORPORATION**
Tokyo 163 (JP)

(72) Inventors:
- **Sasaki, Masao**
  Konishiroku Photo Ind. Co., Ltd.
  Kanagawa-ken (JP)
- **Onodera, Kaoru**
  Konishiroku Photo Ind. Co., Ltd.
  Kanagawa-ken (JP)

(74) Representative:
Henkel, Feiler, Hänzel
Möhlstrasse 37
81675 München (DE)

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- **RESEARCH DISCLOSURE, no. 25758, September 1985, pages 481-499, Industrial Opportunities, Emsworth, Hampshire, GB; "Color photographic light-sensitive material"**
- **RESEARCH DISCLOSURE, no. 24626, October 1984, pages 498-501, Industrial Oppurtunities, Emsworth, Hampshire, GB; "Image-forming process"**
- **PATENT ABSTRACTS OF JAPAN, vol. 10, no. 64 (P-436)[2121], 14th March 1986; & JP-A-60 205 443 (KONISHIROKU SHASHIN KOGYO K.K.) 17-10-1985**

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Description

BACKGROUND OF THE INVENTION

[0001] This invention relates to a processing method for a light-sensitive silver halide photographic material, more particularly to a processing method for a light-sensitive silver halide photographic material in which high color reproducibility and whiteness can be obtained uniformly and stably during continuous processing.

[0002] Color reproducibility of a light-sensitive silver halide color photographic material depends upon various factors. For example, representative factors affecting the color reproducibility are spectral sensitivity distributions of respective light-sensitive emulsion layers, the spectral absorption characteristics of a formed dye image (λmax, sub-absorption, etc.), the degree of turbidity between respective dye images at the development and the presence of fluorescent brightening agent. Particularly in a silver halide photographic material having a reflective support, the dependency of a color forming dye on the spectral absorption characteristics is extremely high when the respective light-sensitive layer has a suitable spectral sensitivity distribution and the turbidity at the development is substantially prevented. As the spectral absorption characteristics of the respective dye image of yellow, magenta and cyan, the main wavelength and the sub-absorption of a spectral transmission curve of a respective dye image are particularly important. Essential spectral absorption characteristics of a dye image of a reflective support type are that the main absorption of a respective dye image of yellow, magenta and cyan is present at the vicinity of 430 to 460 nm, 530 to 550 nm and 630 to 660 nm, respectively, and that unnecessary absorptions at other wavelength regions are not present.

[0003] Heretofore, a dye image which has been used in a light-sensitive silver halide color photographic material for reflective images, did not necessarily satisfy concerning the sub-absorption while it almost satisfied the above requirements as to the main wavelength. Among these, the respective dye image of magenta and cyan has a considerably high sub-absorption at the blue color region (400 nm to 500 nm) and this fact becomes one of the large factors of lowering the color reproducibility of the light-sensitive silver halide color photographic material for reflective images. Further, particularly in the blue color which comprises combining dye images of magenta and cyan, only a blue color having an extremely low saturation can be reproduced due to its high sub-absorption. Such a matter becomes a serious problem at a shadow portion of the blue color having high magenta and cyan concentrations.

[0004] Improvement in such a blue color reproduction can be accomplished by using magenta and cyan couplers which give a little sub-absorption as magenta and cyan couplers. As to such couplers, 1H-pyrazolo-[3,2-C]-S-triazole type magenta couplers are preferred as the magenta coupler and phenol type cyan couplers having acylamino groups at 2- and 5-positions are preferred as the cyan coupler.

[0005] On the other hand, with the usual light-sensitive silver halide color photographic material for reflective image has been carried out a color developing treatment in the presence of a water-soluble fluorescent brightening agent in order to increase the whiteness of an uncolor-formed portion. The fluorescent brightening agent can be added into a color developing solution or previously be added into a light-sensitive photographic material. By remaining the fluorescent brightening agent in the light-sensitive photographic material after processing, a remarkable improvement of the whiteness of the uncolor-formed portion can be accomplished.

[0006] Color reproduction at a high-light portion depends upon not only spectral absorption characteristics but also fluorescent brightening effects and spectral characteristics of the reflective support. In a technique of bluing a reflective support as disclosed in Japanese Provisional Patent Publication No. 19021/1978 and a technique of visually increasing the whiteness by bluing the white portion with a fluorescent brightening agent in order to improve the whiteness, the color reproduction at the high-light portion has also been moved to a blue color direction. Further, in a color photographic material containing a coupler having a little sub-absorption such as 1H-pyrazolo-[3,2-C]-S-triazole type magenta coupler and a phenol type cyan coupler having acylamino groups at 2- and 5-positions, a tendency that the high-light portion is easily carrying a blueness is extremely large.

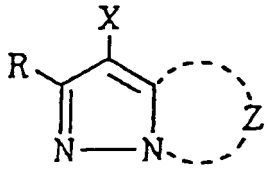
[0007] Further, there is proposed, in Japanese Patent Application No. 175401/1985, a technique of improving a color reproducibility at the high-light portion by processing a color photographic material comprising a combination of a coupler having a little sub-absorption such as 1H-pyrazolo-[3,2-C]-S-triazole type coupler as the aforesaid magenta coupler, a phenol type coupler having acylamino groups at 2- and 5-positions as the cyan coupler and a support having a specific surface reflective characteristic in the presence of a fluorescent brightening agent. However, according to investigations of the present inventors, it can be found that the above effect has been diminished by carrying out a continuous processing while the above effect can be obtained in some extent when a fresh solution has been employed as the processing solution according to the above technique. The fact that a settled effect could not be obtained during such a continuous processing is a great problem since productivity in a developing laboratory is remarkably hindered.

[0008] That is, the present status is that a technique of uniformly and stably obtaining color reproducibilities at both of the shadow portion and the high-light portion even at the continuous processing cannot be found, and development of such a technique has earnestly been desired.

SUMMARY OF THE INVENTION

[0009] An object of the present invention is to provide a processing method for a light-sensitive silver halide photographic material in which high color reproducibility and whiteness at both of the shadow and high-light portions can be obtained uniformly and stably by continuous processing.

[0010] The present inventors have carried out intensive studies in view of the above situation and as a result, they have found a processing method for a light-sensitive silver halide photographic material wherein a light-sensitive silver halide photographic material having at least one silver halide emulsion layer on a reflective support is image-wise exposed and color developed and then immediately bleach-fixed without effecting a water washing step, characterized in that : 1) a magenta coupler represented by the following formula (I) is contained in at least one of the silver halide emulsion layers,



(I)

wherein Z represents a group of non-metallic atoms necessary for forming a nitrogen-containing heterocyclic ring which may have a substituent; X represents a hydrogen atom or a substituent eliminatable through the reaction with the oxidized product of a color developing agent; and R represents a hydrogen atom or a substituent,

2) the total gelatin amount contained in the silver halide emulsion layer containing said magenta coupler and a photographic constituent layer more distant to said layer viewed from the reflective support is 5.0 g/m^2 or more, and 3) a swelling degree (ratio of a film thickness (μm) of a light-sensitive silver halide photographic material at the terminating point of the color development processing step and a film thickness (μm) of the light-sensitive silver halide photographic material before the color development processing step and indicated by the following equation:

$$\text{Swelling degree (\%)} = \frac{\begin{array}{c}\text{Film thickness (}\mu\text{m) of a light-sensitive}\\ \text{silver halide photographic material at the terminating point}\\ \text{of the color development processing step}\end{array}}{\begin{array}{c}\text{Film thickness (}\mu\text{m) of a light-sensitive}\\ \text{silver halide photographic material before}\\ \text{the color development processing step)}\end{array}}$$

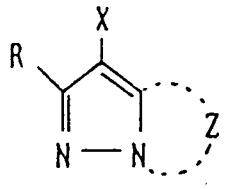
of the light-sensitive silver halide photographic material at the end of said color development processing step is within the range of 220 % to 350 %, and said reflective support has surface reflective characteristics of $L \geqq 88$ - $1.0 \leqq a \leqq 1.5$ and $-5.0 \leqq b \leqq -2.0$ when the values are measured by a method prescribed in JIS-Z-8722-82 and indicated by a method prescribed in JIS-Z-8730-80.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0011] In at least one of silver halide emulsion layers of the light-sensitive silver halide photographic material to be used in the present invention, the magenta coupler represented by the above formula (I) is contained.

[0012] The magenta coupler represented by the formula (I) will be explained below.

[0013] In the formula (I) according to the present invention,



(I)

Z represents a group of non-metallic atoms necessary for forming a nitrogen-containing heterocyclic ring and the ring formed by said Z may have a substituent.

X represents a hydrogen atom or a substituent eliminatable through the reaction with the oxidized product of a color developing agent.

[0014] Further, R represents a hydrogen atom or a substituent.

[0015] As the substituent represented by R, there may be mentioned, for example, halogen atoms, an alkyl group, a cycloalkyl group, an alkenyl group, a cycloalkenyl group, an alkynyl group, an aryl group, a heterocyclic group, an acyl group, a sulfonyl group, a sulfinyl group, a phosphonyl group, a carbamoyl group, a sulfamoyl group, a cyano group, a spiro compound residual group, a bridged hydrocarbon compound residual group, an alkoxy group, an aryloxy group, a heterocyclicoxy group, a siloxy group, an acyloxy group, a carbamoyloxy group, an amino group, an acylamino group, a sulfonamide group, an imide group, an ureido group, a sulfamoylamino group, an alkoxycarbonylamino group, an aryloxycarbonylamino group, an alkoxycarbonyl group, an aryloxycarbonyl group, an alkylthio group, an arylthio group and a heterocyclicthio group.

[0016] As halogen atoms, for example, a chlorine atom or a bromine atom may be used, particularly preferably is the chlorine atom.

[0017] The alkyl group represented by R may include preferably those having 1 to 32 carbon atoms, the alkenyl group or the alkynyl group those having 2 to 32 carbon atoms and the cycloalkyl group or the cycloalkenyl group those having 3 to 12 carbon atoms, particularly 5 to 7 carbon atoms. The alkyl group, alkenyl group or alkynyl group may be either straight or branched.

[0018] These alkyl groups, alkenyl groups, alkynyl groups, cycloalkyl groups and cycloalkenyl groups may also have substituents [e.g. an aryl group, a cyano group, a halogen atom, a heterocyclic ring, a cycloalkyl group, a cycloalkenyl group, a spiro ring compound residual group, a bridged hydrocarbon compound residual group; otherwise those substituted through a carbonyl group such as an acyl group, a carboxy group, a carbamoyl group, an alkoxycarbonyl group and an aryloxycarbonyl group; further those substituted through a hetero atom, specifically those substituted through an oxygen atom such as of a hydroxy group, an alkoxy group, an aryloxy group, a heterocyclicoxy group, a siloxy group, an acyloxy group, or a carbamoyloxy group,; those substituted through a nitrogen atom such as of a nitro group, an amino (including a dialkylamino group,.), a sulfamoylamino group, an alkoxycarbonylamino group, an aryloxycarbonylamino group, an acylamino group, a sulfonamide group, an imide group or an ureido group,; those substituted through a sulfur atom such as of an alkylthio group, an arylthio group, a heterocyclicthio group, a sulfonyl group, a sulfinyl group or a sulfamoyl group,; and those substituted through a phosphorus atom such as of a phosphonyl group,].

[0019] More specifically, there may be included, for example, a methyl group, an ethyl group, an isopropyl group, a t-butyl group, a pentadecyl group, a heptadecyl group, a 1-hexylonyl group, a 1,1'-dipentylnonyl group, a 2-chloro-t-butyl group, a trifluoromethyl group, a 1-ethoxytridecyl group, a 1-methoxyisopropyl group, a methanesulfonylethyl group, a 2,4-di-t-amylphenoxymethyl group, an anilino group, a 1-phenylisopropyl group, a 3-m-butanesulfoneaminophenoxypropyl group, a 3,4'-(α-[4"-(p-hydroxybenzenesulfonyl)phenoxy]dodecanoylamino)phenylpropyl group, a 3-(4'-[α-(2",4"-di-t-amylphenoxy)butaneamido]phenyl)propyl group, a 4-[α-(o-chlorophenoxy)tetradecaneamidophenoxy]propyl group, an allyl group, a cyclopentyl group or a cyclohexyl group.

[0020] The aryl group represented by R may preferably be a phenyl group, which may also have a substituent (e.g. an alkyl group, an alkoxy group, or an acylamino group).

[0021] More specifically, there may be included a phenyl group, a 4-t-butylphenyl group, a 2,4-di-t-amylphenyl group, a 4-tetradecaneamidophenyl group, a hexadecyloxyphenyl group or a 4'-[α-(4"-t-butylphenoxy)tetradecaneamido]phenyl group.

[0022] The heterocyclic group represented by R may preferably be a 5- to 7-membered ring, which may either be substituted or fused. More specifically, a 2-furyl group, a 2-thienyl group, a 2-pyrimidinyl group or a 2-benzothiazolyl group may be mentioned.

[0023] The acyl group represented by R may be, for example, an alkylcarbonyl group such as an acetyl group, a phenylacetyl group, a dodecanoyl group, or an α-2,4-di-t-amylphenoxybutanoyl group; an arylcarbonyl group such as a benzoyl group, a 3-pentadecyloxybenzoyl group or a p-chlorobenzoyl group.

[0024] The sulfonyl group represented by R may include alkylsulfonyl groups such as a methylsulfonyl group or a dodecylsulfonyl group; arylsulfonyl groups such as a benzenesulfonyl group, or a p-toluenesulfonyl group.

[0025] Examples of the sulfinyl group represented by R are alkylsulfinyl groups such as an ethylsulfinyl group, an octylsulfinyl group or a 3-phenoxybutylsulfinyl group arylsulfinyl groups such as a phenylsulfinyl group or a m-pentadecylphenylsulfinyl group.

[0026] The phosphonyl group represented by R may be exemplified by alkylphosphonyl groups such as a butyloctylphosphonyl group; alkoxyphosphonyl groups such as an octyloxyphosphonyl group; aryloxyphosphonyl groups such as a phenoxyphosphonyl group; and arylphosphonyl groups such as a phenylphosphonyl group.

[0027] The carbamoyl group represented by R may be substituted by an alkyl group, an aryl group (preferably a phenyl group), including, for example, an N-methylcarbamoyl group, an N,N-dibutylcarbamoyl group, an N-(2-pentadecyloctylethyl)carbamoyl group, an N-ethyl-N-dodecylcarbamoyl group or an N-{3-(2,4-di-t-amylphenoxy)propyl}carbamoyl group.

[0028] The sulfamoyl group represented by R may be substituted by an alkyl group, an aryl group (preferably a phenyl group) including, for example, an N-propylsulfamoyl group, an N,N-diethylsulfamoyl group, an N-(2-pentadecyloxyethyl)sulfamoyl group, an N-ethyl-N-dodecylsulfamoyl group or an N-phenylsulfamoyl group.

[0029] The spiro compound residue represented by R may be, for example, spiro[3.3]heptan-1-yl.

[0030] The bridged hydrocarbon residual group represented by R may be, for example, bicyclo[2.2.1]heptan-1-yl, tricyclo[3.3.1.1^{3,7}]decan-1-yl or 7,7-dimethylbicyclo[2.2.1]heptan-1-yl.

[0031] The alkoxy group represented by R may be substituted by those as mentioned above as substituents for alkyl groups, including a methoxy group, a propoxy group, a 2-ethoxyethoxy group, a pentadecyloxy group, a 2-dodecyloxyethoxy group or a phenethyloxyethoxy group.

[0032] The aryloxy group represented by R preferably is a phenyloxy group of which the aryl nucleus may be further substituted by those as mentioned above as substituents or atoms for the aryl groups, including, for example, a phenoxy group, a p-t-butylphenoxy group, or a m-pentadecylphenoxy group.

[0033] The heterocyclicoxy group represented by R preferably is one having a 5- to 7-membered hetero ring, which hetero ring may further have substituents, including a 3,4,5,6-tetrahydropyranyl-2-oxy group or a 1-phenyltetrazole-5-oxy group.

[0034] The siloxy group represented by R may further be substituted by an alkyl group,, including a siloxy group, a trimethylsiloxy group, a triethylsiloxy group or a dimethylbutylsiloxy group.

[0035] The acyloxy group represented by R may be exemplified by an alkylcarbonyloxy group, an arylcarbonyloxy group, which may further have substituents, including specifically an acetyloxy group, an α-chloroacetyloxy group or a benzoyloxy.

[0036] The carbamoyloxy group represented by R may be substituted by an alkyl group, or an aryl group, including an N-ethylcarbamoyloxy group, an N,N-diethylcarbamoyloxy group or an N-phenylcarbamoyloxy group.

[0037] The amino group represented by R may be substituted by an alkyl group, an aryl group (preferably a phenyl group), including an ethylamino group, an anilino group, a m-chloroanilino group, a 3-pentadecyloxycarbonylanilino group or a 2-chloro-5-hexadecaneimidoanilino group.

[0038] The acylamino group represented by R may include an alkylcarbonylamino group, an arylcarbonylamino group (preferably a phenylcarbonylamino group), which may further have substituents, specifically an acetamide group, an α-ethylpropaneamide group, an N-phenylacetamide group, a dodecaneamide group, a 2,4-di-t-amylphenoxyacetamide group or an α-3-t-butyl-4-hydroxyphenoxybutaneamide group.

[0039] The sulfonamide group represented by R may include an alkylsulfonylamino group or an arylsulfonylamino group,, which may further have substituents, specifically a methylsulfonylamino group, a pentadecylsulfonylamino group, a benzenesulfonamide group, a p-toluenesulfonamide group or a 2-methoxy-5-t-amylbenzenesulfonamide.

[0040] The imide group represented by R may be either open-chained or cyclic, which may also have substituents, as exemplified by a succinimide group, a 3-heptadecylsuccinimide group, a phthalimide group or a glutarimide group.

[0041] The ureido group represented by R may be substituted by an alkyl group, an aryl group (preferably a phenyl group) including an N-ethylureido group, an N-methyl-N-decylureido group, an N-phenylureido group or an N-p-tolylureido group.

[0042] The sulfamoylamino group represented by R may be substituted by an alkyl group, an aryl group (preferably a phenyl group) including an N,N-dibutylsulfamoylamino group, an N-methylsulfamoylamino group or an N-phenylsulfamoylamino group.

[0043] The alkoxycarbonylamino group represented by R may further have substituents, including a methoxycarbonylamino group, a methoxyethoxycarbonylamino group or an octadecyloxycarbonylamino group.

[0044] The aryloxycarbonylamino group represented by R may have substituents, and may include a phenoxycarbonylamino groups or a 4-methylphenoxycarbonylamino group.

[0045] The alkoxycarbonyl group represented by R may further have substituents, and may include a methoxycarbonyl group, a butyloxycarbonyl group, a dodecyloxycarbonyl group, an octadecyloxycarbonyl group, an ethoxymethox-

ycarbonyloxy group or an benzyloxycarbonyl group.

[0046] The aryloxycarbonyl group represented by R may further have substituents, and may include a phenoxycarbonyl group, a p-chlorophenoxycarbonyl group or a m-pentadecyloxyphenoxycarbonyl group.

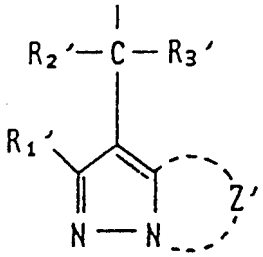
[0047] The alkylthio group represented by R may further have substituents, and may include an ethylthio group, a dodecylthio group, an octadecylthio group, a phenethylthio group or a 3-phenoxypropylthio group.

[0048] The arylthio group represented by R preferably is a phenylthio group, which may further have substituents, and may include, for example, a phenylthio group, a p-methoxyphenylthio group, a 2-t-octylphenylthio group, a 3-octadecylphenylthio group, a 2-carboxyphenylthio group or a p-acetaminophenylthio group.

[0049] The heterocyclicthio group represented by R preferably is a 5- to 7-membered heterocyclicthio group, which may further have a fused ring or have substituents, including, for example, a 2-pyridylthio group, a 2-benzothiazolylthio groups or a 2,4-di-phenoxy-1,3,5-triazole-6-thio group.

[0050] The atom eliminatable through the reaction with the oxidized product of a color developing agent represented by X may include halogen atoms (e.g. a chlorine atom, a bromine atom or a fluorine atom) and also groups substituted through a carbon atom, an oxygen atom, a sulfur atom or a nitrogen atom.

[0051] The group substituted through a carbon atom include the groups represented by the formula:



wherein $R^{1'}$ has the same meaning as the above R, Z' has the same meaning as the above Z, $R^{2'}$ and $R^{3'}$ each represent a hydrogen atom, an aryl group, an alkyl group or a heterocyclic group,
a hydroxymethyl group and a triphenylmethyl group.

[0052] The group substituted through an oxygen atom may include an alkoxy group, an aryloxy group, a heterocyclicoxy group, an acyloxy group, a sulfonyloxy group, an alkoxycarbonyloxy group, an aryloxycarbonyloxy group, an alkyloxalyloxy group, an alkoxyoxalyloxy groups.

[0053] Said alkoxy group may further have substituents, including an ethoxy group, a 2-phenoxyethoxy group, a 2-cyanoethoxy group, a phenethyloxy group or a p-chlorobenzyloxy group.

[0054] Said aryloxy group preferably is a phenoxy group, which aryl group may further have substituents. Specific examples may include a phenoxy group, a 3-methylphenoxy group, a 3-dodecylphenoxy group, a 4-methanesulfonamidophenoxy group, a 4-[α-(3'-pentadecylphenoxy)butaneamido]phenoxy group, a hexadecylcarbamoylmethoxy group, a 4-cyanophenoxy group, a 4-methanesulfonylphenoxy group, a 1-naphthyloxy group or a p-methoxyphenoxy group.

[0055] Said heterocyclicoxy group preferably is a 5- to 7-membered heterocyclicoxy group, which may be a fused ring or have substituents. Specifically, a 1-phenyltetrazolyloxy group or a 2-benzothiazolyloxy group may be included.

[0056] Said acyloxy group may be exemplified by an alkylcarbonyloxy group such as an acetoxy group or a butanoyloxy group; an alkenylcarbonyloxy group such as a cinnamoyloxy group; an arylcarbonyloxy group such as a benzoyloxy group.

[0057] Said sulfonyloxy group may be, for example, a butanesulfonyloxy group or a methanesulfonyloxy group.

[0058] Said alkoxycarbonyloxy group may be, for example, an ethoxycarbonyloxy group or a benzyloxycarbonyloxy group.

[0059] Said aryloxycarbonyl group may be, for example or a phenoxycarbonyloxy group.

[0060] Said alkyloxalyloxy group may be, for example, a methyloxalyloxy group. Said alkoxyoxalyloxy group may be, for example, an ethoxyoxalyloxy group.

[0061] The group substituted through a sulfur atom may include an alkylthio group, an arylthio group, a heterocyclicthio group or an alkyloxythiocarbonylthio group.

[0062] Said alkylthio group may include a butylthio group, a 2-cyanoethylthio group, a phenethylthio group or a benzylthio group.

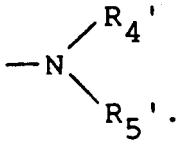
[0063] Said arylthio group may include a phenylthio group, a 4-methanesulfonamidophenylthio group, a 4-dodecylphenethylthio group, a 4-nonafluoropentaneamidophenethylthio group, a 4-carboxyphenylthio group or a 2-ethoxy-5-t-butylphenylthio group.

[0064] Said heterocyclicthio group may be, for example, a 1-phenyl-1,2,3,4-tetrazolyl-5-thio group or a 2-benzothi-

azolylthio group.

[0065] Said alkyloxythiocarbonylthio group may include a dodecyloxythiocarbonylthio group.

[0066] The group substituted through a nitrogen atom may include, for example, those represented by the formula:



[0067] Here, R_4' and R_5' each represent a hydrogen atom, an alkyl group, an aryl group, a heterocyclic group, a sulfamoyl group, a carbamoyl group, an acyl group, a sulfonyl group, an aryloxycarbonyl group or an alkoxycarbonyl group. R_4' and R_5' may be bonded to each other to form a hetero ring. However, R_4' and R_5' cannot both be hydrogen atoms.

[0068] Said alkyl group may be either straight or branched, having preferably 1 to 22 carbon atoms. Also, the alkyl group may have substituents such as an aryl group, an alkoxy group, an aryloxy group, an alkylthio group, an arylthio group, an alkylamino group, an arylamino group, an acylamino group, a sulfonamide group, an imino group, an acyl group, an alkylsulfonyl group, an arylsulfonyl group, a carbamoyl group, a sulfamoyl group, an alkoxycarbonyl group, an aryloxycarbonyl group, an alkyloxycarbonylamino group, an aryloxycarbonylamino group, a hydroxyl group, a carboxyl group, a cyano group or halogen atoms. Typical examples of said alkyl group may include an ethyl group, an octyl group, a 2-ethylhexyl group or a 2-chloroethyl group.

[0069] The aryl group represented by R_4' or R_5' may preferably have 6 to 32 carbon atoms, particularly a phenyl group or a naphthyl group, which aryl group may also have substituents such as those as mentioned above for substituents on the alkyl group represented by R_4' or R_5' and alkyl groups. Typical examples of said aryl group may be, for example, a phenyl group, a 1-naphtyl group or a 4-methylsulfonylphenyl group.

[0070] The heterocyclic group represented by R_4' or R_5' may preferably a 5- or 6-membered ring, which may be a fused ring or have substituents. Typical examples may include a 2-furyl group, a 2-quinolyl group, a 2-pyrimidyl group, a 2-benzothiazolyl group or a 2-pyridyl group.

[0071] The sulfamoyl group represented by R_4' or R_5' may include an N-alkylsulfamoyl group, an N,N-dialkylsulfamoyl group, an N-arylsulfamoyl group, an N,N-diarylsulfamoyl group and these alkyl and aryl groups may have substituents as mentioned above for the alkyl groups and aryl groups. Typical examples of the sulfamoyl group are, an N,N-diethylsulfamoyl group, an N-methylsulfamoyl group, an N-dodecylsulfamoyl group or an N-p-tolylsulfamoyl group.

[0072] The carbamoyl group represented by R_4' or R_5' may include an N-alkylcarbamoyl group, an N,N-dialkylcarbamoyl group, an N-arylcarbamoyl group, an N,N-diarylcarbamoyl group, and these alkyl and aryl groups may have substituents as mentioned above for the alkyl groups and aryl groups. Typical examples of the carbamoyl group are an N,N-diethylcarbamoyl group, an N-methylcarbamoyl group, an N-dodecylcarbamoyl group, an N-p-cyanocarbamoyl group or an N-p-tolylcarbamoyl group.

[0073] The acyl group represented by R_4' or R_5' may include an alkylcarbonyl group, an arylcarbonyl group, a heterocyclic carbonyl group, which alkyl group, aryl group and heterocyclic group may have substituents. Typical examples of the acyl group are a hexafluorobutanoyl group, a 2,3,4,5,6-pentafluorobenzoyl group, an acetyl group, a benzoyl group, a naphthoyl group or a 2-furylcarbonyl group.

[0074] The sulfonyl group represented by R_4' or R_5' may be, for example, an alkylsulfonyl group, an arylsulfonyl group or a heterocyclic sulfonyl group, which may also have substituents, including specifically an ethanesulfonyl group, a benzenesulfonyl group, an octanesulfonyl group, a naphthalenesulfonyl group or a p-chlorobenzenesulfonyl group.

[0075] The aryloxycrbonyl group represented by R_4' or R_5' may have substituents as mentioned for the above aryl group, including specifically a phenoxycarbonyl group.

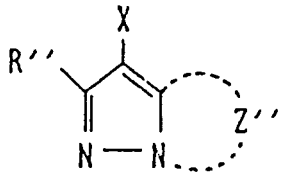
[0076] The alkoxycarbonyl group represented by R_4' or R_5' may have substituents as mentioned for the above alkyl group, and its specific examples are a methoxycarbonyl group, a dodecyloxycarbonyl group or a benzyloxycarbonyl group.

[0077] The heterocyclic ring formed by bonding between R_4' and R_5' may preferably be a 5- or 6-membered ring, which may be either saturated or unsaturated, either has aromaticity or not, or may also be a fused ring. Said heterocyclic ring may include, for example, an N-phthalimide group, an N-succinimide group, a 4-N-urazolyl group, a 1-N-hydantoinyl group, a 3-N-2,4-dioxooxazolidinyl group, a 2-N-1,1-dioxo-3-(2H)-oxo-1,2-benzthiazolyl group, a 1-pyrrolyl group, a 1-pyrrolidinyl group, a 1-pyrazolyl group, a 1-pyrazolidinyl group, a 1-piperidinyl group, a 1-pyrrolinyl group, a 1-imidazolyl group, a 1-imidazolinyl group, a 1-indolyl group, a 1-isoindolinyl group, a 2-isoindolyl group, a 2-isoindolinyl group, a 1-benzotriazolyl group, a 1-benzoimidazolyl group, a 1-(1,2,4-triazolyl) group, a 1-(1,2,3-triazolyl) group, a 1-(1,2,3,4-tetrazolyl) group, an N-morpholinyl group, a 1,2,3,4-tetrahydroquinolyl group, a 2-oxo-1-pyrrolidinyl group, a 2-

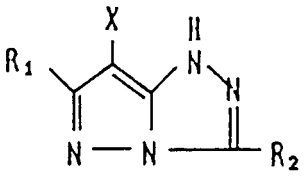
1H-pyrridone group, a phthaladione group or a 2-oxo-1-piperidinyl group. These heterocyclic groups may be substituted by an alkyl group, an aryl group, an alkyloxy group, an aryloxy group, an acyl group, a sulfonyl group, an alkylamino group, an arylamino group, an acylamino group, a sulfonamino group, a carbamoyl group, a sulfamoyl group, an alkylthio group, an arylthio group, an ureido group, an alkoxycarbonyl group, an aryloxycarbonyl group, an imide group, a nitro group, a cyano group, a carboxyl group or halogen atoms.

[0078] The nitrogen-containing heterocyclic ring formed by Z and Z' may include a pyrazole ring, a imidazole ring, a triazole ring or a tetrazole ring, and the substituents which may be possessed by the above rings may include those as mentioned for the above R.

[0079] When the substituent (e.g. R, R_1 to R_8) on the heterocyclic ring in the formula (I) and the formulae (II) to (VII) as hereinafter described has a moiety of the formula:



(wherein R", X and Z" have the same meanings as R, X and Z in the formula (I)), the so-called bis-form type coupler is formed, which is of course included in the present invention. The ring formed by Z, Z', Z" and Z_1 as hereinafter described may also be fused with another ring (e.g. a 5- to 7-membered cycloalkene). For example, R_5 and R_6 in the formula [V], R_7 and R_8 in the formula (VI) may be bonded to each other to form a ring (e.g. a 5- to 7-membered rings). The compounds represented by the formula (I) can be also represented specifically by the following formulae (II) through (VII).



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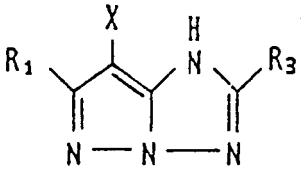

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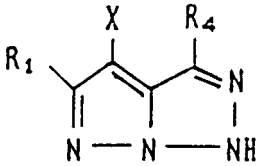

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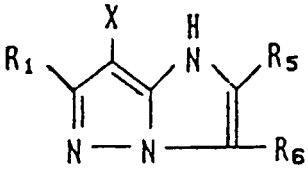

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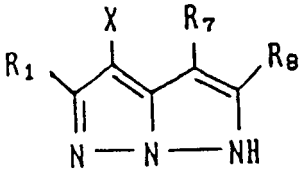

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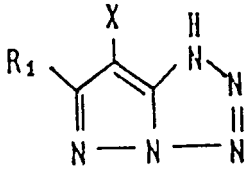
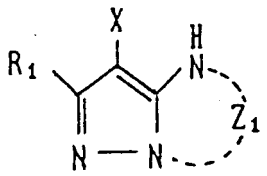


(VII)

[0080] In the above formulae (II) to (VII), R_1 to R_8 and X have the same meanings as the above R and X.

[0081] Of the compounds represented by the formula (I), those represented by the following formula (VIII) are preferred.



(VIII)

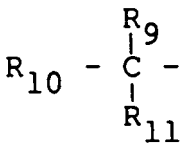
wherein R_1, X and Z_1 have the same meanings as R, X and Z in the formula (I).

[0082] Of the magenta couplers represented by the formulae (II) to (VII), the magenta coupler represented by the formula (II) is particularly preferred.

[0083] To describe about the substituents on the heterocyclic ring in the formulae (I) to (VIII), R in the formula (I) and R_1 in the formulae (II) to (VIII) should preferably satisfy the following condition 1, more preferably satisfy the following conditions 1 and 2, and particularly preferably satisfy the following conditions 1, 2 and 3:

Condition 1: a root atom directly bonded to the heterocyclic ring is a carbon atom,
Condition 2: only one of hydrogen atom is bonded to said carbon atom or no hydrogen atom is bonded to it, and
Condition 3: the bondings between the root atom and adjacent atoms are all single bonds.

[0084] Of the substituents R and R_1 on the above heterocyclic ring, most preferred are those represented by the formula (IX) shown below:



(IX)

[0085] In the above formula, each of R_9, R_{10} and R_{11} represents a hydrogen atom, a halogen atom, an alkyl group, a cycloalkyl group, an alkenyl group, a cycloalkenyl group, an alkynyl group, an aryl group, a heterocyclic group, an acyl group, a sulfonyl group, a sulfinyl group, a phosphonyl group, a carbamoyl group, a sulfamoyl group, a cyano group, a spiro compound residual group, a bridged hydrocarbon compound residual group, an alkoxy group, an aryloxy group, a heterocyclicoxy group, a siloxy group, an acyloxy group, a carbamoyloxy group, an amino group, an acylamino group, a sulfonamide group, an imide group, an ureido group, a sulfamoylamino group, an alkoxycarbonylamino group, an aryloxycarbonylamino group, an alkoxycarbonyl group, an aryloxycarbonyl group, an alkylthio group, an arylthio group or a heterocyclicthio group.

[0086] Also, at least two of said R_9, R_{10} and R_{11}, for example, R_9 and R_{10} may be bonded together to form a saturated or unsaturated ring (e.g. cycloalkane ring, cycloalkene ring or heterocyclic ring), and further to form a bridged hydrocarbon compound residual group by bonding R_{11} to said ring.

[0087] The groups represented by R_9 to R_{11} may have substituents, and examples of the groups represented by R_9 to R_{11} and the substituents which may be possessed by said groups may include examples of the substituents which may be possessed by the R in the above formula (I), and substituents which may be possessed by said substituents.

[0088] Also, examples of the ring formed by bonding between R_9 and R_{10}, the bridged hydrocarbon compound residual group formed by R_9 to R_{11} and the substituents which may be possessed thereby may include examples of cycloalkyl, cycloalkenyl and heterocyclic groups as mentioned for substituents on the R in the aforesaid formula (I) and substituents thereof.

[0089] Of the compounds of the formula (IX), preferred are:

(i) the case where two of R_9 to R_{11} are alkyl groups; and
(ii) the case where one of R_9 to R_{11}, for example, R_{11} is a hydrogen atom and two of the other R_9 and R_{10} are bonded together with the root carbon atom to form a cycloalkyl group.

[0090] Further, preferred in (i) is the case where two of R_9 to R_{11} are alkyl groups and the other one is a hydrogen atom or an alkyl group.

[0091] Here, said alkyl and said cycloalkyl may further have substituents, and examples of said alkyl, said

cycloalkyl and substituents thereof may include those of alkyl, cycloalkyl and substituents thereof as mentioned for the substituents on the R in the formula (I) and the substituents thereof.

[0092] The substituents which the ring to be formed by Z in the formula (I) and the ring to be formed by Z_1 in the formula (VIII) may have, and the substituents R_2 to R_8 in the formulae (II) to (VI), are preferably those represented by the formula (X) shown below:

$$-R^1-SO_2-R^2 \qquad (X)$$

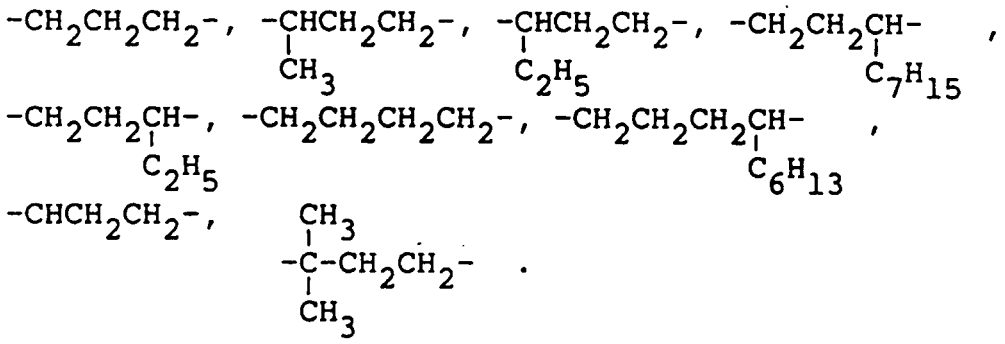
wherein R^1 represents an alkylene group, R^2 represents an alkyl group, a cycloalkyl group or an aryl group.

[0093] The alkylene represented by R^1 preferably has 2 or more, and more preferably 3 to 6 carbon atoms at the straight chain portion, and may be of straight chain or branched structure. Also, this alkylene may have a substituent.

[0094] Examples of such substituent may include those shown as the substituents which the alkyl group when R in the formula (I) may have.

[0095] Preferable substituents include a phenyl.

[0096] Preferable example for the alkylene represented by R^1 are shown below:



[0097] The alkyl group represented by R^2 may be of straight chain or branched structure.

[0098] Specifically, it may include methyl, ethyl, propyl, iso-propyl, butyl, 2-ethylhexyl, octyl, dodecyl, tetradecyl, hexadecyl, octadecyl or 2-hexyldecyl.

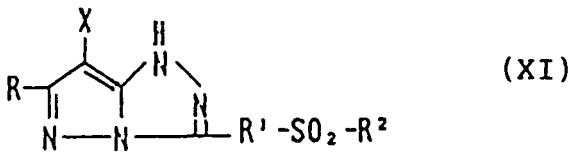
[0099] The cycloalkyl group represented by R^2 is preferably of 5 to 6 members, and may include, for example, a cyclohexyl group.

[0100] The alkyl group and the cycloalkyl group represented by R^2 may each have a substituent including, fur example, those exemplified as the substituents for the above R^1.

[0101] The aryl group represented by R^2 may specifically include a phenyl group, and a naphthyl group. The aryl group may have a substituent. Such a substituent may include, for example, a straight chain or branched alkyl group, and besides, those exemplified as the substituents for the above R^1.

[0102] Also, when there are two or more substituents, they may be the same or different substituents.

[0103] Particularly preferable in the compounds represented by the formula (I) are those represented by the formula (XI) shown below:



(XI)

wherein R and X each have the same meaning as R and X in the formula (I), and R^1 and R^2 each have the same meaning as R^1 and R^2 in the formula (X).

[0104] In the following, examples of the magenta coupler of the present invention are enumerated, which are not limitative of the present invention.

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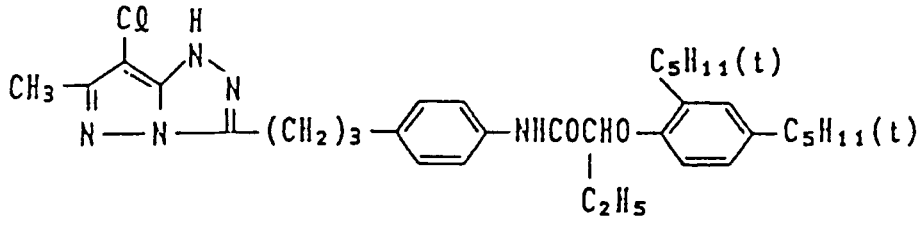

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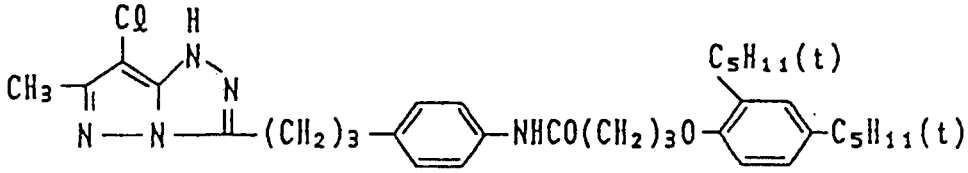

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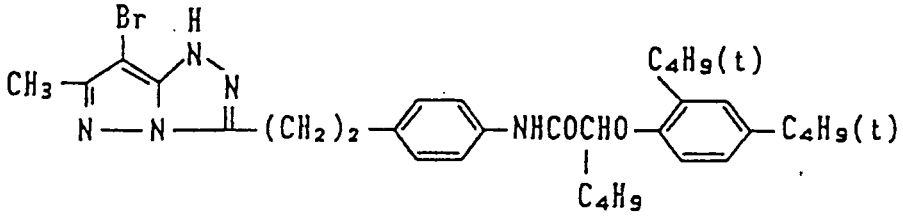

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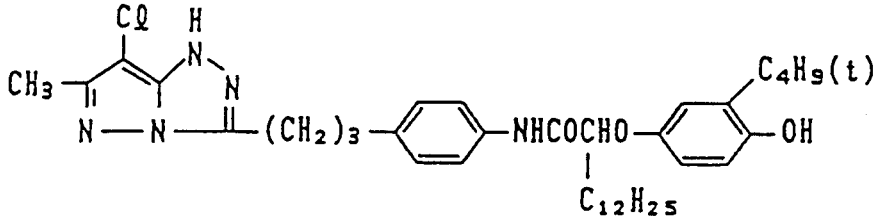

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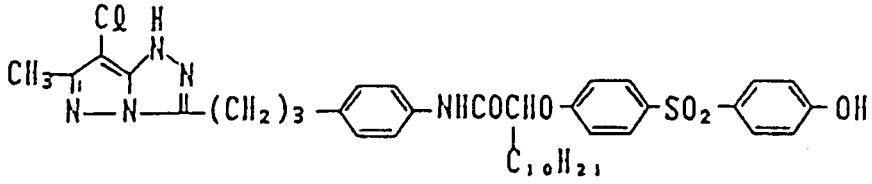

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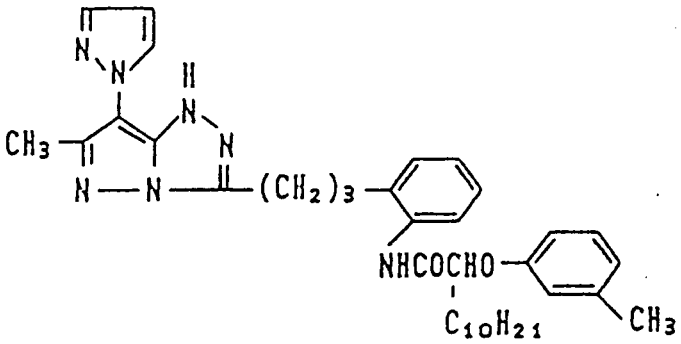

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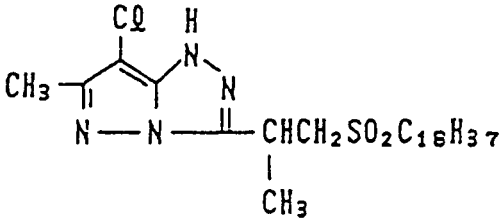

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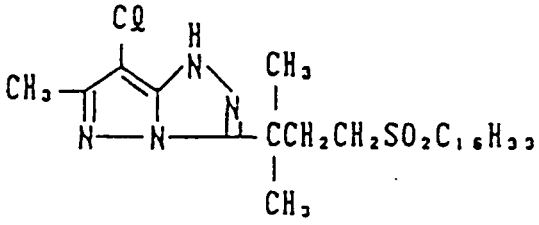

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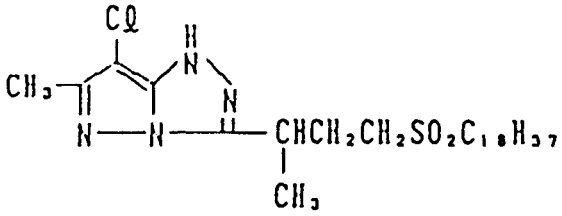

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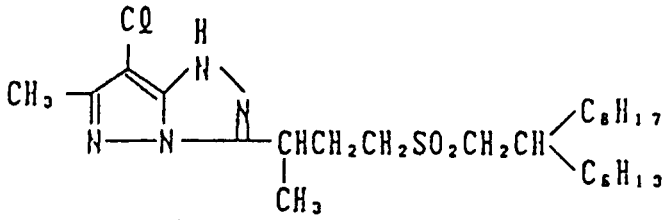

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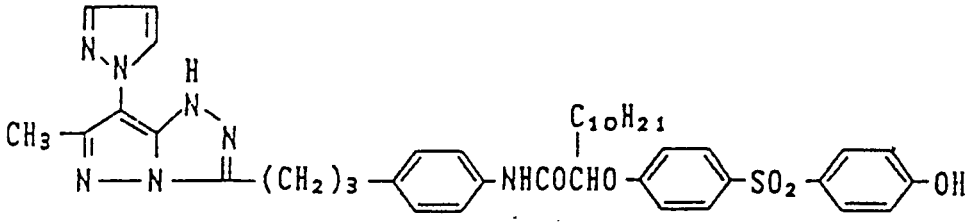

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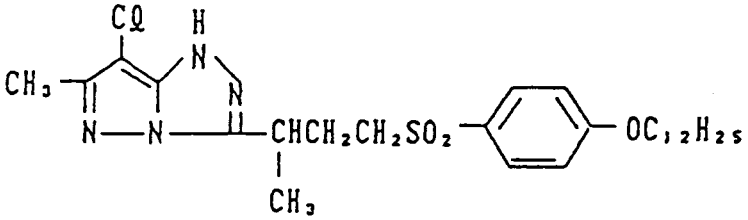

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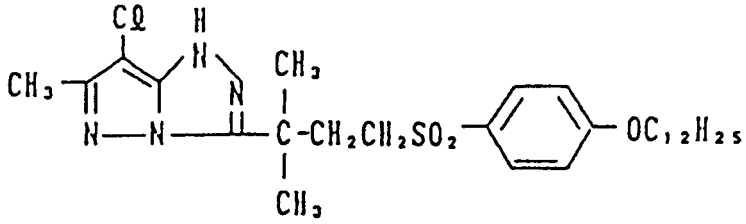

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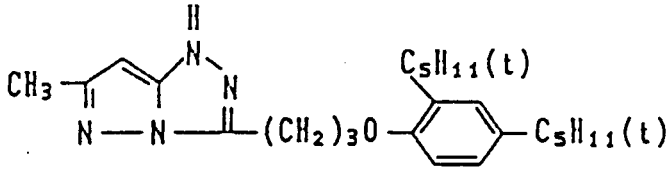

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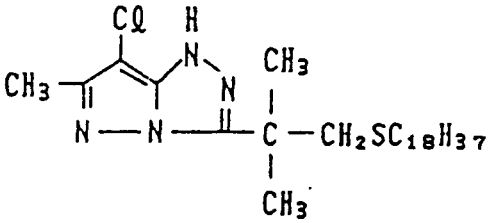

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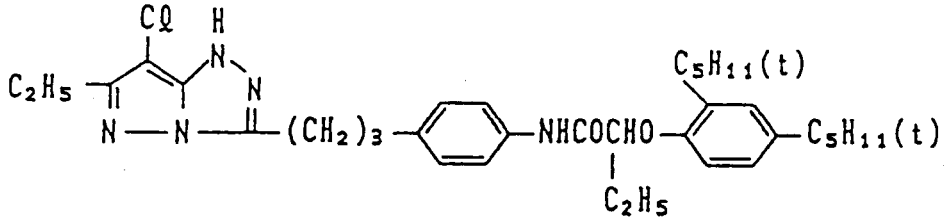

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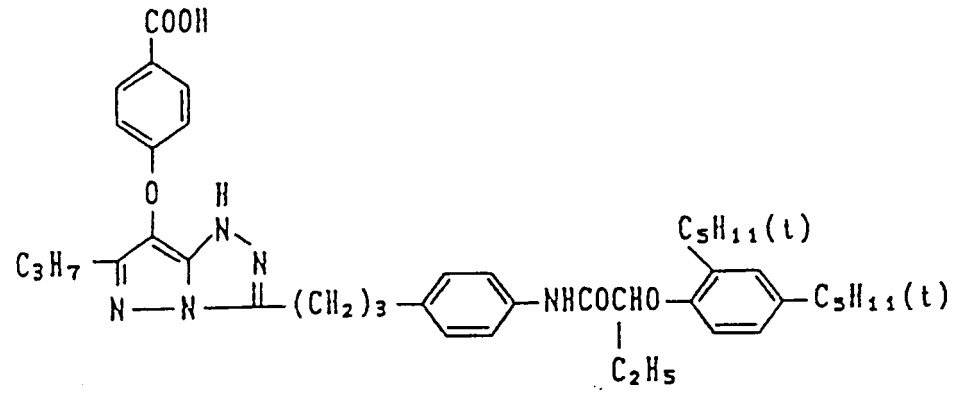

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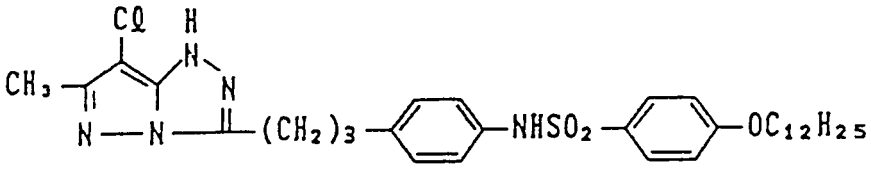

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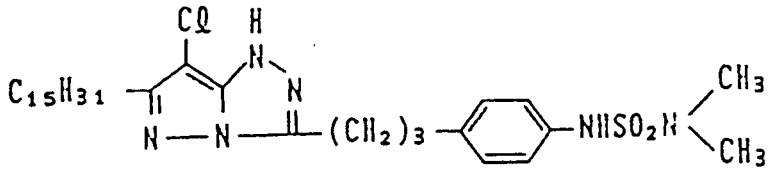

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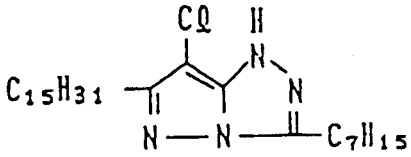

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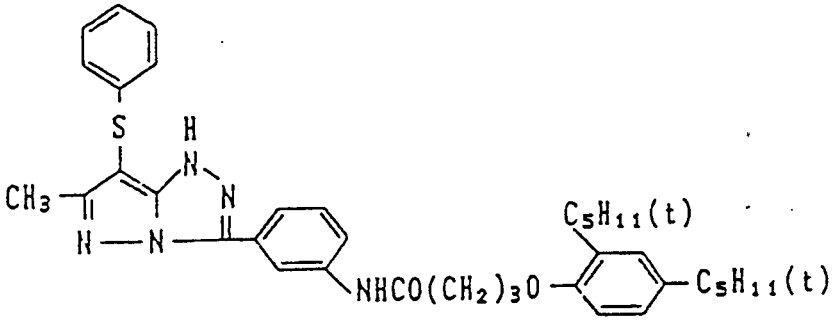

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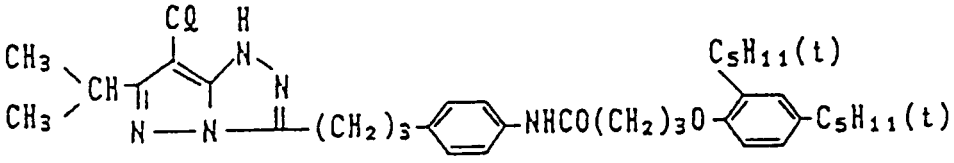

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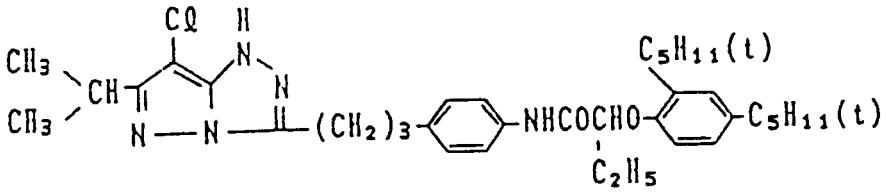

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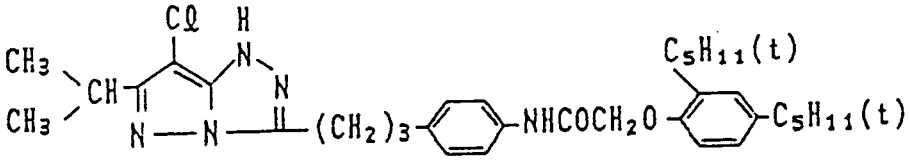

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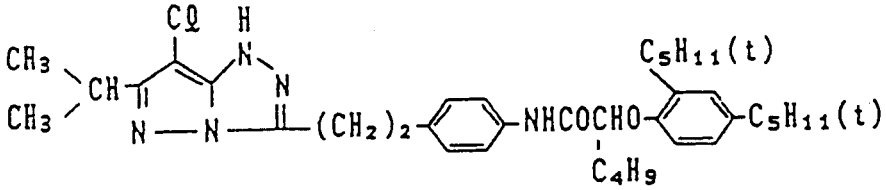

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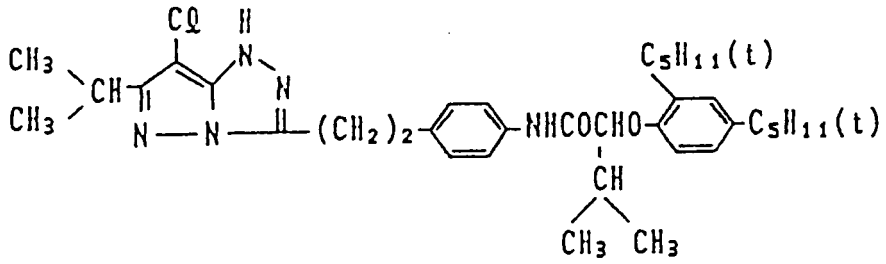

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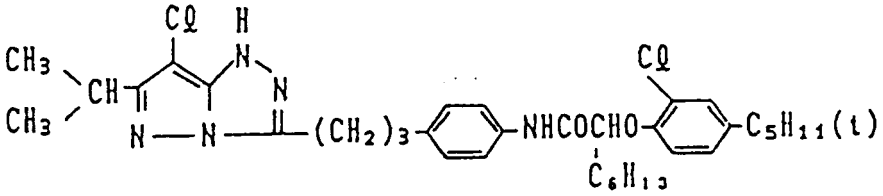

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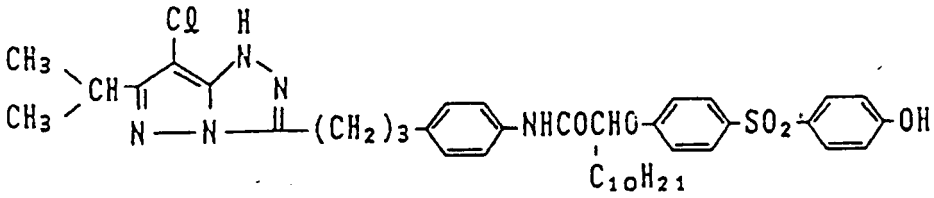

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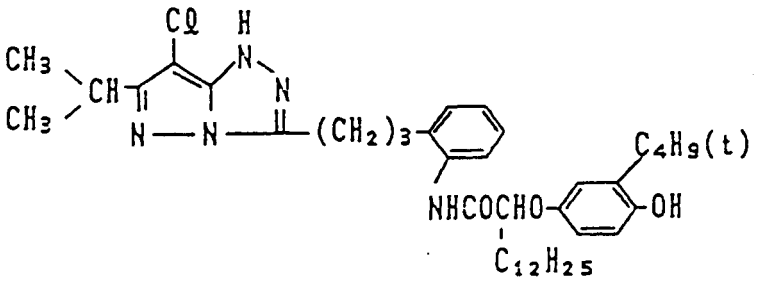

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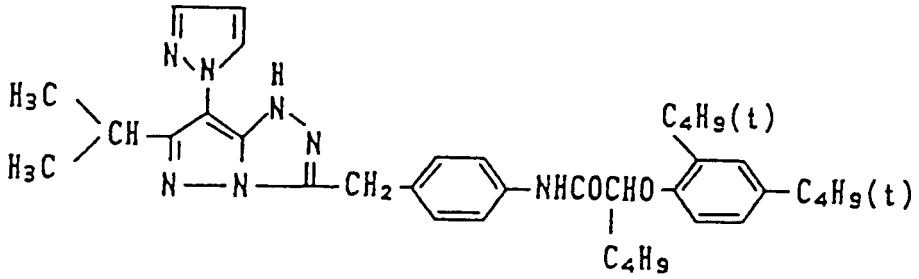

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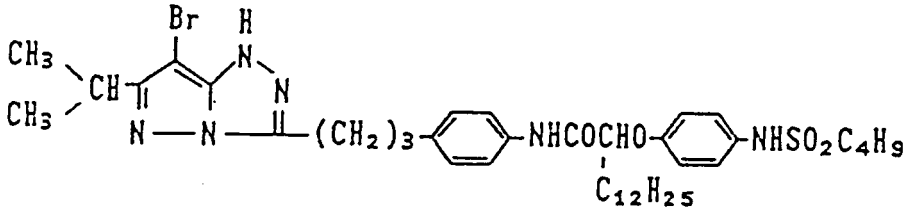

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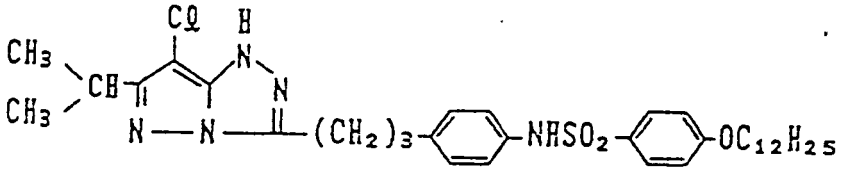

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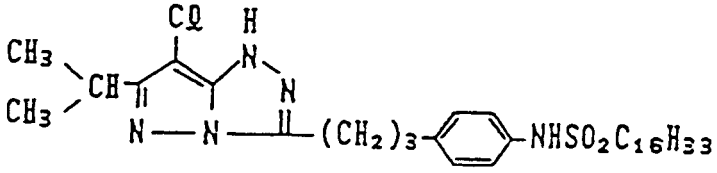

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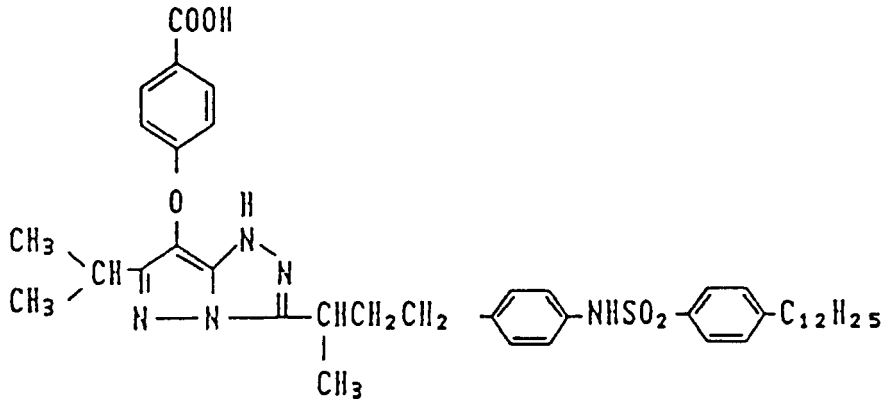

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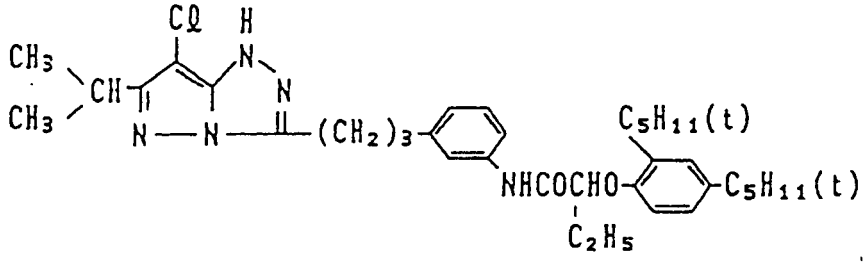

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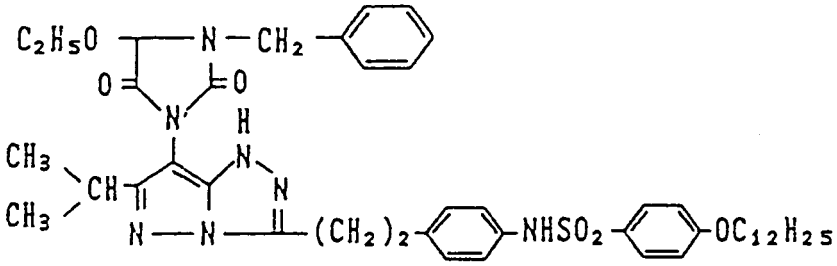

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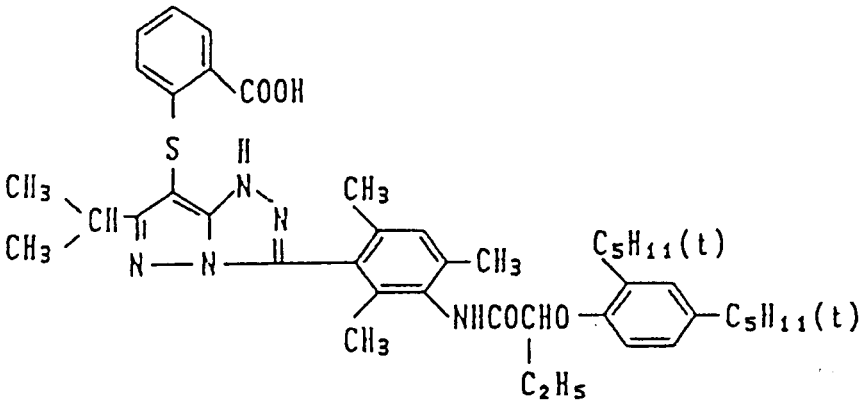

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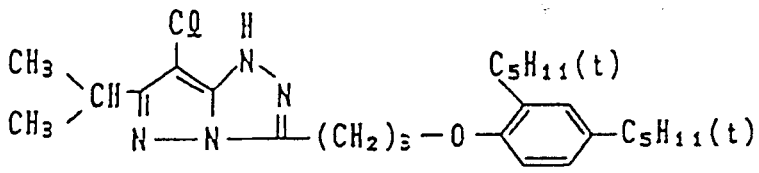

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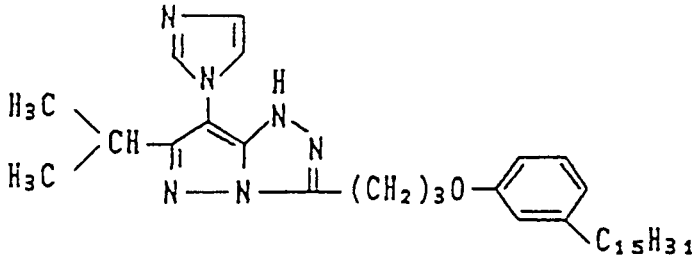

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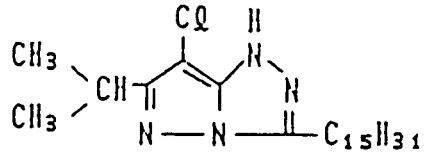

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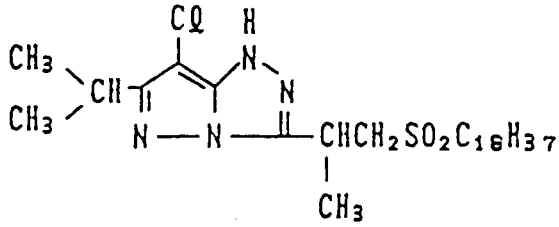

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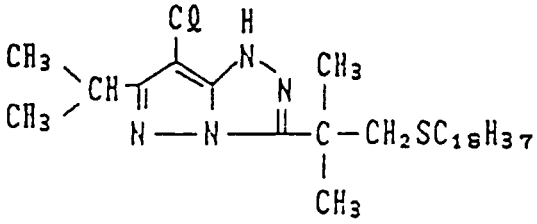

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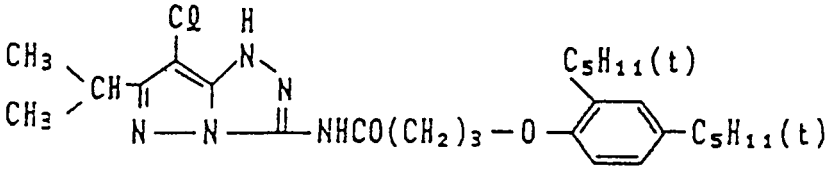

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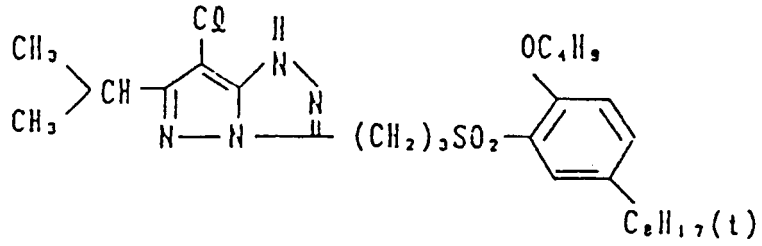

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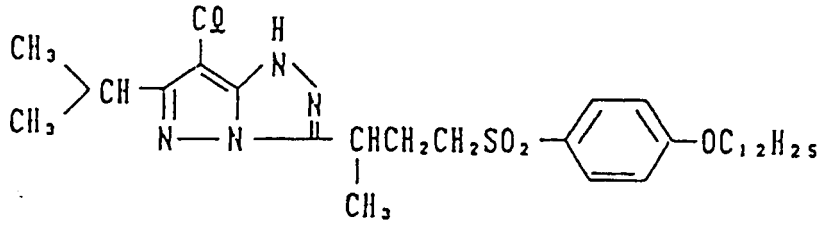

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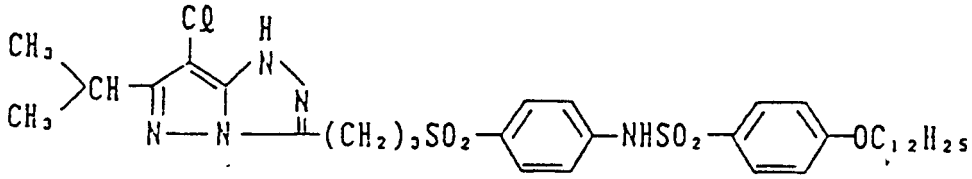

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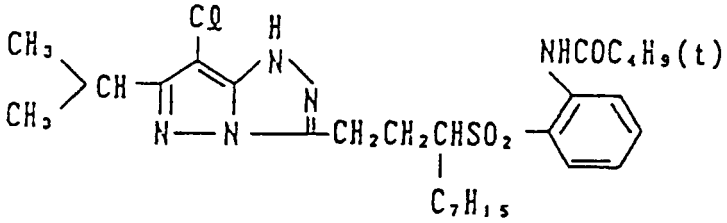

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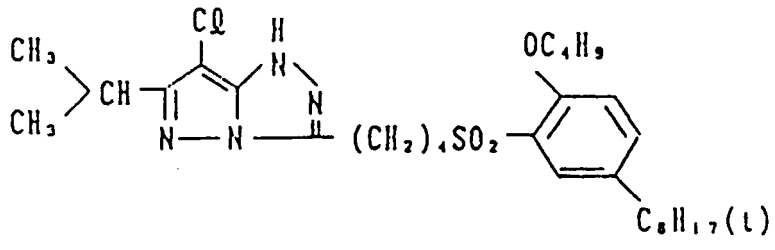

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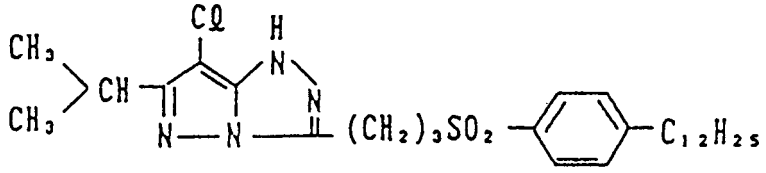

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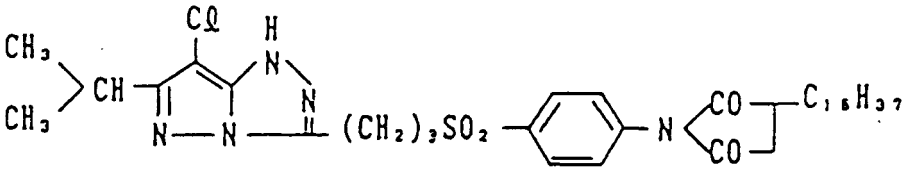

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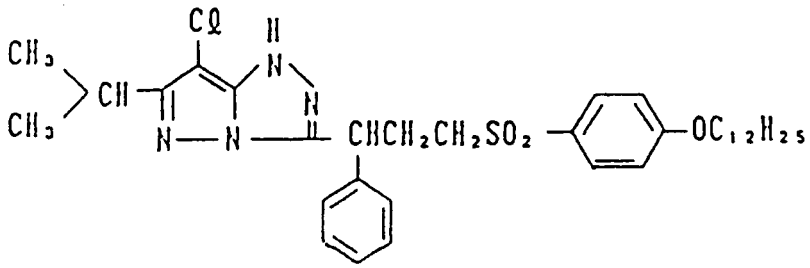

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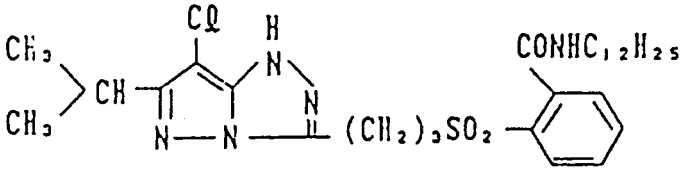

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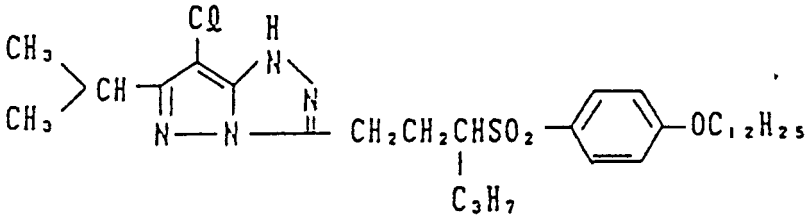

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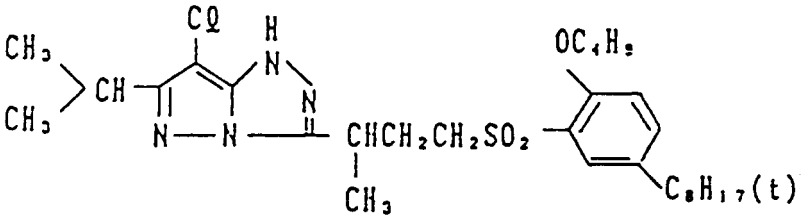

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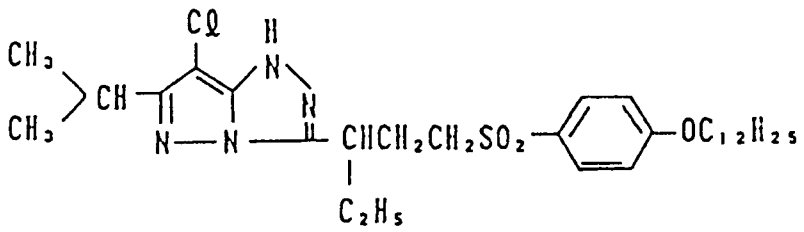

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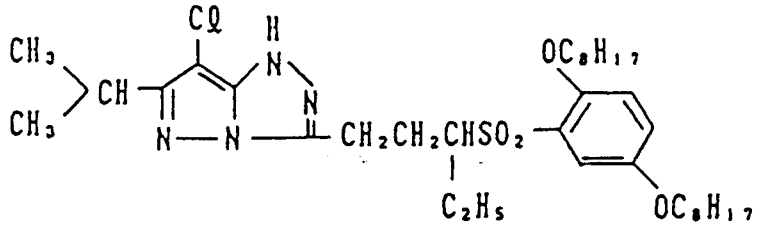

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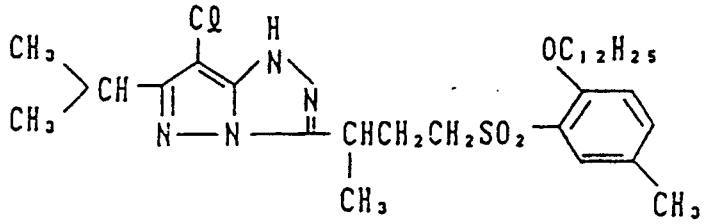

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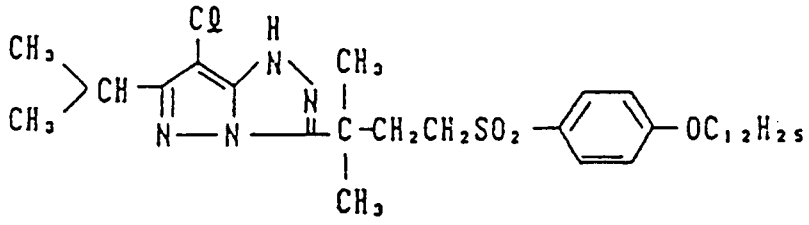

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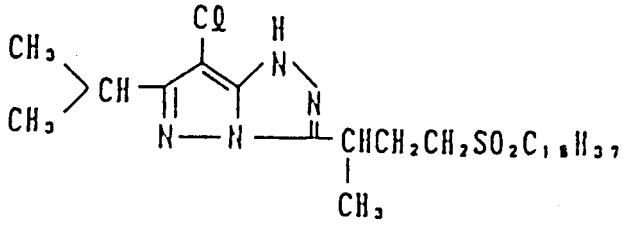

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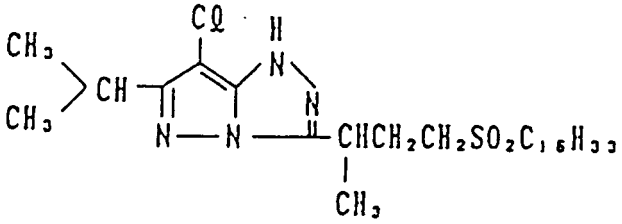

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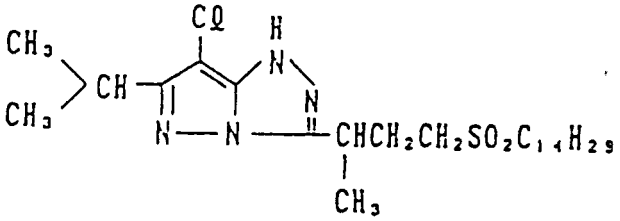

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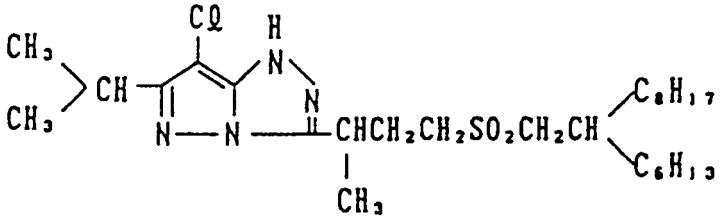

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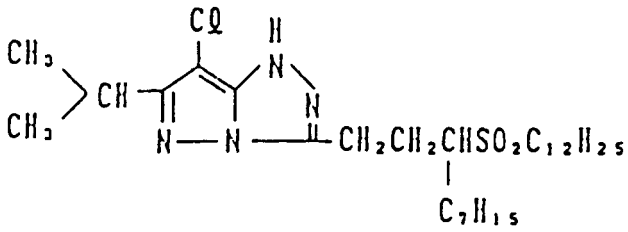

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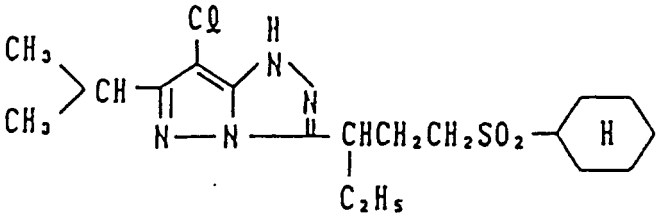

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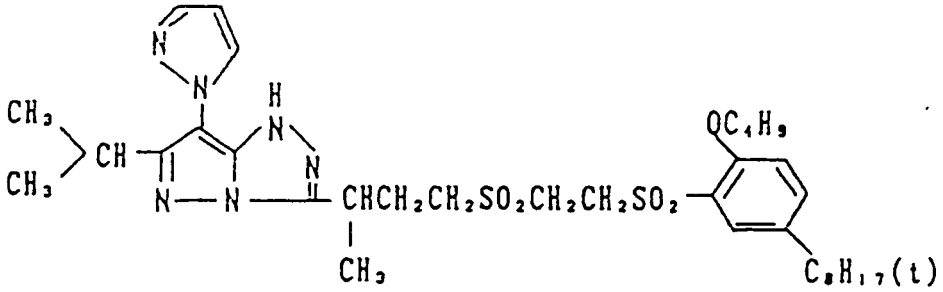

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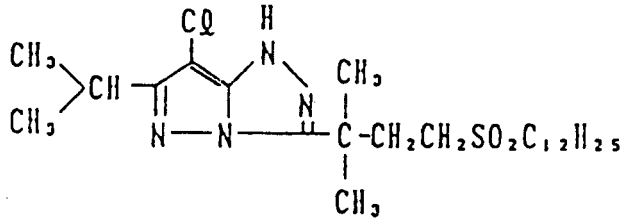

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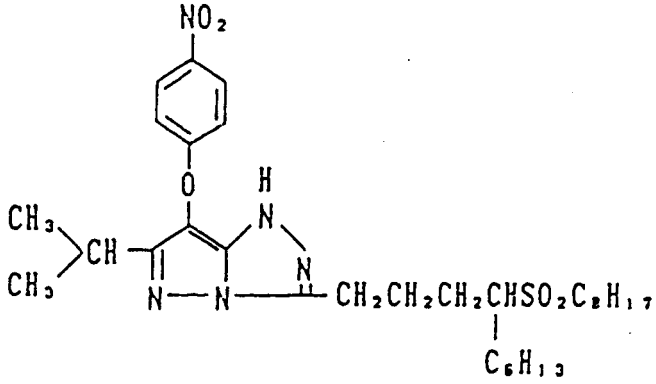

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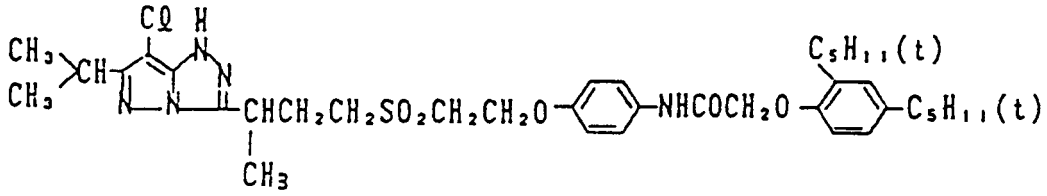

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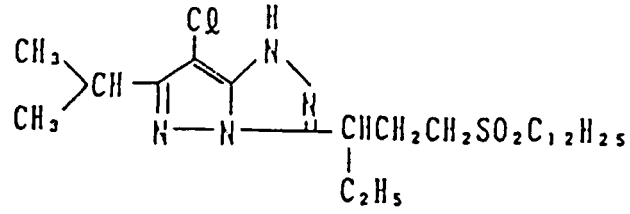

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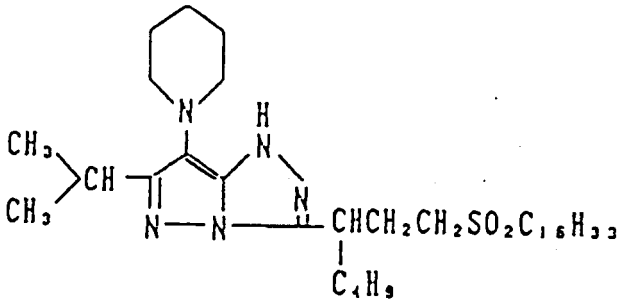

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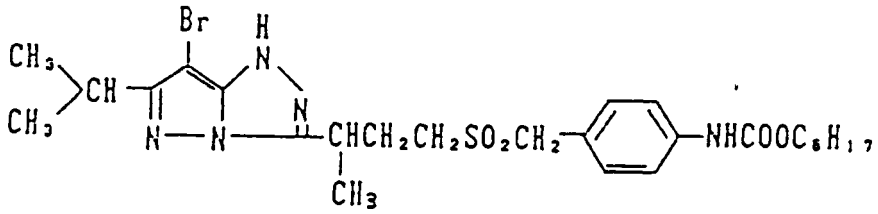

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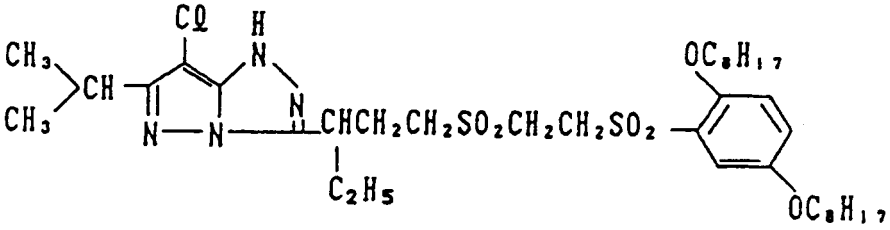

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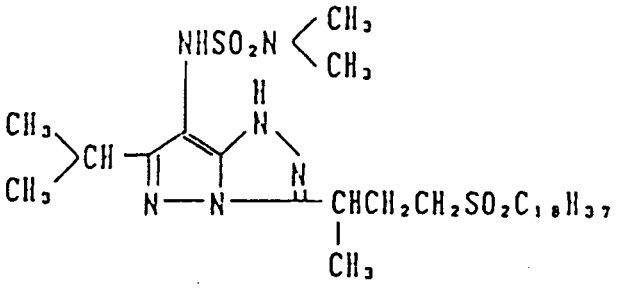

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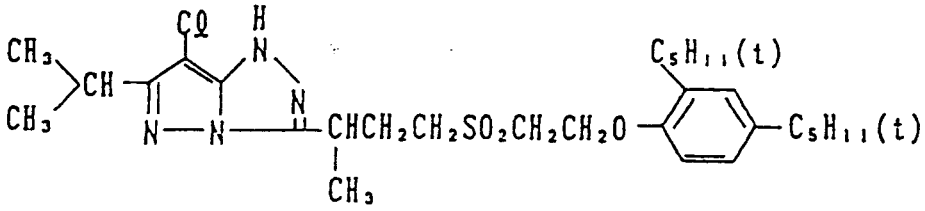

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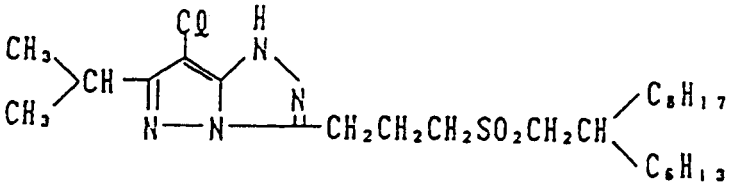

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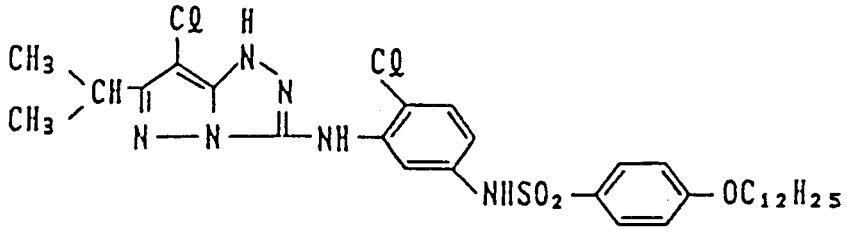

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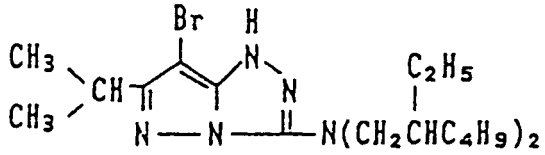

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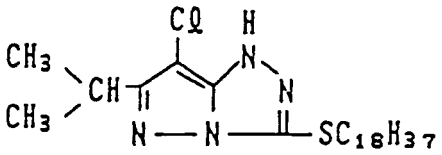

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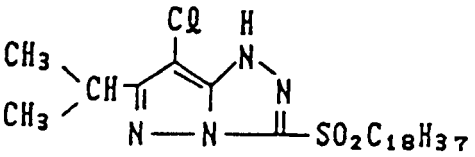

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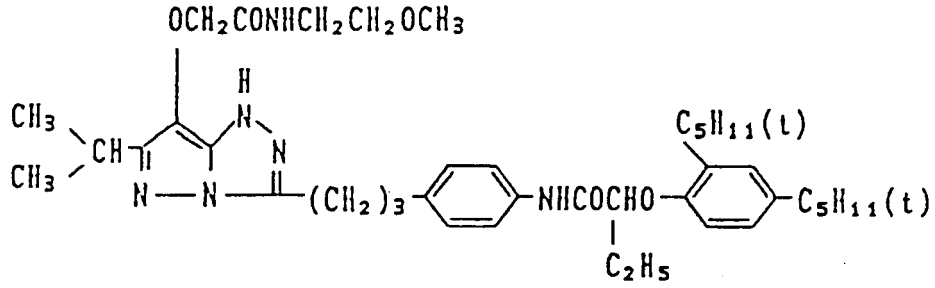

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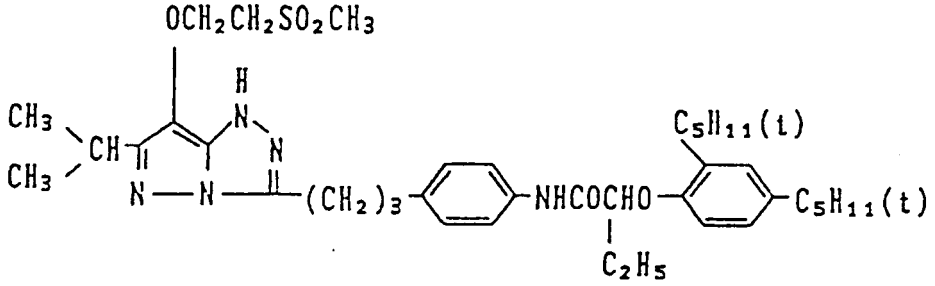

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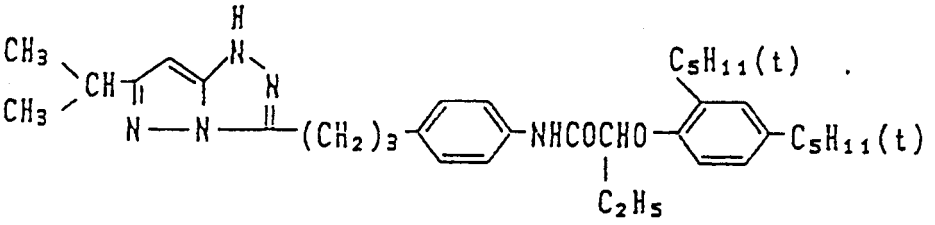

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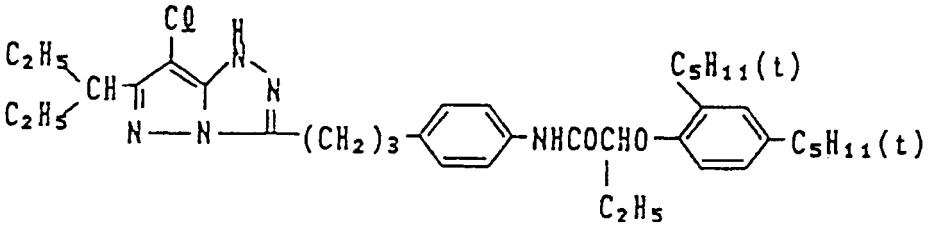

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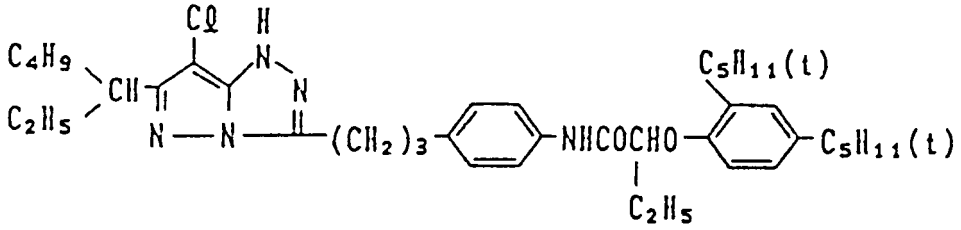

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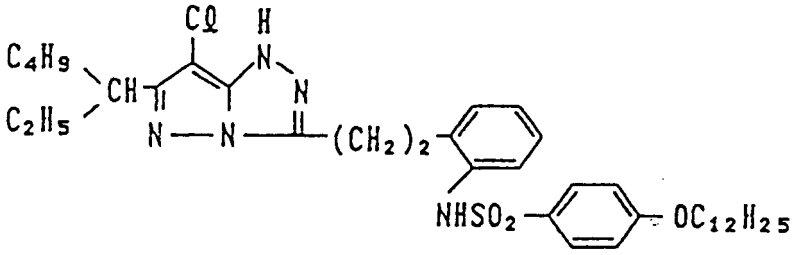

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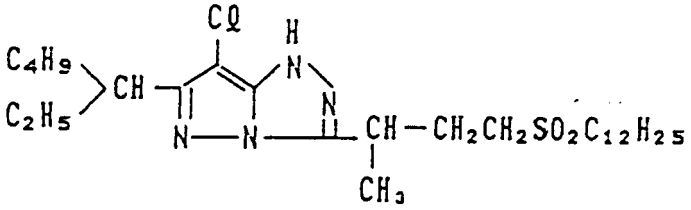

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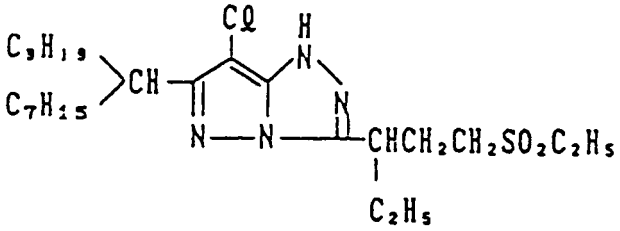

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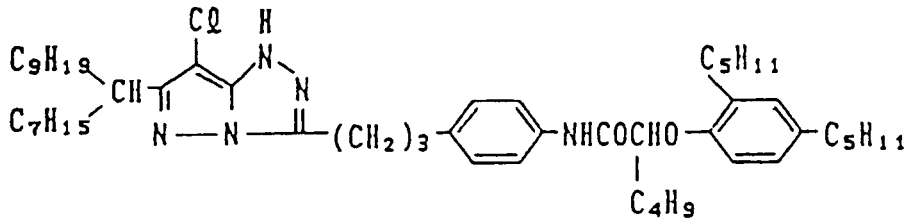

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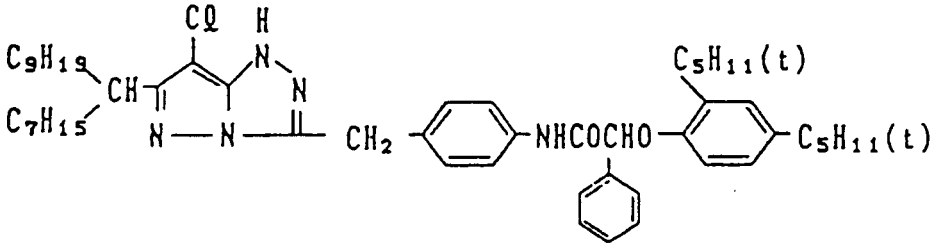

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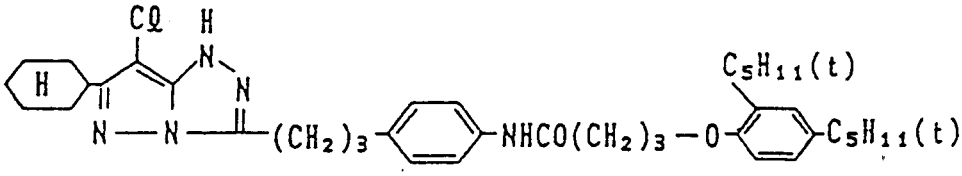

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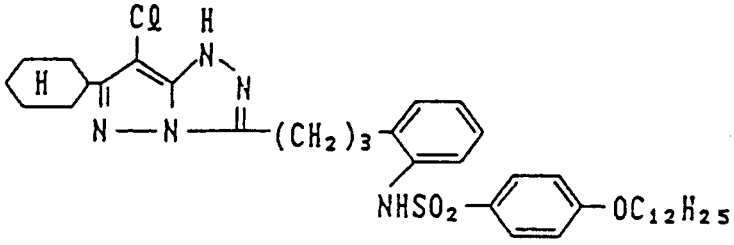

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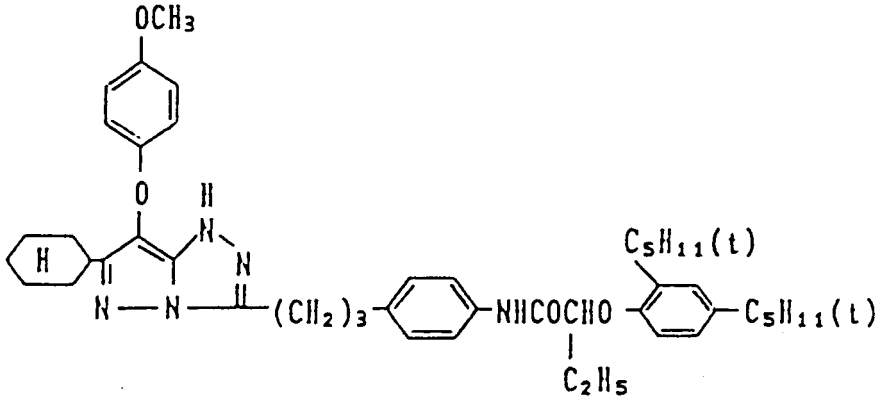

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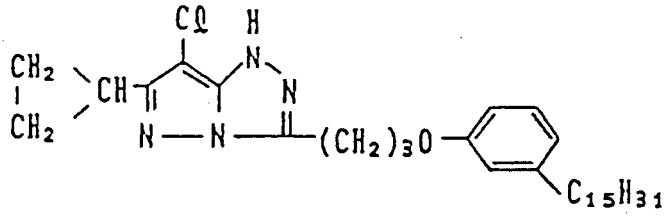

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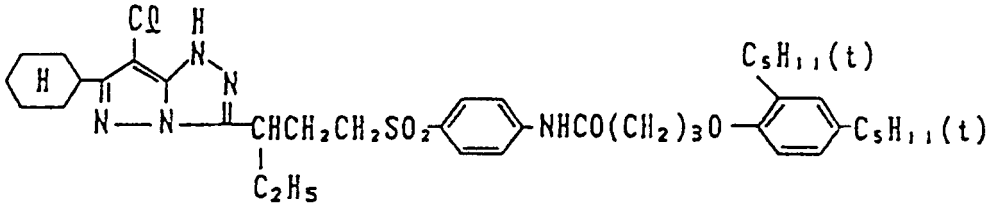

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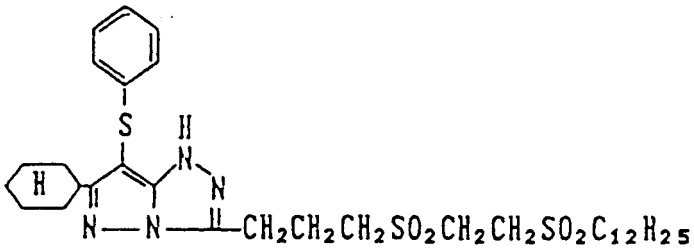

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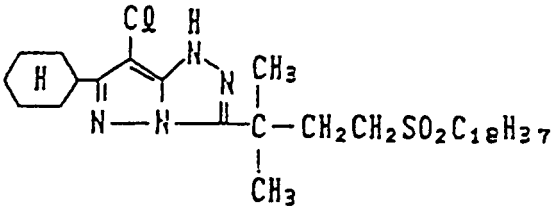

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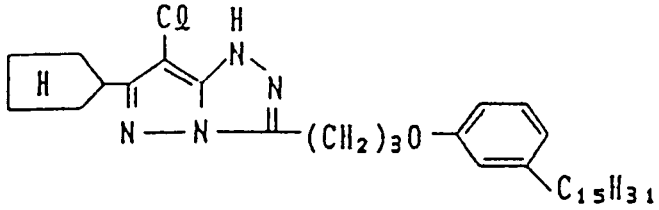

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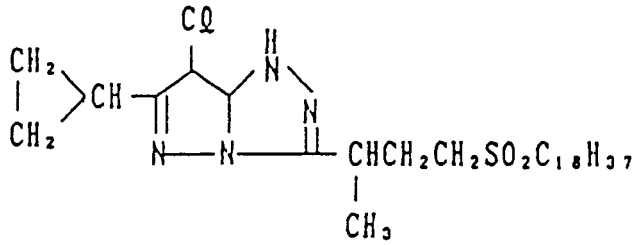

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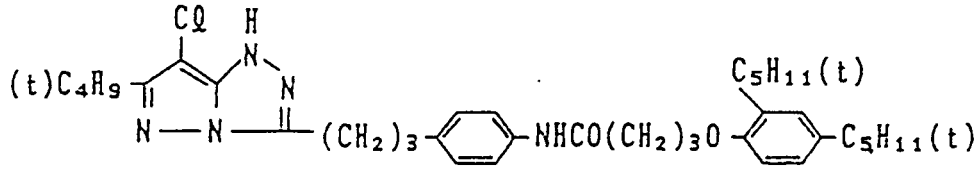

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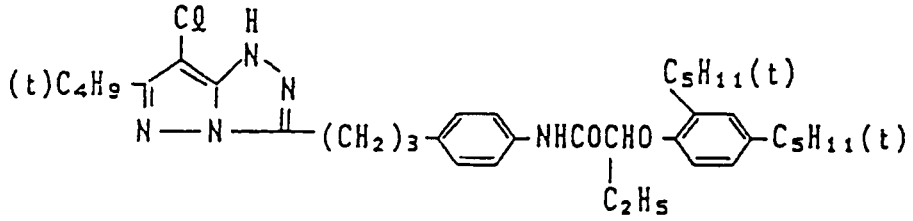

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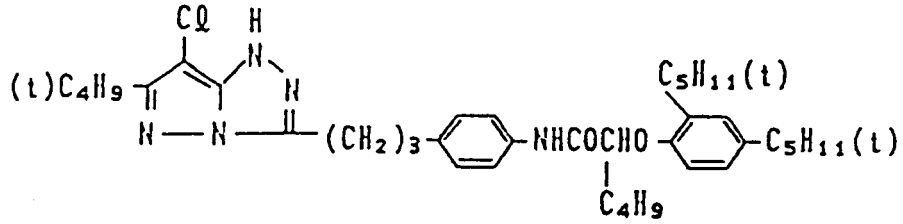

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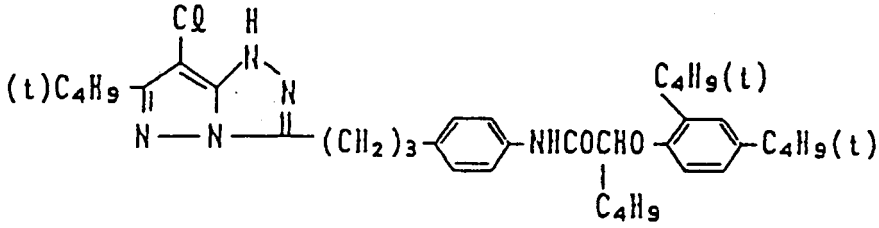

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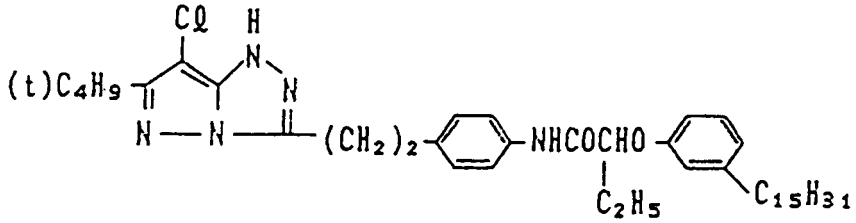

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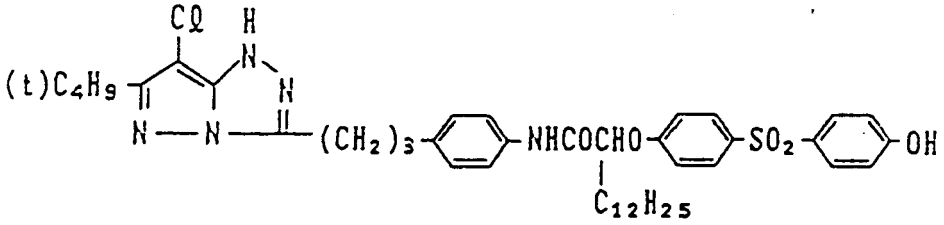

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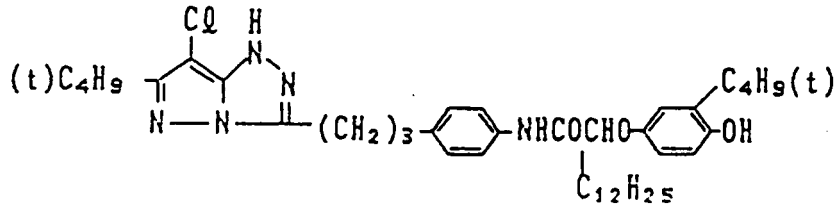

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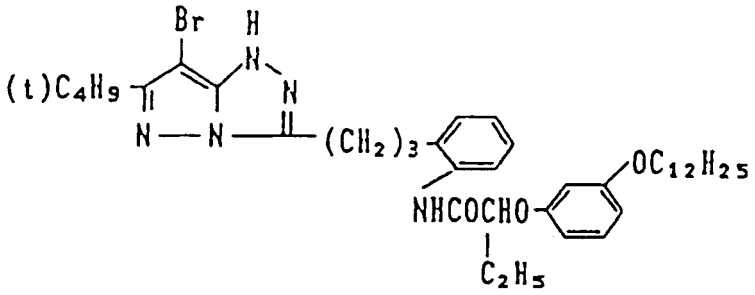

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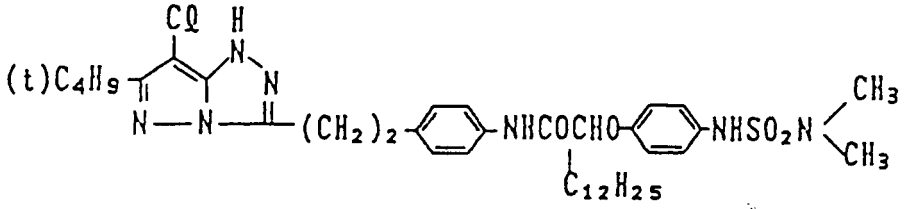

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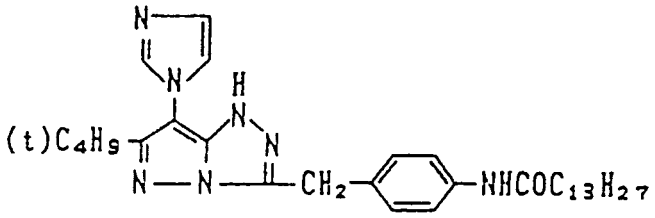

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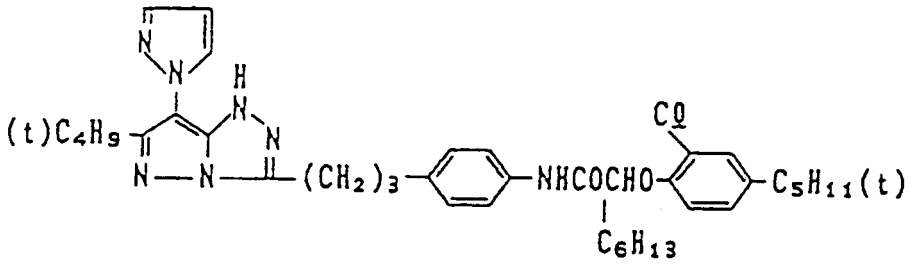

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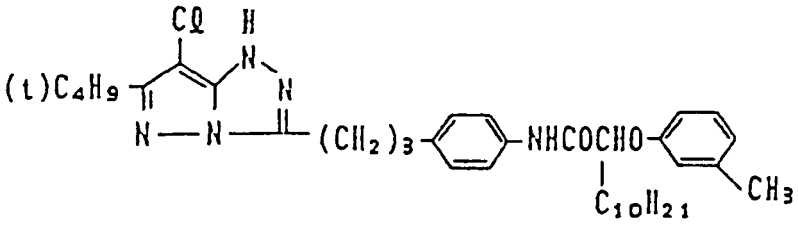

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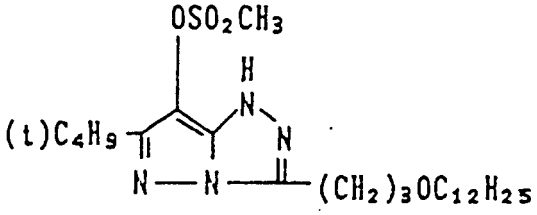

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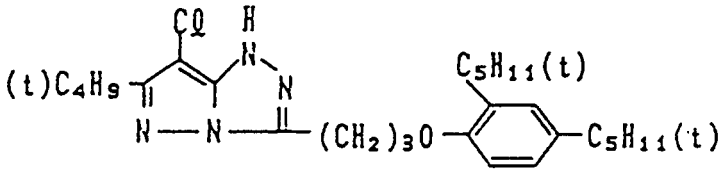

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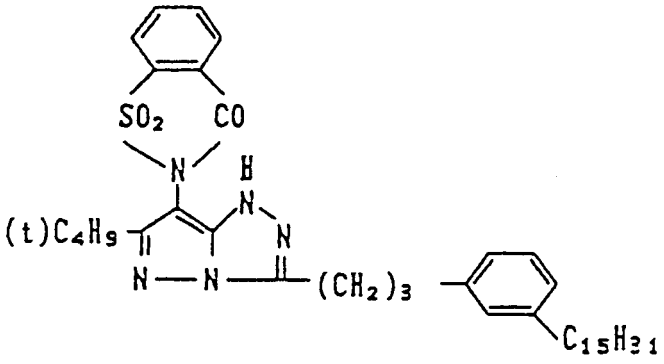

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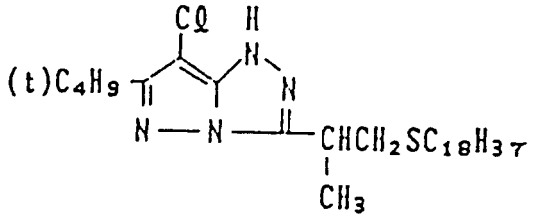

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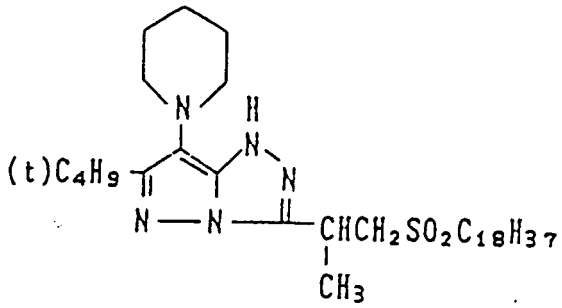

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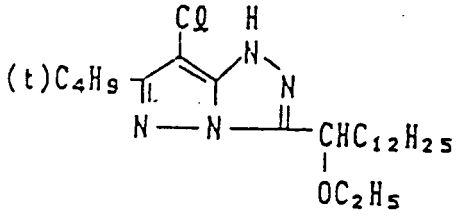

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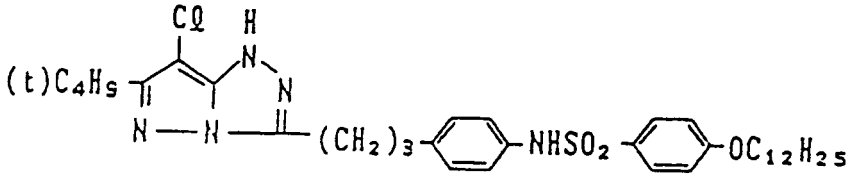

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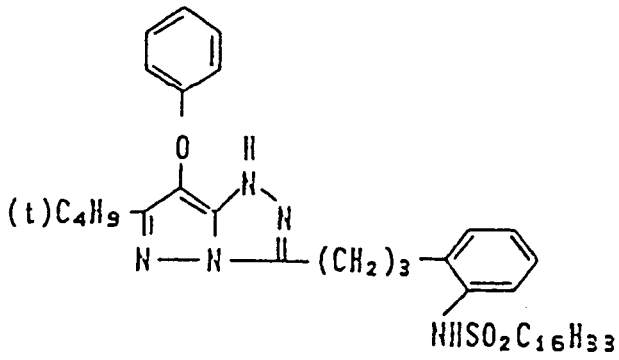

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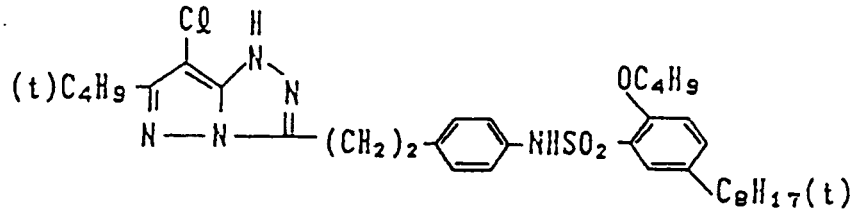

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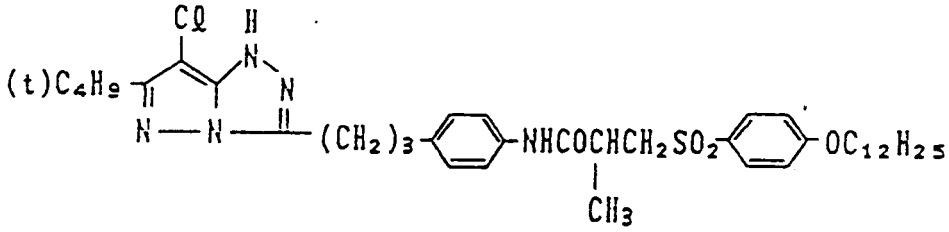

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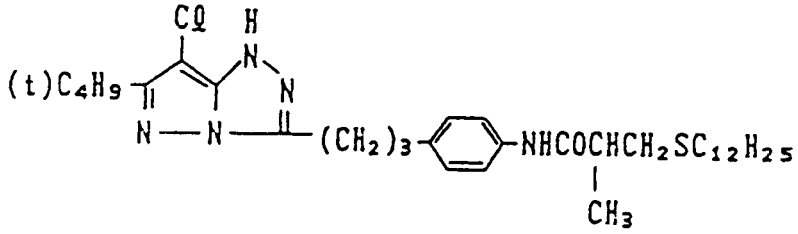

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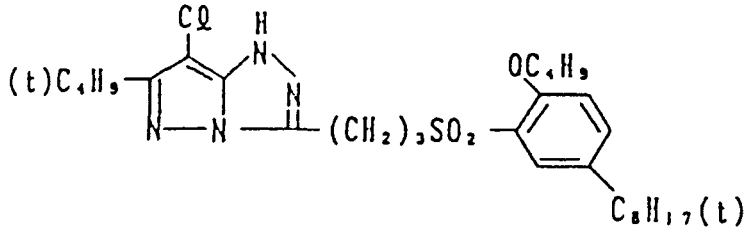

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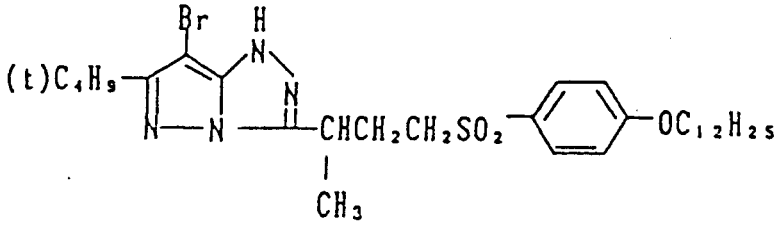

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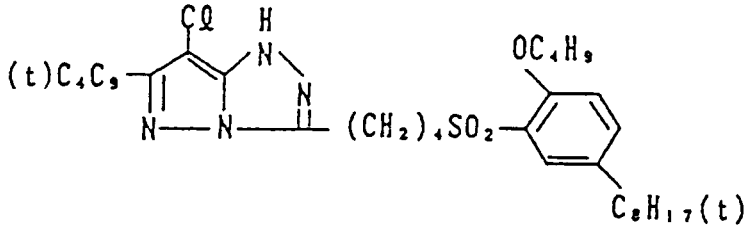

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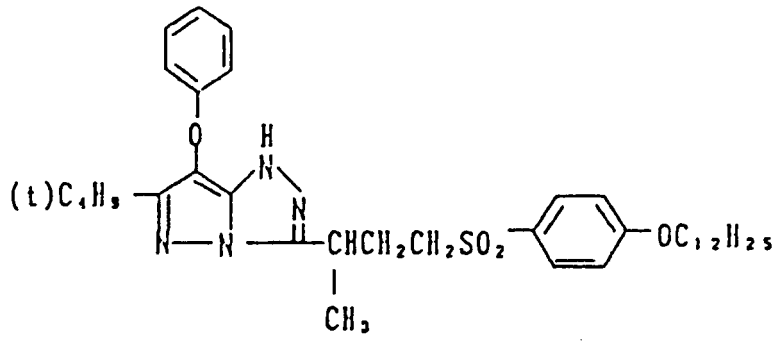

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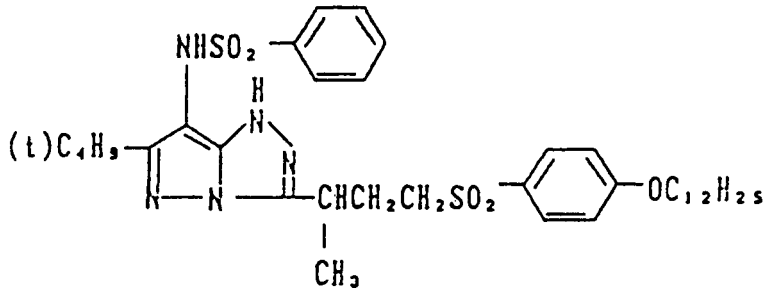

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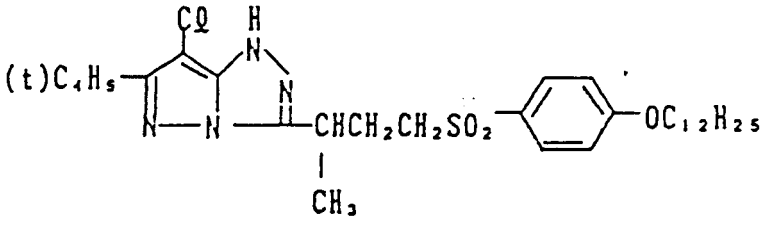

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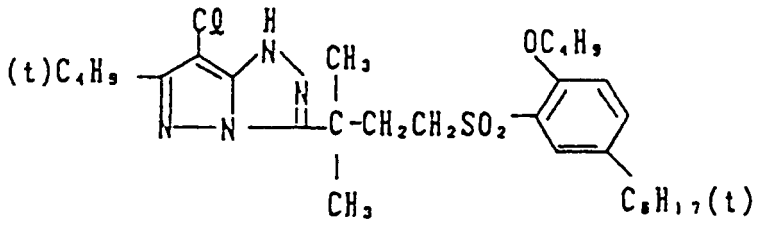

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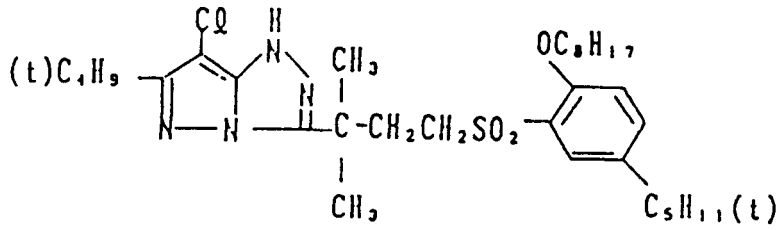

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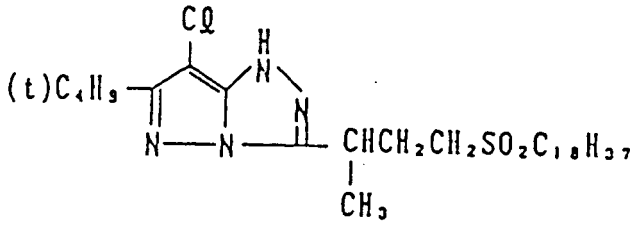

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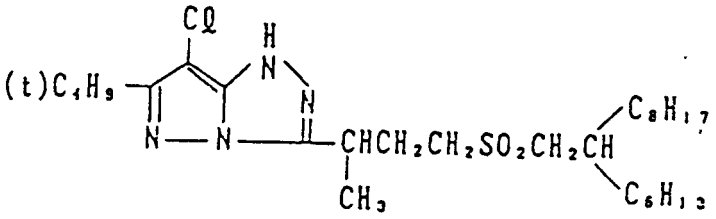

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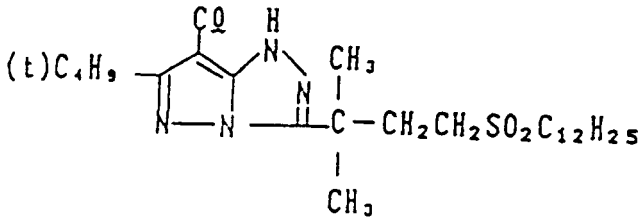

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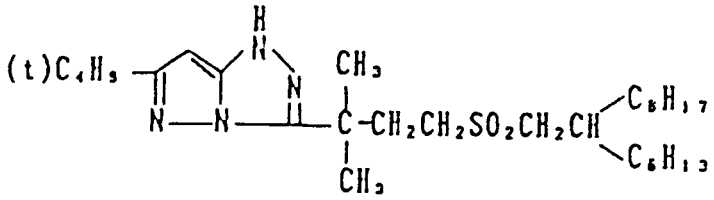

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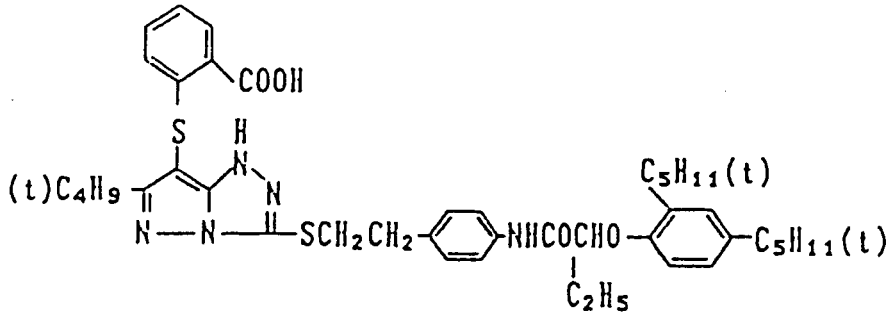

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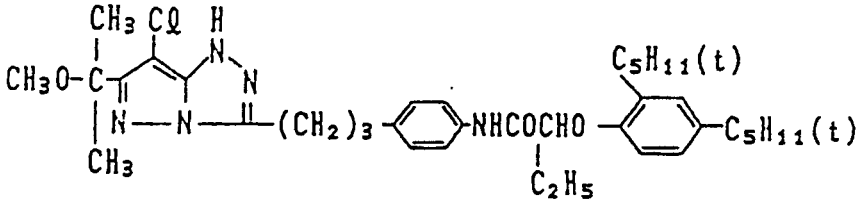

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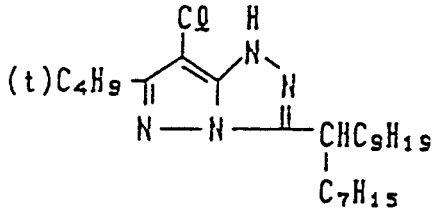

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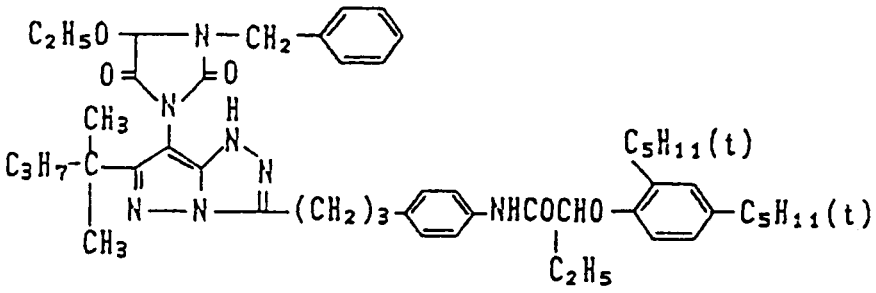

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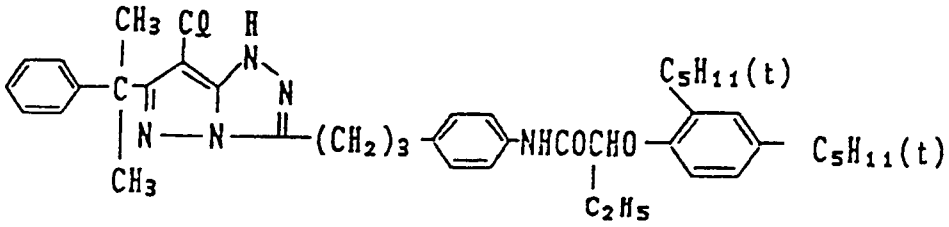

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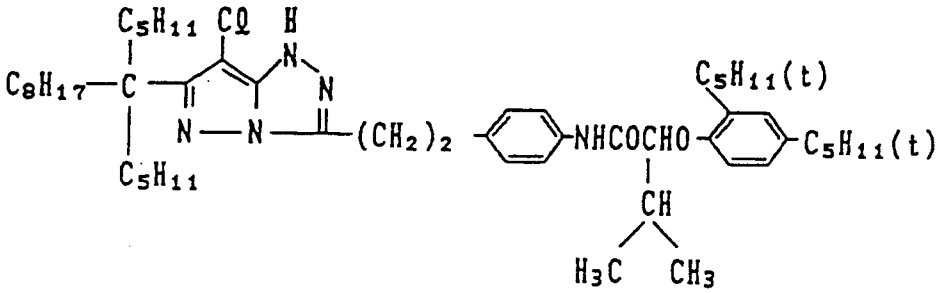

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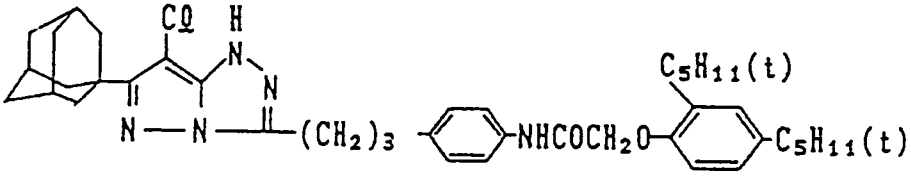

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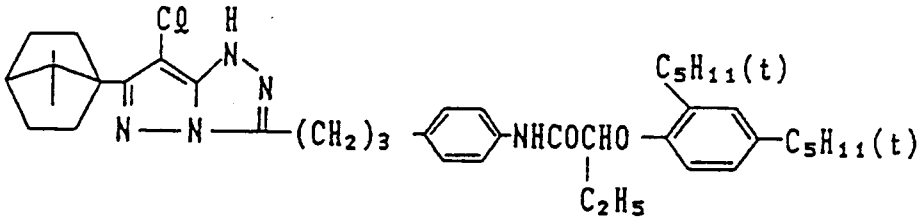

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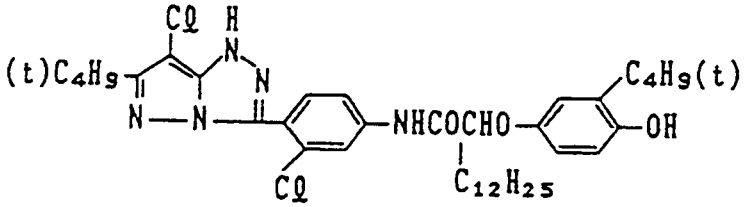

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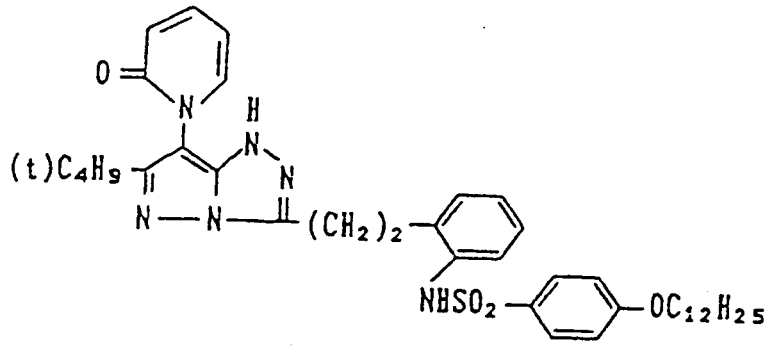

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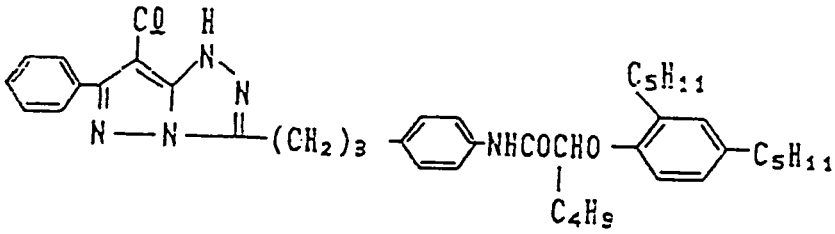

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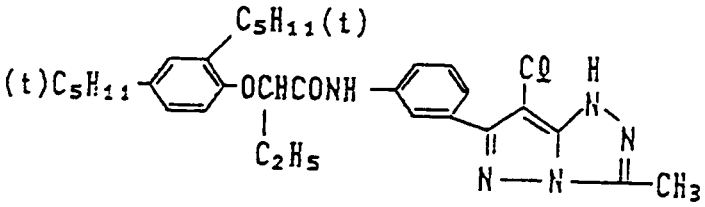

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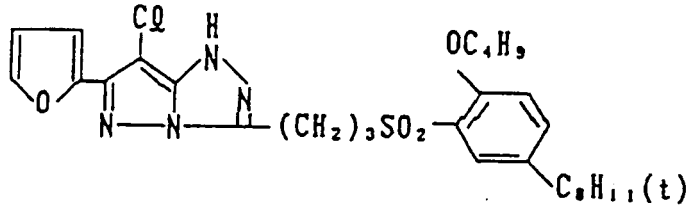

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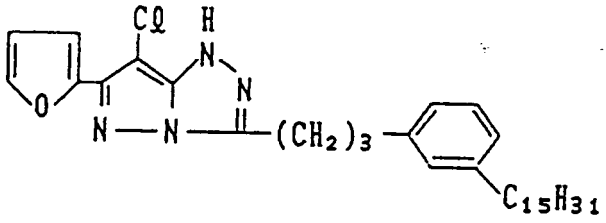

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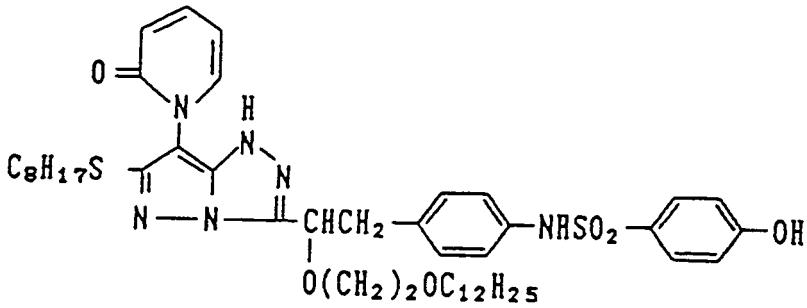

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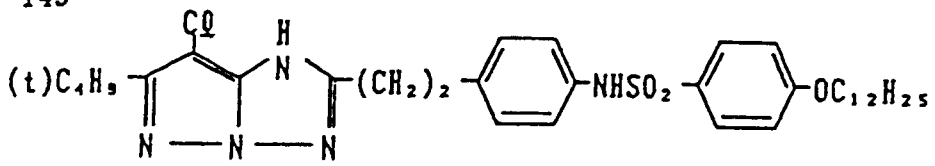

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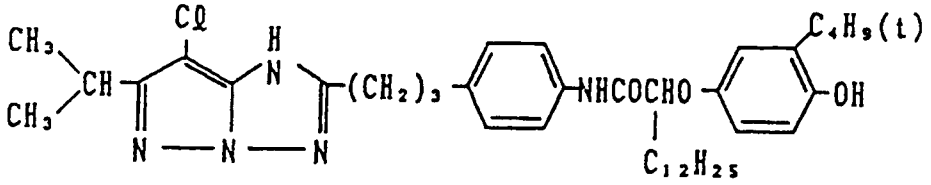

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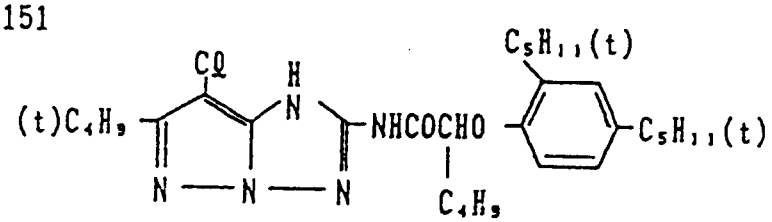

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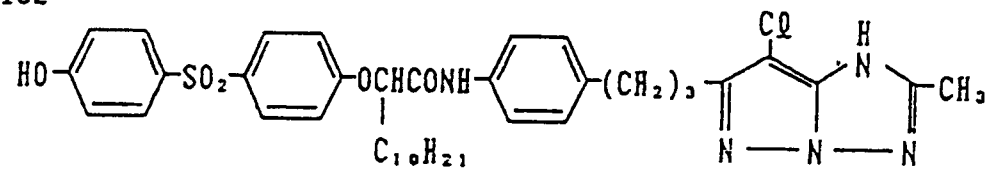

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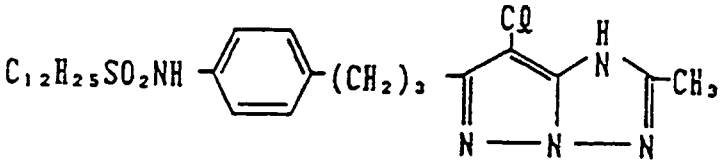

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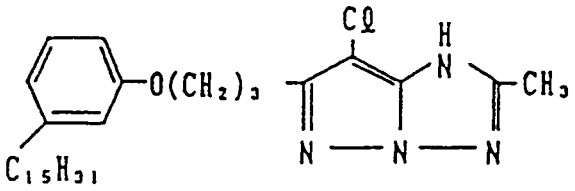

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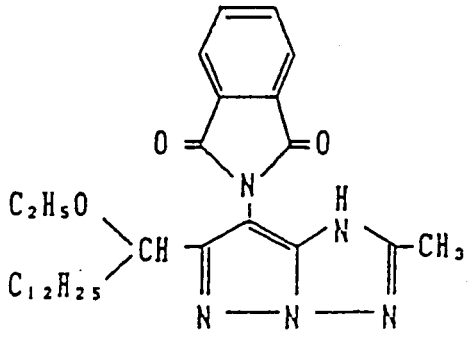

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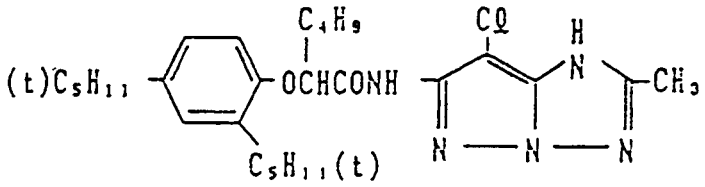

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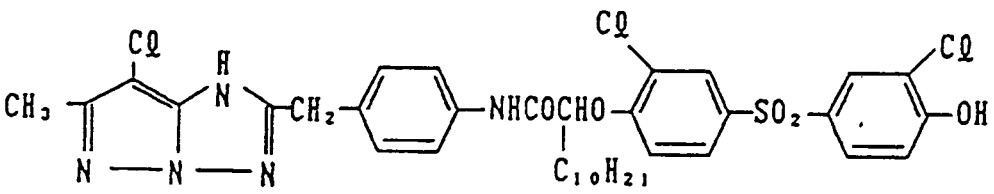

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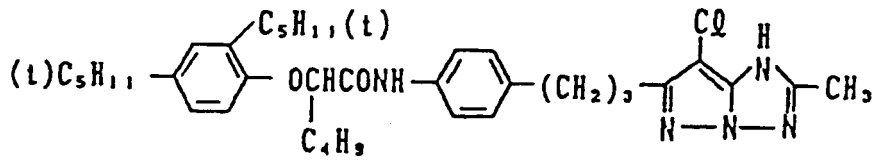

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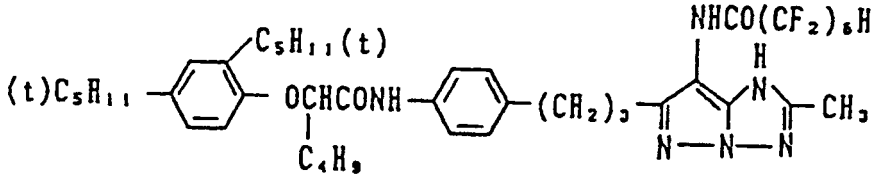

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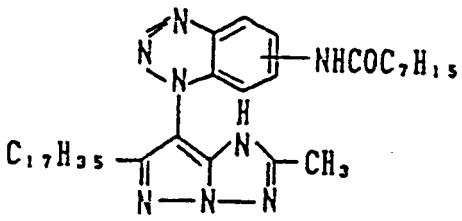

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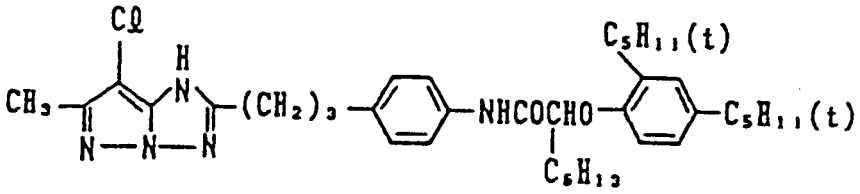

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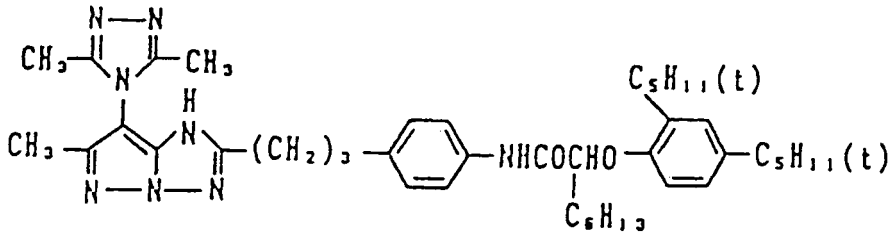

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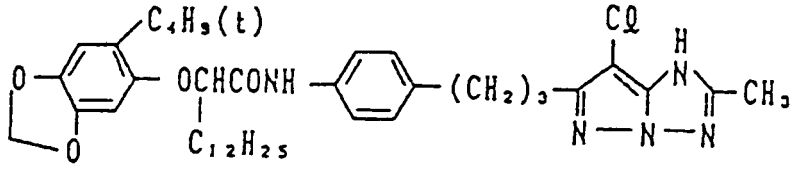

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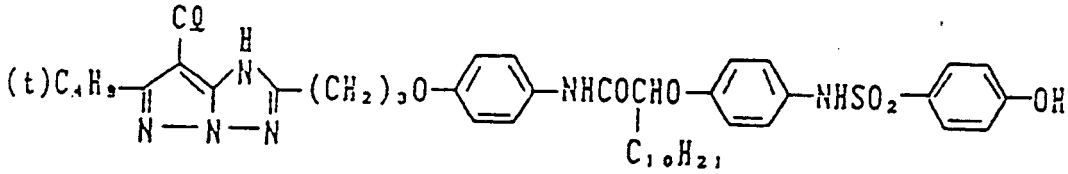

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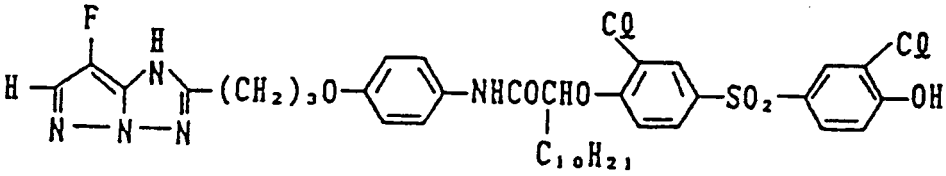

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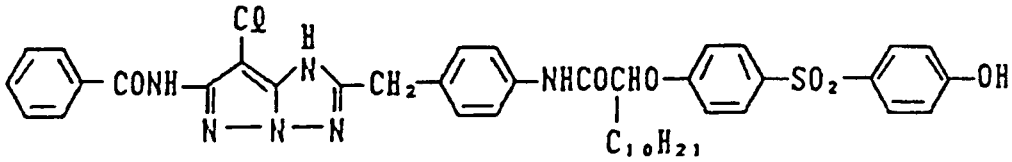

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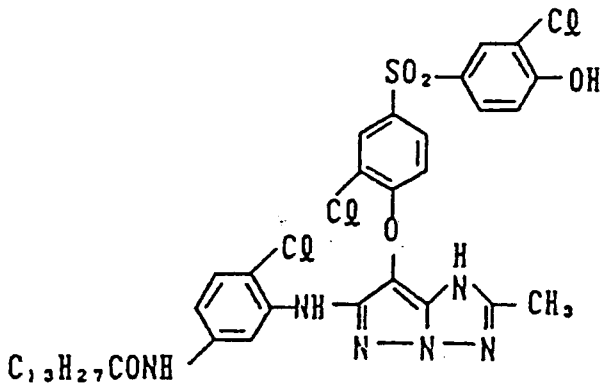

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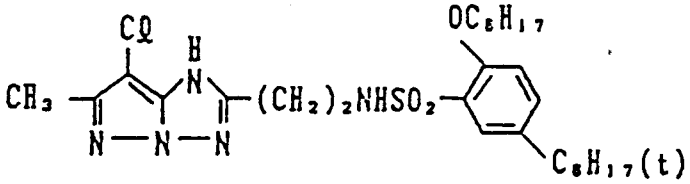

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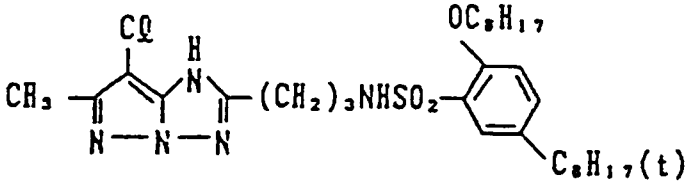

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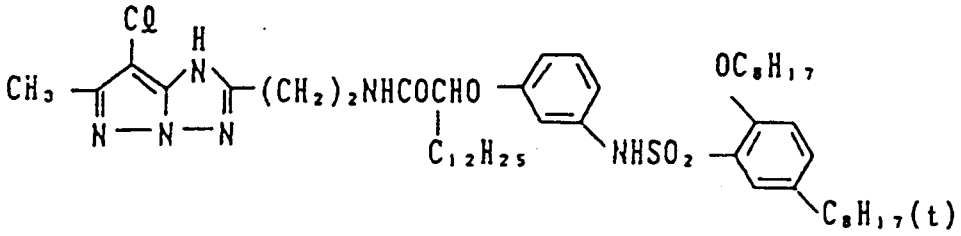

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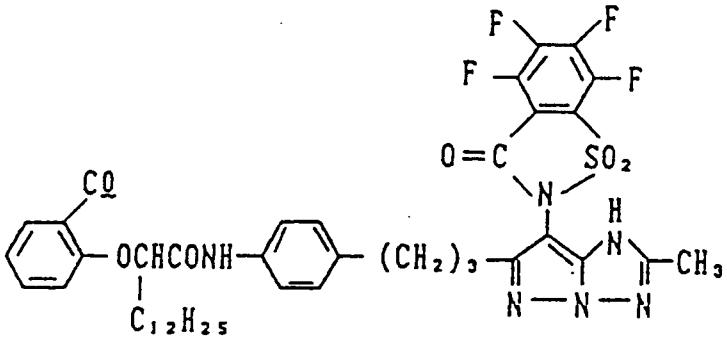

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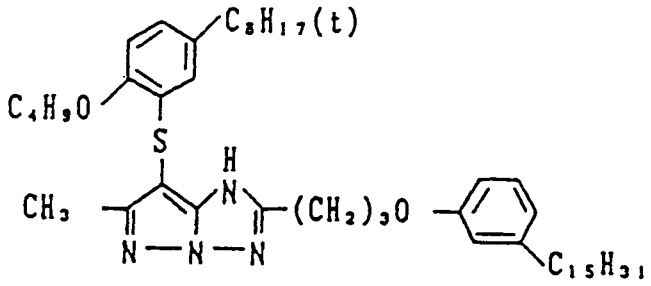

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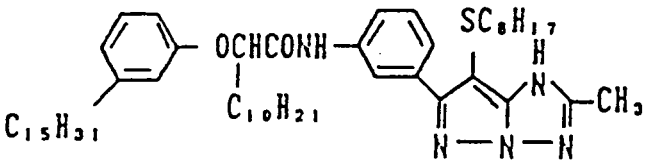

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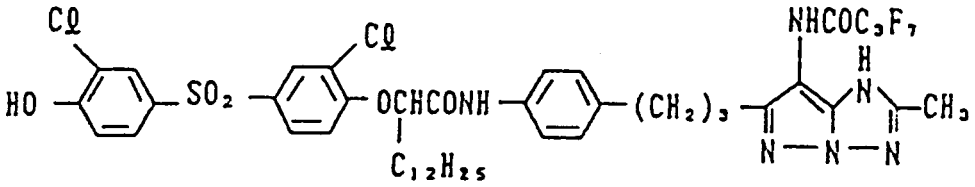

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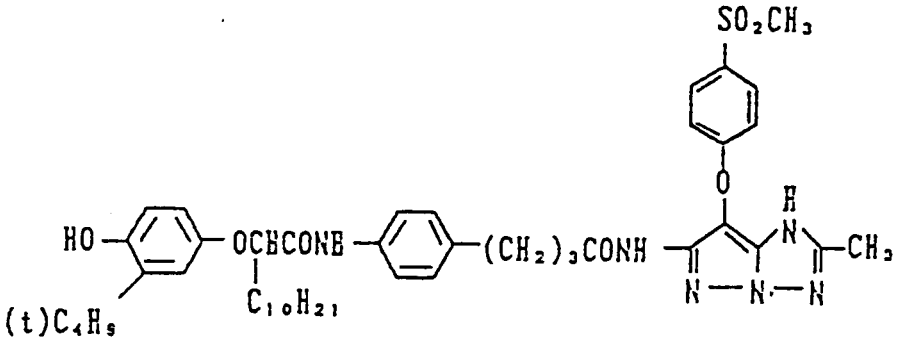

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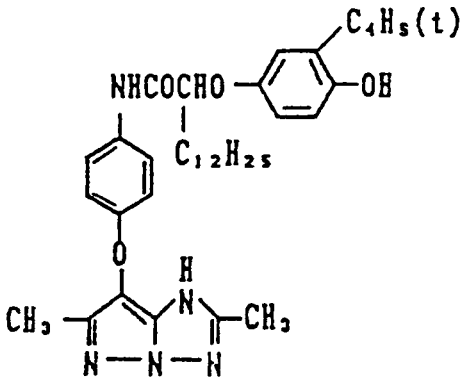

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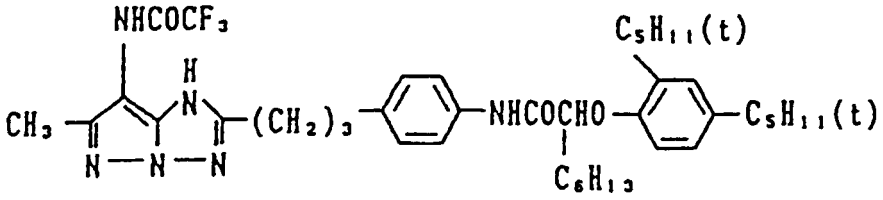

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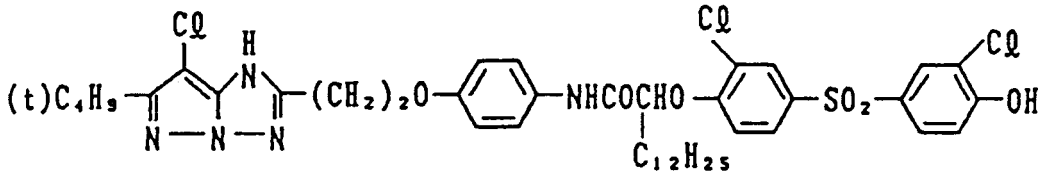

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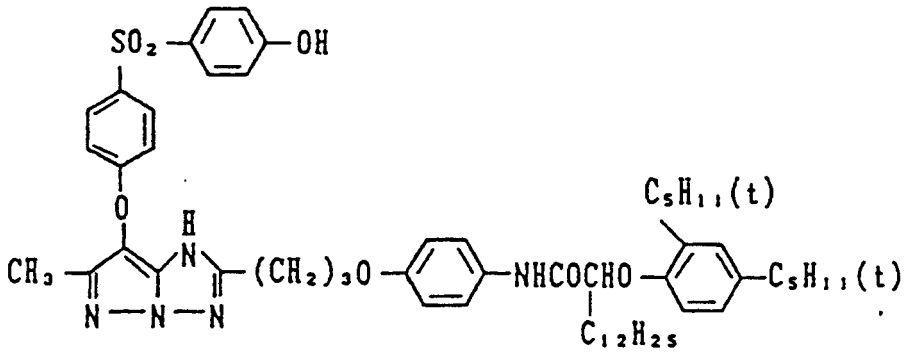

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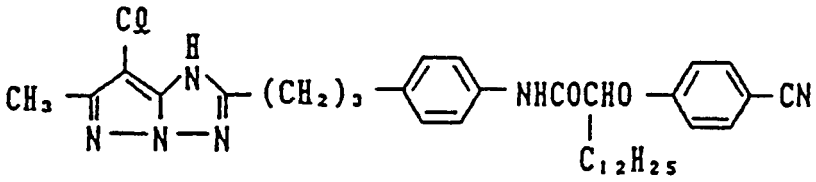

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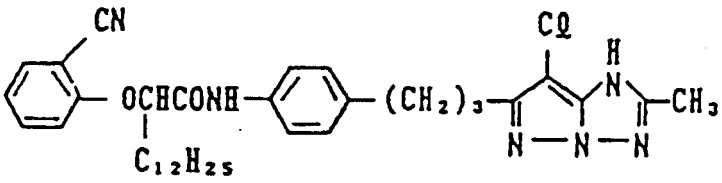

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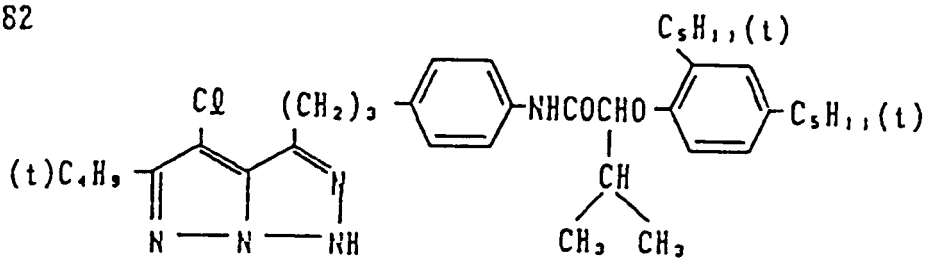

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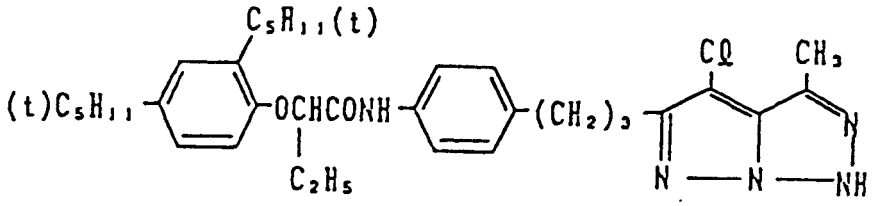

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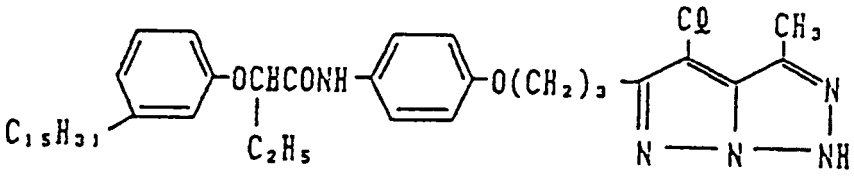

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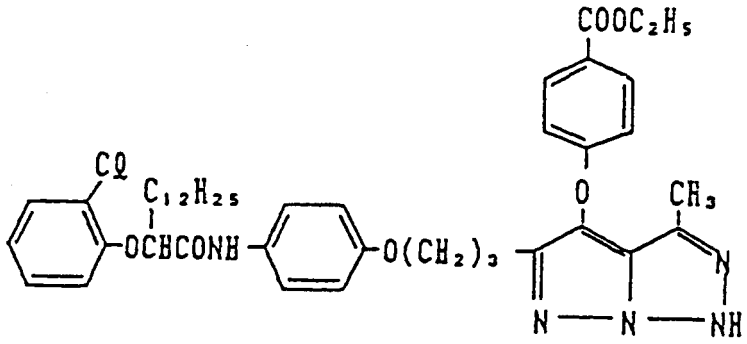

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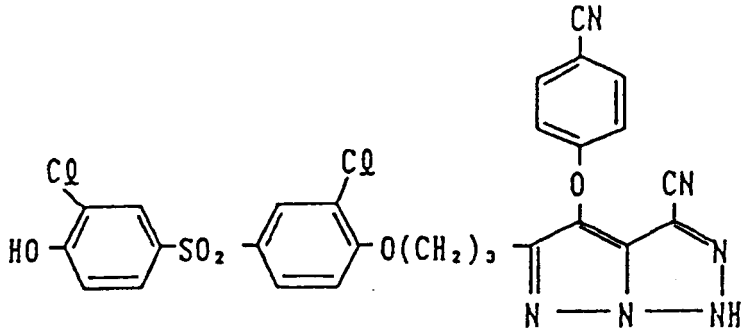

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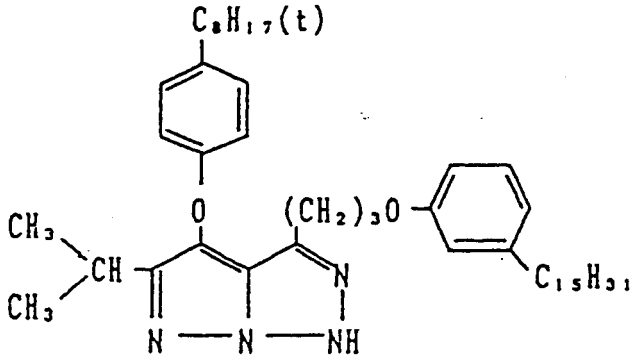

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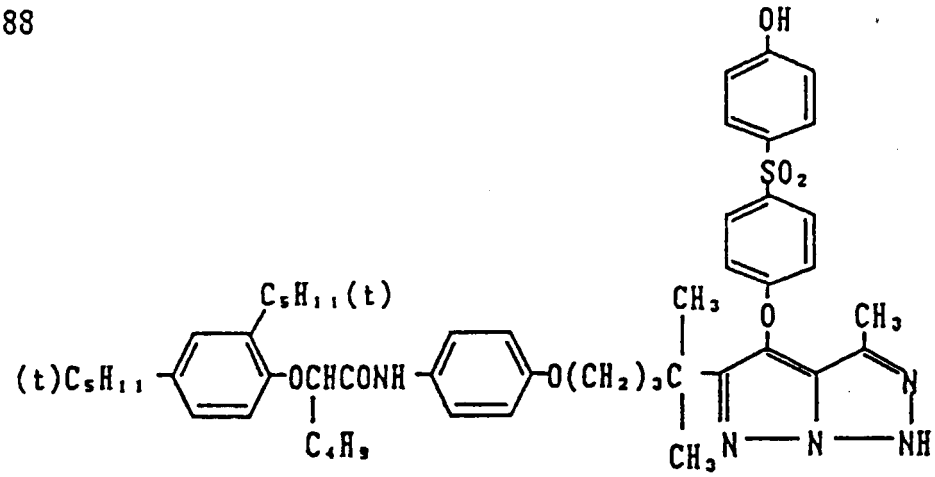

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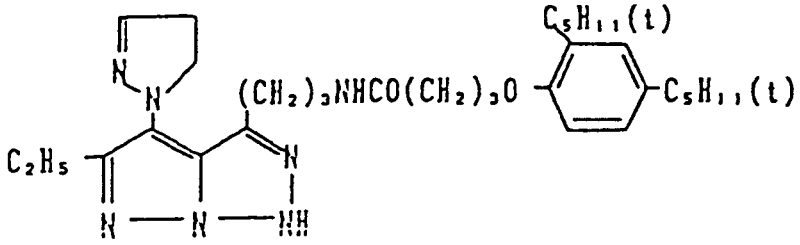

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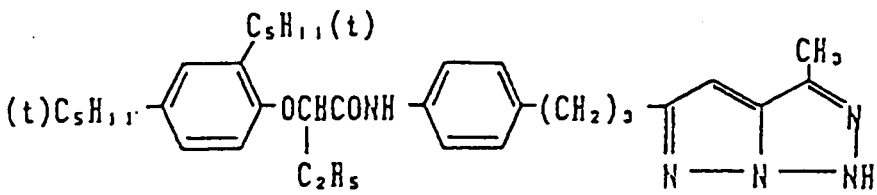

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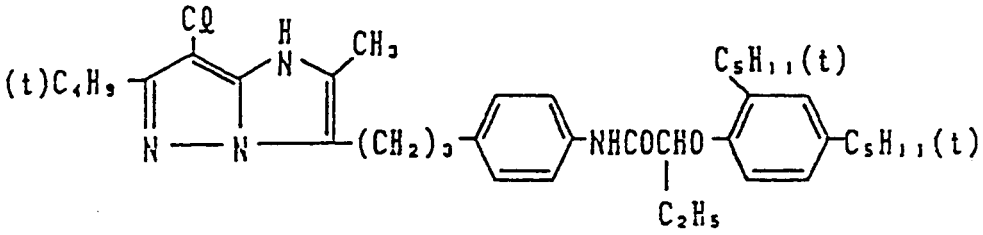

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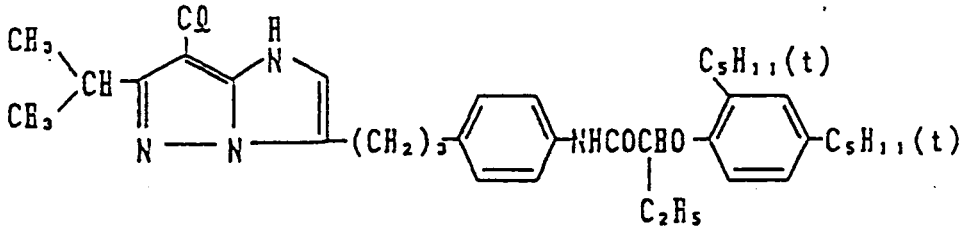

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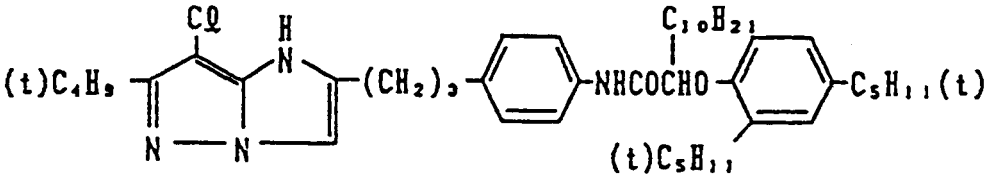

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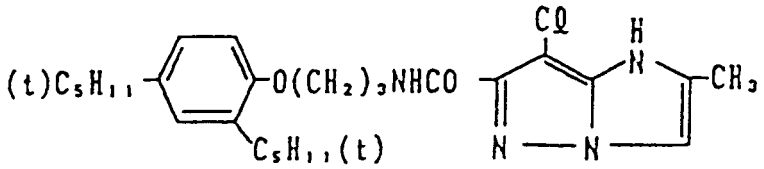

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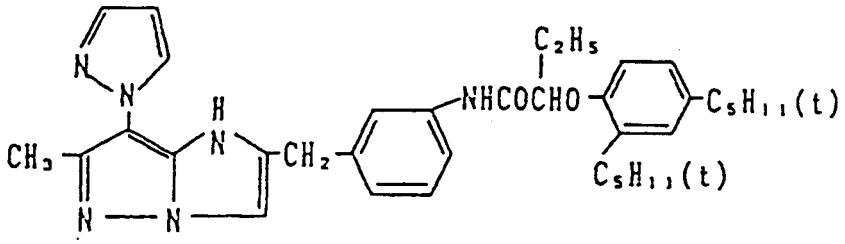

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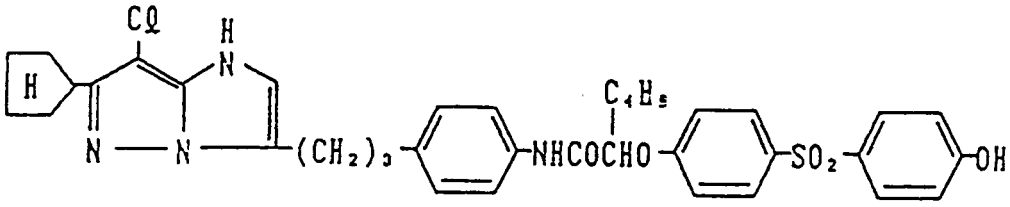

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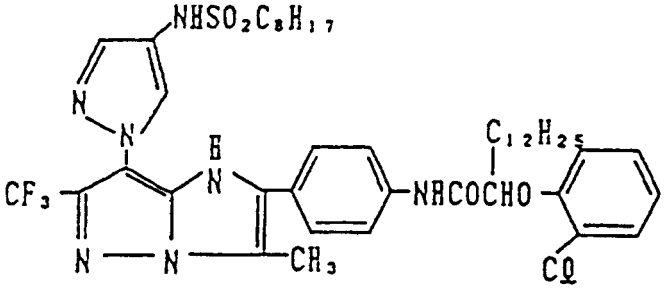

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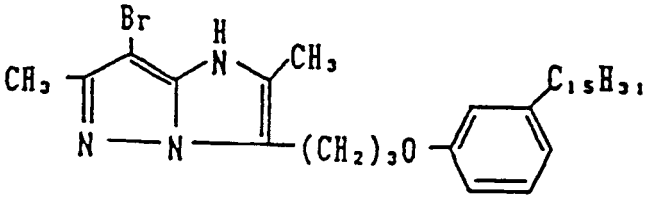

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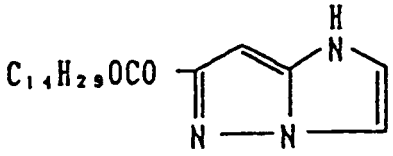

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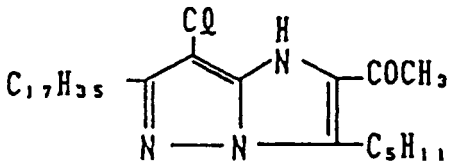

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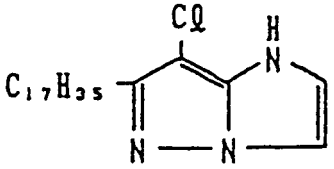

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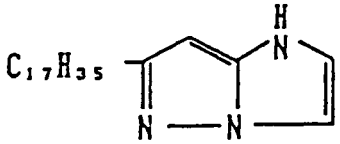

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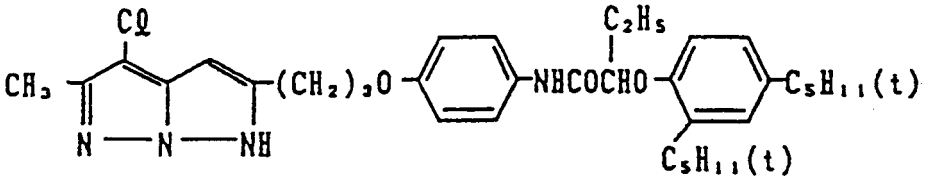

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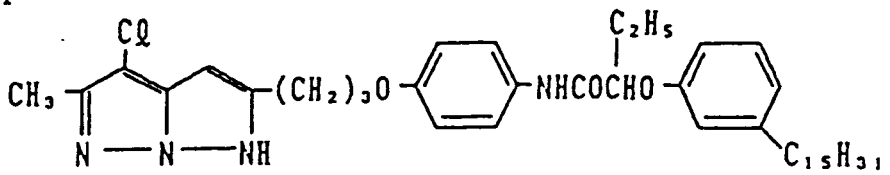

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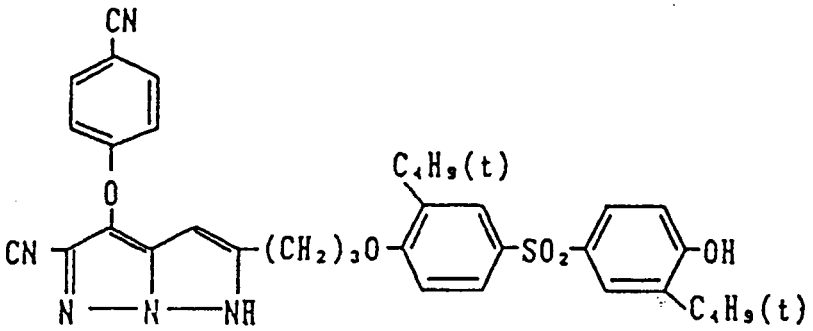

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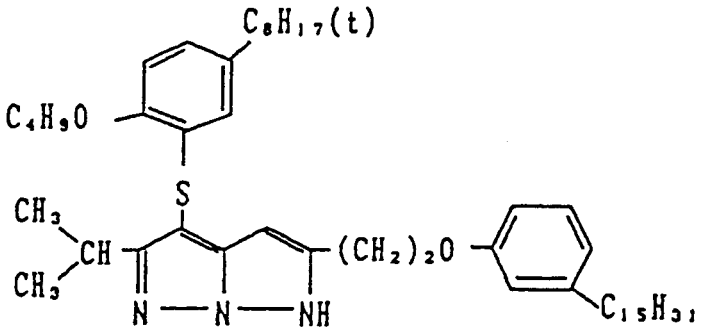

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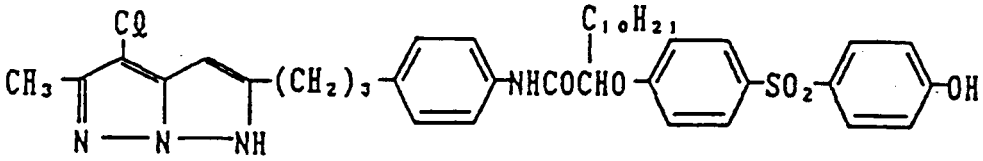

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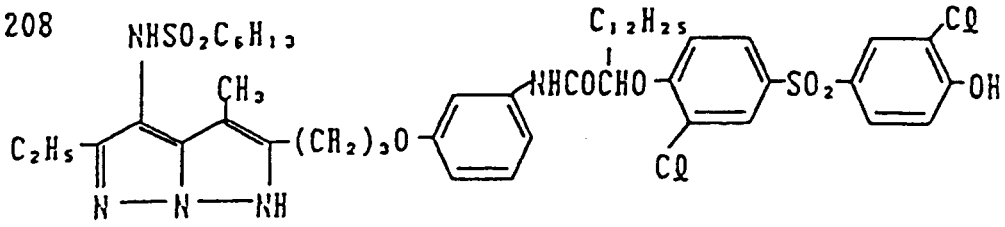

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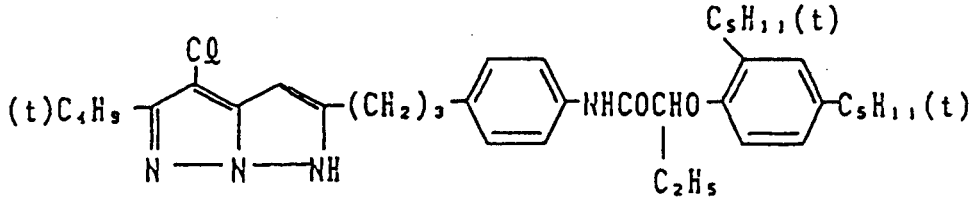

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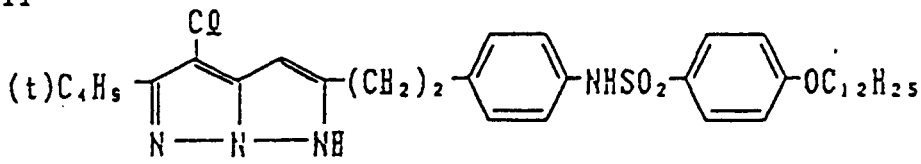

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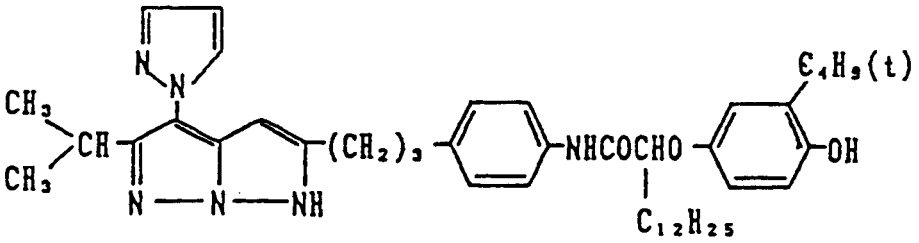

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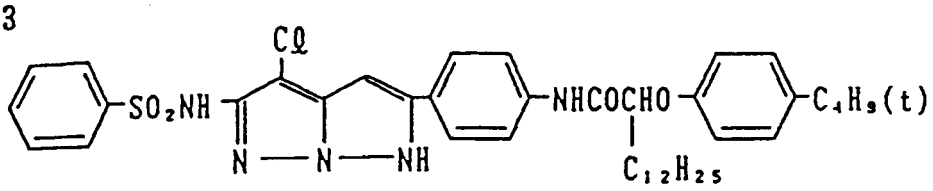

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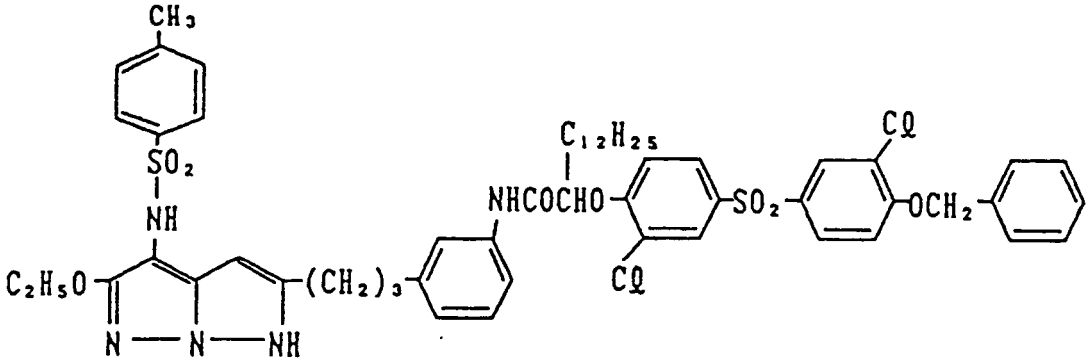

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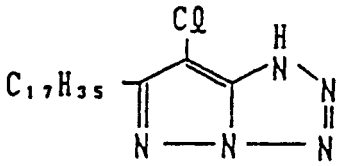

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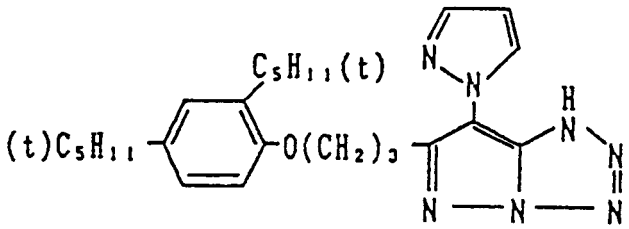

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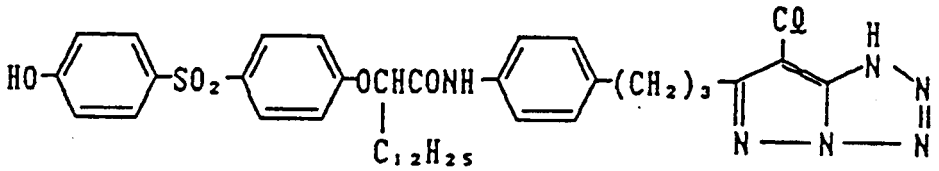

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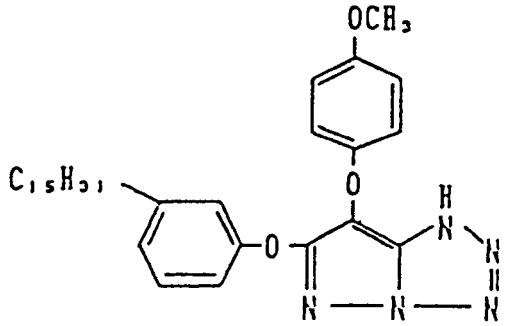

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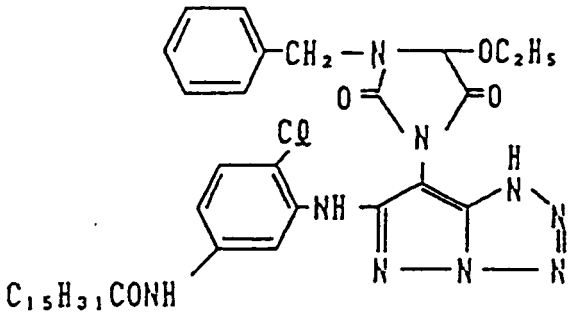

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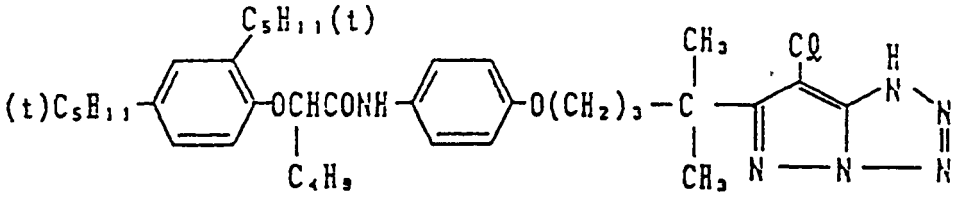

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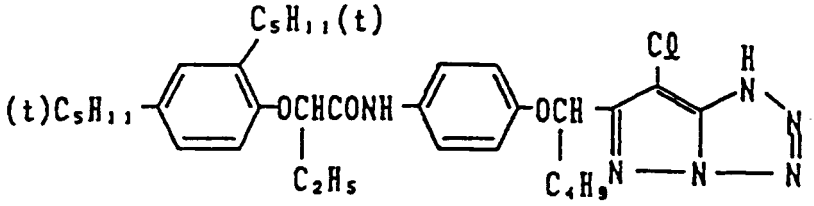

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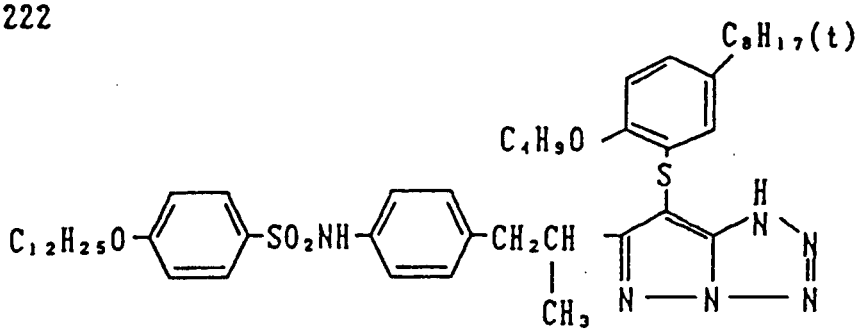

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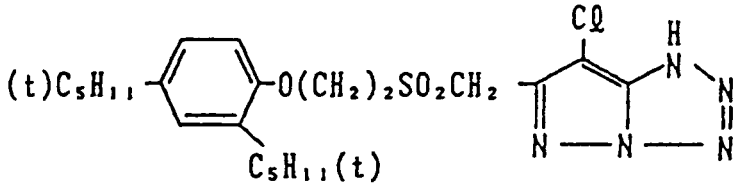


[0105] The above couplers were synthesized by referring to Journal of the Chemical Society, Perkin I (1977), pp. 2047 - 2052, U.S. Patent No. 3,725,067, Japanese Provisional Patent Publications No. 99437/1984 and No. 42045/1984.

[0106] The coupler of the present invention can be used in an amount generally within the range of from 1 x 10^{-3} mole to 5 x 10^{-1} mole, preferably from 1 x 10^{-2} to 5 x 10^{-1} mole, per mole of the silver halide.

[0107] The coupler of the present invention can be used in combination with other kinds of magenta couplers.

[0108] As the method for adding the magenta coupler represented by the formula (I) (hereinafter referred to as the magenta coupler of the present invention) to the light-sensitive silver halide photographic material, the same as in the additional method of the general hydrophobic compounds, there may be employed various methods such as the solid dispersing method, latex dispersing method or oil droplet-in-water type emulsifying methods. These methods can suitably be selected depending on the chemical structures of the hydrophobic compounds such as the coup-the couplers. According to the oil droplet-in-water type emulsification dispersion method, a conventional method of dispersing a hydrophobic compound such as a coupler may be applied, which method may usually comprise dissolving in a high boiling point organic solvent boiling at about 150 °C or higher a low boiling point organic solvent and/or a water soluble organic solvent which may be optionally used in combination, and carrying out emulsification dispersion by using a surface active agent in a hydrophilic binder such as a gelatin solution and by using a dispersion means such as a stirrer or a ultrasonic device followed by adding a resultant dispersion to the aimed hydrophilic colloid layer. After dispersion or at the time of the dispersion, a step to remove the low boiling point organic solvent may be included.

[0109] As the high boiling point organic solvent, an organic solvent boiling at 150 °C or higher may be used, comprising a phenol derivative, a phthalate, a phosphate, a citrate, a benzoate, an alkylamide, an aliphatic acid ester or a trimesic acid ester, which do not react with the oxidized product of a developing agent.

[0110] In this invention, the high boiling point organic solvent which can be preferably used when the magenta coupler according to the present invention is dispersed includes a compound having the dielectric constant of 6.0 or less, for example, esters such as phthalates and phosphates, organic amides, ketones or hydrocarbon compounds,, which have a dielectric constant of 6.0 or less.

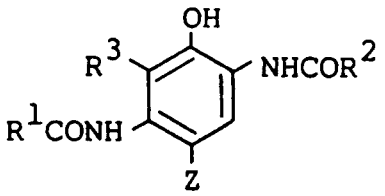
[0111] These organic solvents may be used generally in a proportion of of 10 to 150 % by weight, preferably 20 to 100 % by weight, based on the magenta coupler of the present invention.

[0112] As a dispersing aid to be used when the hydrophobic compound such as a coupler is dissolved in the solvent employing a high boiling point solvent alone or in combination with the low boiling point solvent to carry out the dispersion by use of a mechanical means or an ultrasonic wave, there may be used an anionic surface active agent, a nonionic surface active agent and cationic surface active agent.

[0113] The layer constitution in the light-sensitive silver halide color photographic material to be used in the present invention may assume any layer number and layer sequence, but preferably such that layers constituted of, on a reflective support, (1) a silver halide emulsion layer containing a yellow coupler, (2) a silver halide emulsion layer containing a magenta coupler according to the present invention and (3) a silver halide emulsion layer containing a cyan coupler are provided in the order of (1) - (2) - (3) from the support side, intermediate layers are provided between (1) and (2), and (2) and (3), respectively, and a non-light-sensitive layer is provided at a side more distant to (3) viewed from the support, and preferably ultraviolet absorbers are contained in the intermediate layer between said (2) and (3) and in the non-light-sensitive layer adjacent to (3). When the ultraviolet absorber is contained in the non-light-sensitive layer adjacent to the above (3), it is preferred to further provide a protective layer adjacent to the layer.

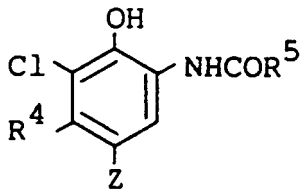
[0114] As the cyan coupler and the yellow coupler to be used in the present invention, phenol type or naphthol type tetraequivalent or diequivalent type cyan couplers are representative, and specific examples thereof are described in, for example, U.S. Patents No. 2,306,410, No. 2,356,475, No. 2,362,589, No. 2,367,531, No. 2,369,929, No. 2,423,730, No. 2,474,293, No. 2,476,008, No. 2,498,466, No. 2,545,687, No. 2,728,660, No. 2,772,162, No. 2,895,826, No. 2,976,146, No. 3,002,836, No. 3,419,390, No. 3,446,622, No. 3,476,563, No. 3,737,316, No. 3,758,308 and No. 3,839,044, British Patent No. 478,991, No. 945,542 No. 1,084,480, No. 1,377,233, No. 1,388,024 and No. 1,543,040; and Japanese Provisional Patent Publications No. 37425/1972, No. 10135/1975, No. 25228/1975, No. 112039/1975, No. 117422/1975, No. 130441/1975, No. 6551/1976, No. 37647/1976, No. 52828/1976, No. 108841/1976, No. 109630/1978, No. 48237/1979, No. 66129/1979, No. 131931/1979 and No. 32071/1980.

[0115] Further, as the cyan coupler to be used in the present invention, the compounds represented by the following formulae [CC - 1] and [CC - 2] are preferred.



[CC - 1]

wherein R^1 represents an alkyl group or an aryl group; R^2 represents an alkyl group, a cycloalkyl group, an aryl group or a heterocyclic group; R^3 represents a hydrogen atom, a halogen atom, an alkyl group or an alkoxy group, and R^3 may form a ring combined with R^1; and Z represents a hydrogen atom or a substituent eliminatable through the reaction with the oxidized product of a color developing agent.



[CC - 2]

wherein R^4 represents a straight of branched alkyl group having 1 to 4 carbon atoms; R^5 represents a ballast group; Z have the same meaning as defined in the formula [CC - 1]; and particularly preferred R^4 is a straight or branched alkyl group having 2 to 4 carbon atoms.

[0116] In the present invention, the alkyl group represented by R^1 of the formula [CC - 1] is a straight or branched one, such as, for example, a methyl group, an ethyl group, an iso-propyl group, a butyl group, a pentyl group, an octyl group, a nonyl group, a tridecyl group, etc. Also, the aryl group may include, for example, a phenyl group or a naphthyl group. These groups represented by R^1 may include those having single or plural number of substituents, and for example, as the substituent introduced in the phenyl group, there may be mentioned, as the representative examples, a halogen atom (e.g., each atom of fluorine, chlorine or bromine), an alkyl group (e.g., a methyl group, an ethyl group, a propyl group, a butyl group or a dodecyl group), a hydroxyl group, a cyano group, a nitro group, an alkoxy group (e.g., a methoxy group, an ethoxy group), an alkylsulfonamide group (e.g., a methylsulfonamide group or an octylsulfonamide group), an arylsulfonamide group (e.g., a phenylsulfonamide group, a naphthylsulfonamide group), an alkylsulfamoyl group (e.g., a butylsulfamoyl group), an arysulfamoyl group (e.g., a phenylsulfamoyl group), an alkyloxycarbonyl group (e.g., a methyloxycarbonyl group) an aryloxycarbonyl group (e.g., a phenyloxycarbonyl group), an aminosulfonamide group (e.g., an N,N-dimethylaminosulfonamide group), an acylamino group, a carbamoyl group, a sulfonyl group, a sulfi-

nyl group, a sulfoxy group, a sulfo group, an aryloxy group, an alkoxy group, a carboxy group, an alkylcarbonyl group or an arylcarbonyl group.

[0117] These substituents may be introduced into the phenyl group with two or more.

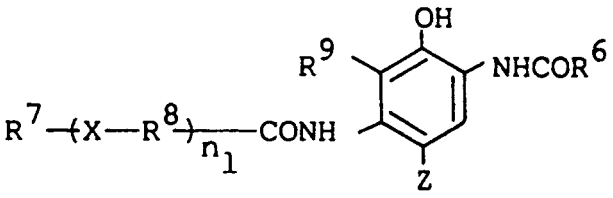
[0118] The halogen atom represented by R^3 may be, for example, each atom of fluorine, chlorine or bromine, the alkyl group may be, for example, a methyl group, an ethyl group, a propyl group, a butyl group or a dodecyl group, and the alkoxy group may be, for example, a methoxy group, an ethoxy group, a propyloxy group or a butoxy group. R^3 may form a ring combined with R^1.

[0119] In the present invention, the alkyl group represented by R^2 of the above formula [CC - 2] may be, for example, a methyl group, an ethyl group, a butyl group, a hexyl group, a tridecyl group, a pentadecyl group, a heptadecyl group or a so-called polyfluoroalkyl group substituted by fluorine atoms.

[0120] The aryl group represented by R^2 may be, for example, a phenyl group, a naphthyl group, preferably a phenyl group. The heterocyclic group represented by R^2 may be, for example, a pyridyl group or a furan group. The cycloalkyl group represented by R^2 may be, for example, a cyclopropyl group or a cyclohexyl group. These groups represented by R^2 may also include those having single or plural number of substituents, and for example, as the substituents introduced into the phenyl group, there may be mentioned, as the representative examples a halogen atom (e.g., each atom of fluorine, chlorine or bromine,), an alkyl group (e.g., a methyl group, an ethyl group, a propyl group, a butyl group or a dodecyl group,), a hydroxyl group, a cyano group, a nitro group, an alkoxy group (e.g., a methoxy group or an ethoxy group), an alkylsulfonamide group (e.g., a methylsulfonamide group or an octylsulfonamide group), an arylsulfonamide group (e.g., a phenylsulfonamide group or a naphthylsulfonamide group), an alkylsulfamoyl group (e.g., a butylsulfamoyl group), an arylsulfamoyl group (e.g., a phenylsulfamoyl group), an alkyloxycarbonyl group (e.g., a methyloxycarbonyl group), an aryloxycarbonyl group (e.g., a phenyloxycarbonyl group), an aminosulfonamide group, an acylamino group, a carbamoyl group, a sulfonyl group, a sulfinyl group, a sulfoxy group, a sulfo group, an aryloxy group, an alkoxy group, a carboxy group, an alkylcarbonyl group or an arylcarbonyl group. These substituents may be introduced into the phenyl group with two kinds or more.

[0121] As the preferred groups represented by R^2, there may be mentioned a polyfluoroalkyl group, a phenyl group or a phenyl group having one or more substituents such as a halogen atom, an alkyl group, an alkoxy group, an alkylsulfonamide group, an arylsulfonamide group, an alkylsulfamoyl group, an arylsulfamoyl group, an alkylsulfonyl group, an arylsulfonyl group, an alkylcarbonyl group, an arylcarbonyl group or a cyano group.

[0122] In the present invention, preferred cyan coupler represented by the formula [CC - 1] is a compound represented by the following formula [CC - 3]:



[CC - 3]

[0123] In the formula [CC - 3], R^6 represents a phenyl group. This phenyl group may include those having single or plural numbers of substituents, and for example, as the substituents introduced into the phenyl group, there may be mentioned, as the representative examples a halogen atom (e.g., each atom of fluorine, chlorine or bromine), an alkyl group (e.g., a methyl group, an ethyl group, a propyl group, a butyl group, or a dodecyl group), a hydroxyl group, a cyano group, a nitro group, an alkoxy group (e.g., a methoxy group or an ethoxy group), an alkylsulfonamide group (e.g., a methylsulfonamide group or an octylsulfonamide group, an arylsulfonamide group (e.g., a phenylsulfonamide group or a naphthylsulfonamide group), an alkylsulfamoyl group (e.g., a butylsulfamoyl group), an arylsulfamoyl group (e.g., a phenylsulfamoyl group), an alkyloxycarbonyl group (e.g., a methyloxycarbonyl group), an aryloxycarbonyl group (e.g., a phenyloxycarbonyl group). The phenyl group may be substituted by two or more kinds of these substituents. As the preferred group represented by R^6, there may be mentioned a phenyl group, or a phenyl group having one or more substituents such as a halogen atom (preferably each atom of fluorine, chlorine, bromine), an alkylsulfonamide group (preferably an o-methylsulfonamide group, a p-octylsulfonamide group, an o-dodecylsulfonamide group), an arylsulfonamide group (preferably a phenylsulfonamide group), an alkylsulfamoyl group (preferably a butylsulfamoyl group), an arylsulfamoyl group (preferably a phenylsulfamoyl group), an alkyl group (preferably a methyl group, a trifluoromethyl group) and an alkoxy group (preferably a methoxy group, an ethoxy group).

[0124] R^7 represents an alkyl group or an aryl group. The alkyl group and the aryl group may include those having single or plural numbers of substituents, and as the representative examples, there may be mentioned a halogen atom

(e.g., each atom of fluorine, chlorine or bromine), a hydroxyl group, a carboxyl group, an alkyl group (e.g., a methyl group, an ethyl group, a propyl group, a butyl group, an octyl group or a dodecyl group), an aralkyl group, a cyano group, a nitro group, an alkoxy group (e.g., a methoxy group or an ethoxy group), an aryloxy group, an alkylsulfonamide group (e.g., a methylsulfonamide group or an octylsulfonamide group), an arylsulfonamide group (e.g., a phenylsulfonamide group or a naphthylsulfonamide group), an alkylsulfamoyl group (e.g., a butylsulfamoyl group), an arylsulfamoyl group (e.g., a phenylsulfamoyl group), an alkyloxycarbonyl group (e.g., a methyloxycarbonyl group), an aryloxycarbonyl group (e.g., a phenyloxycarbonyl group), an aminosulfonamide group (e.g., a dimethylaminosulfonamide group, an alkylsulfonyl group, an arylsulfonyl group, an alkylcarbonyl group, an arylcarbonyl group, an aminocarbonylamide group or a carbamoyl group, a sulfinyl group. The substituents may be introduced therein with two or more kinds.

[0125] A preferred group represented by R^7 is an alkyl group when n_1 is 0 and an aryl group when n_1 is 1 more more. As the more preferred group represented by R^7, when n_1 = 0, it is an alkyl group having 1 to 22 carbon atoms (preferably a methyl group, an ethyl group, a propyl group, a butyl group, an octyl group or a dodecyl group), while n_1 = 1 or more, it is a phenyl group, or a phenyl group which has one or more substituents such as an alkyl group (preferably a t-butyl group, a t-amyl group, an octyl group), an alkylsulfonamide group (preferably a butylsulfonamide group, an octylsulfonamide group, a dodecylsulfonamide group), an arylsulfonamide group (preferably a phenylsulfonamide group), an aminosulfonamide group (preferably dimethylaminosulfonamide group) and an alkyloxycarbonyl group (preferably a methyloxycarbonyl group, a butyloxycarbonyl group).

[0126] R^8 represents an alkylene group. The alkylene group may be a straight or branched one having 1 to 20 carbon atoms, preferably those having 1 to 12 carbon atoms.

[0127] R^9 represents a hydrogen atom or a halogen atom (each atom of fluorine, chlorine, bromine or iodine). Preferred is a hydrogen atom.

[0128] n_1 is 0 or a positive integer, preferably 0 or 1.

[0129] X represents a divalent group such as -O-, -CO-, -COO-, -OCO-, $-SO_2NR-$, $-NR'SO_2NR''-$, -S-, -SO- or $-SO_2-$ groups. Here, R' and R'' each represent an alkyl group and each of the R' and R'' may include those having substituents. Preferred X are -O-, -S-, -SO- and $-SO_2-$ groups.

[0130] Z have the same meaning with Z as defined in the formula [CC - 1].

[0131] In the present invention, said straight or branched alkyl group having 1 to 4 carbon atoms represented by R^4 in the formula [CC - 2] may be, for example, an ethyl group, a propyl group, a butyl group, an iso-propyl group, an iso-butyl group, a sec-butyl group or a tert-butyl group and they may include those having substituents. As the substituents, there may be mentioned an acylamino group (e.g., an acetylamino group), an alkoxy group (e.g., a methoxy group), and the like.

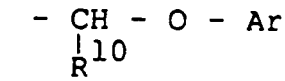
[0132] R^4 preferably is an alkyl group having 2 to 4 carbon atoms.

[0133] The ballast group represented by R^5 is an organic group having a bulk and a shape for providing a sufficient bulk size to a coupler molecule to substantially inhibit diffusion of the coupler from a layer applied said coupler to other layers.

[0134] As the representative ballast group, there may be mentioned an alkyl group or an aryl group each having 8 to 32 total carbon atoms.

[0135] These alkyl group and the aryl group may include those having substituents. As the substituents for the aryl group, there may be mentioned, for example, an alkyl group, an aryl group, an alkoxy group, an aryloxy group, a carboxy group, an acyl group, an ester group, a hydroxy group, a cyano group, a nitro group, a carbamoyl group, a carbonamide group, an alkylthio group, an arylthio group, a sulfonyl group, a sulfonamide group, a sulfamoyl group and a halogen atom. Further, as the substituents for the alkyl group, the aforesaid substituents other than the alkyl group mentioned for the aryl group may be mentioned.

[0136] Particularly preferred ballast groups may be represented by the following formula [CC - 4]:



[0137] R^{10} represents a hydrogen atom or an alkyl group having 1 to 12 carbon atoms; Ar represents an aryl group such as a phenyl group and the aryl group may include those having substituents. As substituents, there may be mentioned an alkyl group, a hydroxy group, an alkylsulfonamide group, etc., but the most preferred is a branched alkyl group such as a t-butyl group.

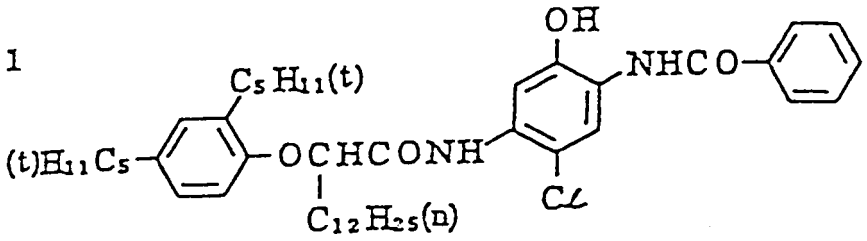
[0138] In the formulae [CC - 1], [CC - 2] and [CC - 3], the substituent eliminatable through the reaction with the oxidized product of an aromatic primary amine type color developing agent represented by Z has been known for a person

skilled in the art, and it reforms reactivity of the coupler, or breaks away from the coupler and carries out the functions of development inhibition, bleaching inhibition, color correction and the like in a coated layer containing a coupler in the light-sensitive silver halide color photographic material or other layers, whereby it acts advantageously. As the representative, there may be mentioned a halogen atom typified by chlorine and fluorine, a substituted or unsubstituted alkoxy group, an aryloxy group, an arylthio group, a carbamoyloxy group, an acyloxy group, a sulfonyloxy group, a sulfonamide group, a heteroylthio group or a heteroyloxy group. Particularly preferred Z is a hydrogen atom or a chlorine atom.

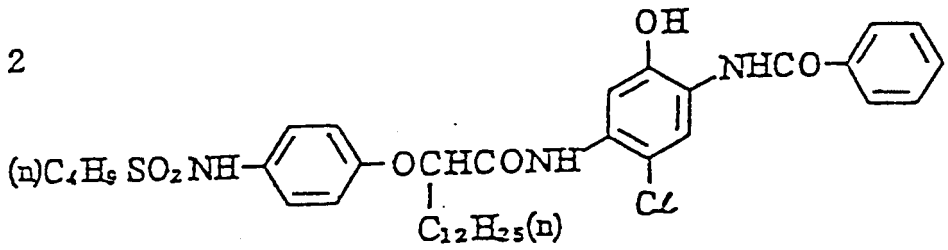
[0139] More specifically, there may be disclosed in Japanese Provisional Patent Publications No. 10135/1975, No. 120334/1975, No. 130441/1975, No. 48237/1979, No. 146828/1976, No. 14736/1979, No. 37425/1972, No. 123341/1975 and No. 95346/1983; Japanese Patent Publication No. 36894/1973; U.S. Patents No. 3,476,563, No. 3,737,316 and No. 3,227,551 and the like.

[0140] In the following, representative examples of the cyan coupler represented by the formula [CC - 1] are shown, but they are not limitative.

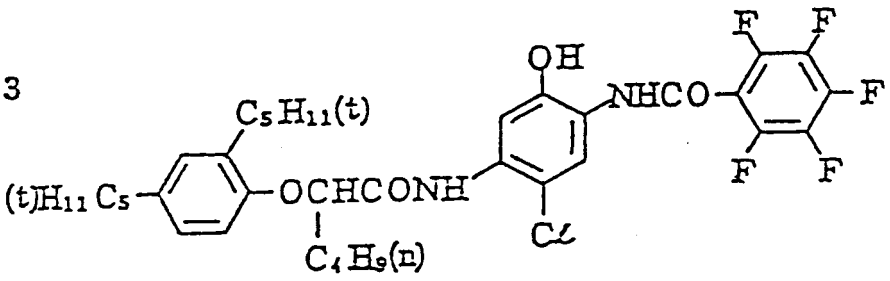
C − 1



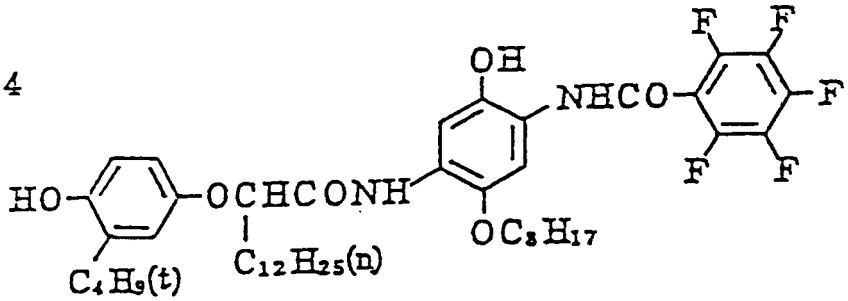
C − 2



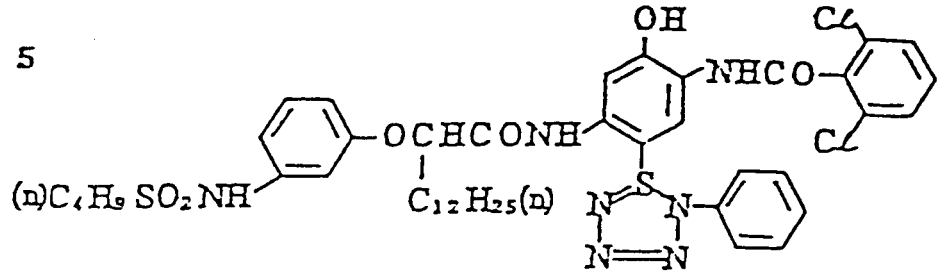
C − 3



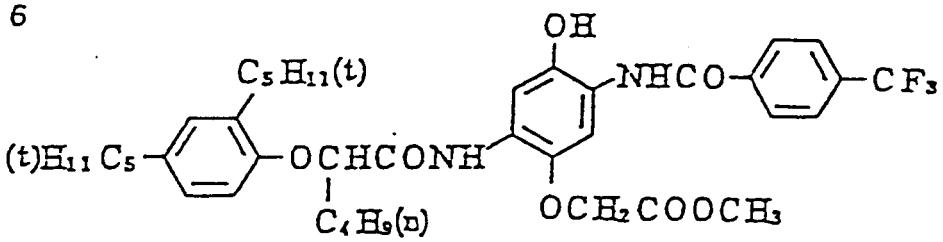
C − 4



C − 5



C − 6



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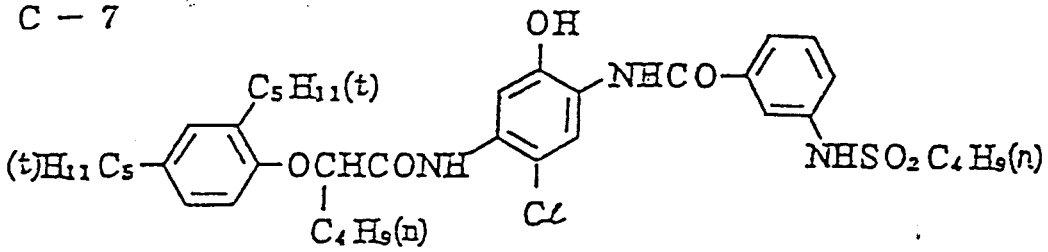
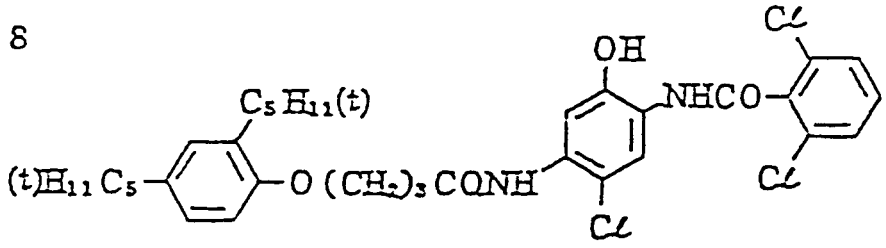
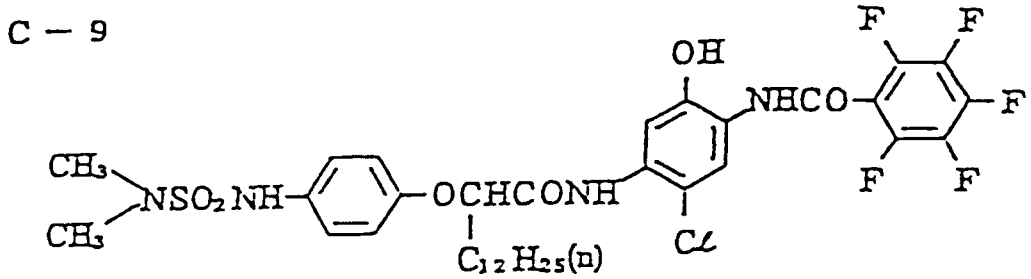


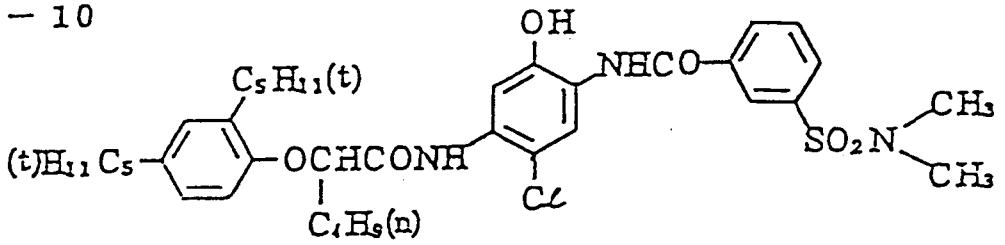
C − 8



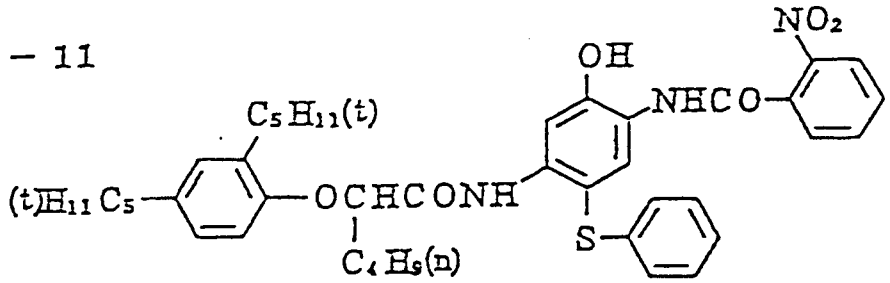
C − 9



C − 10



C − 11



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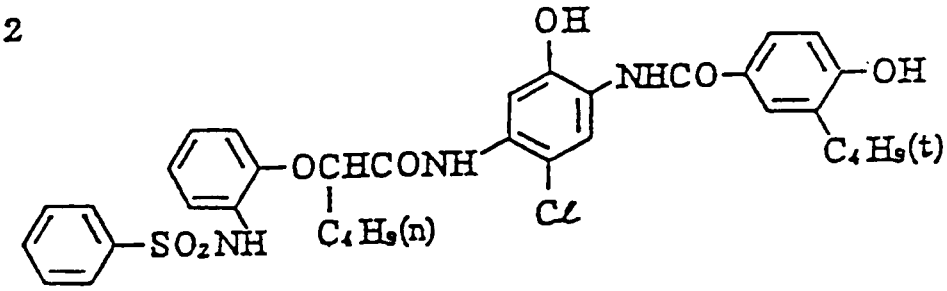
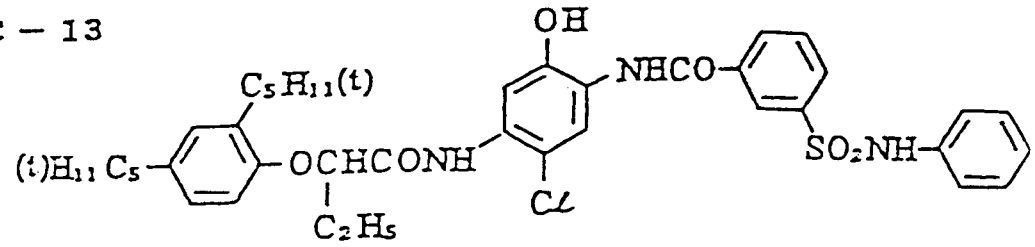
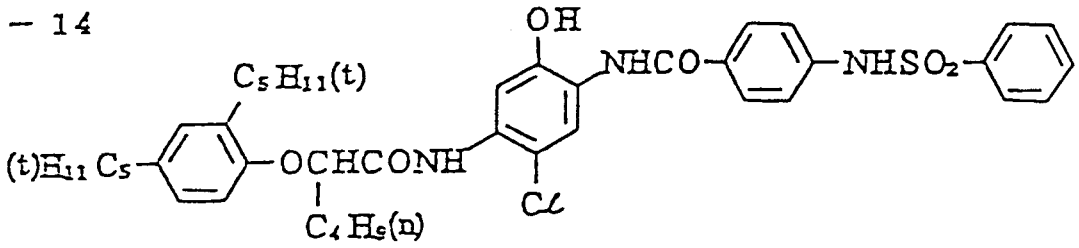


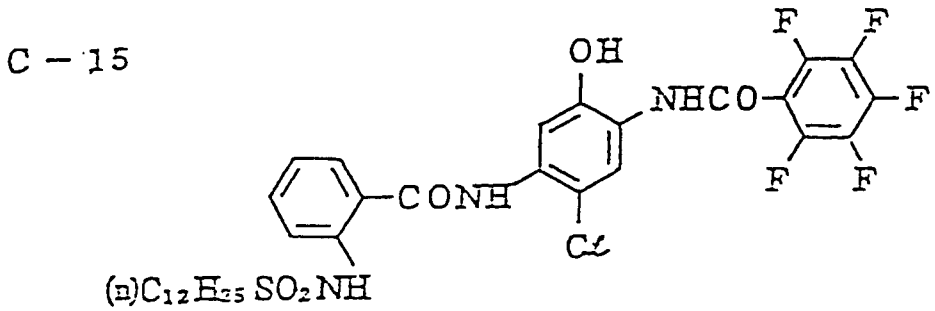
C − 13



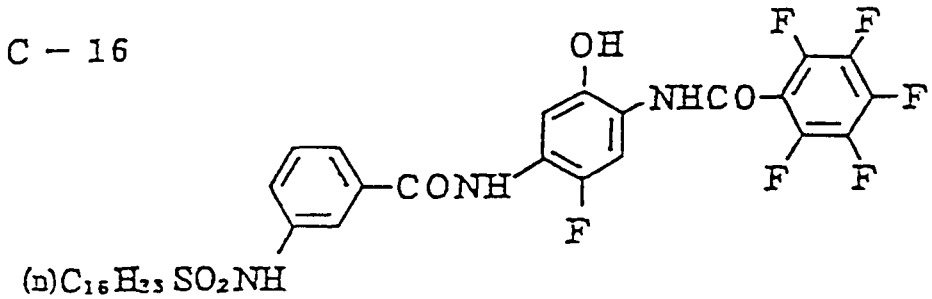
C − 14



C − 15



C − 16



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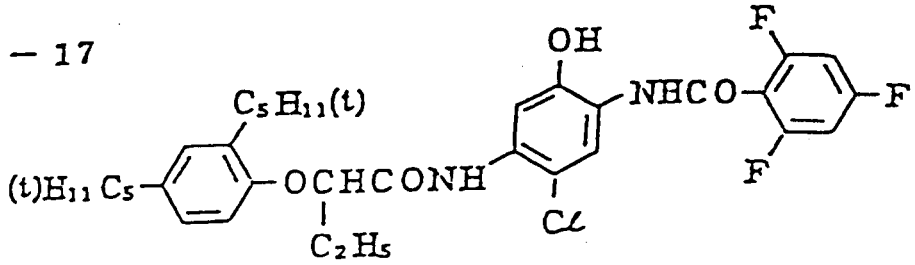

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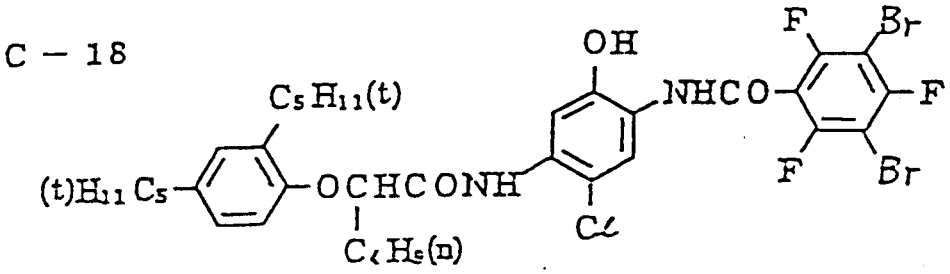
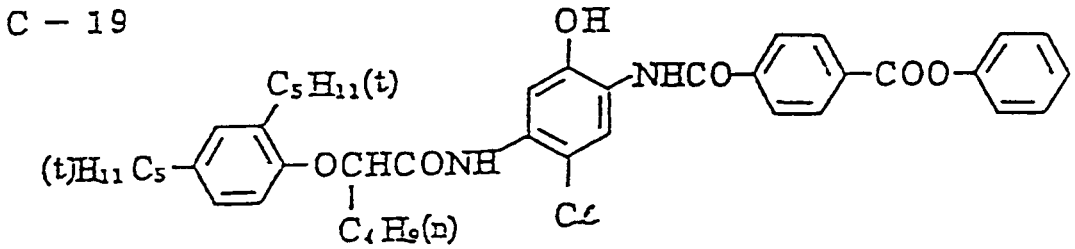
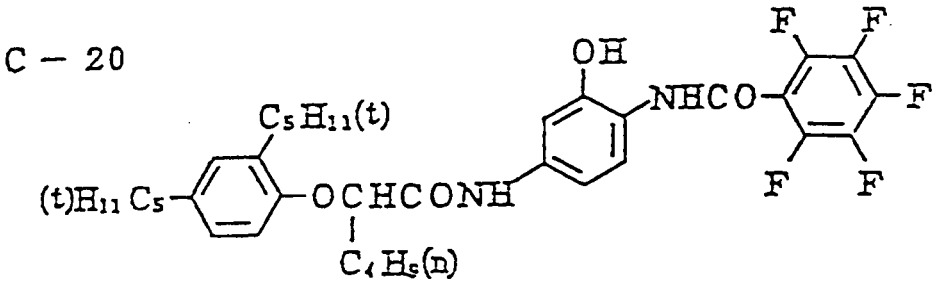


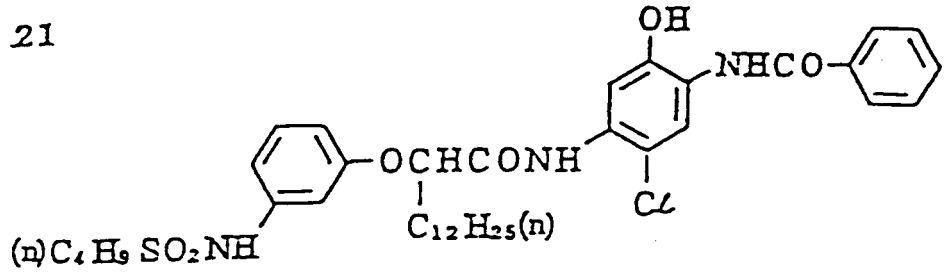
C − 19



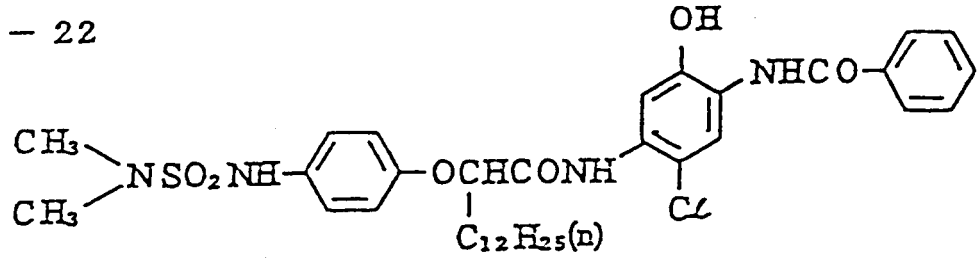
C − 20



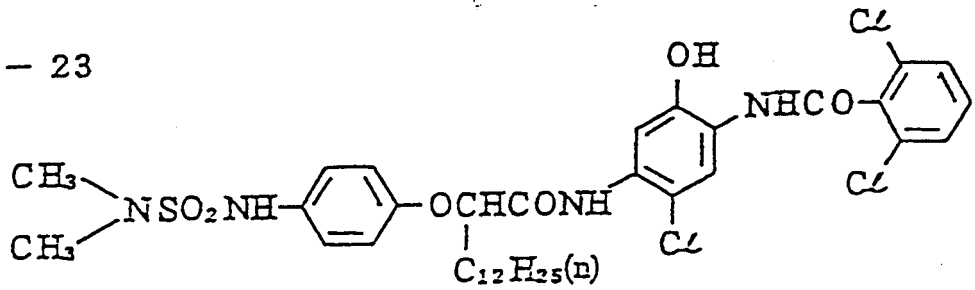
C − 21



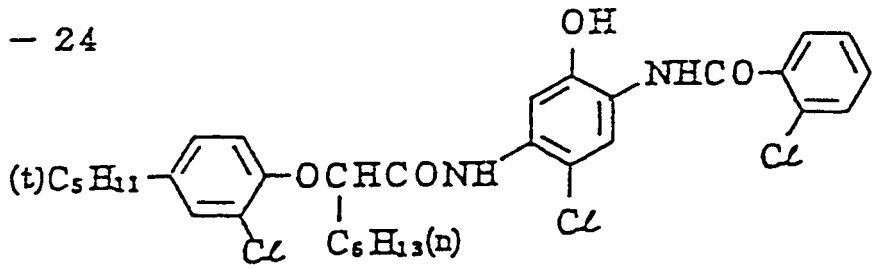
C − 22



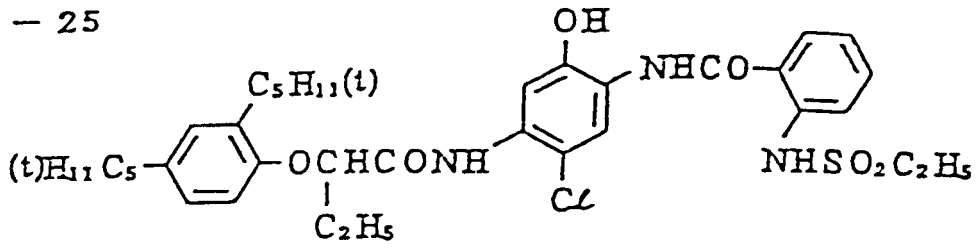
C − 23



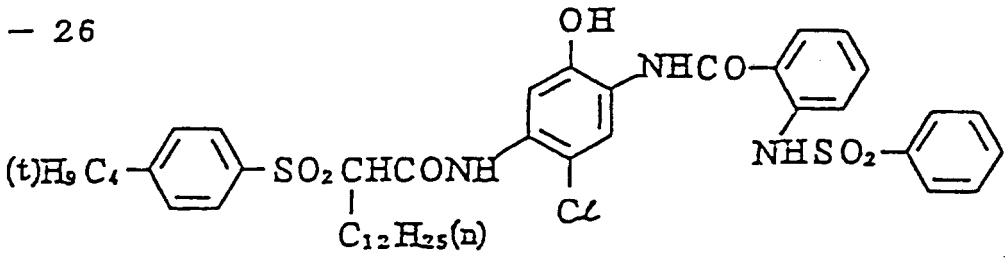
C − 24



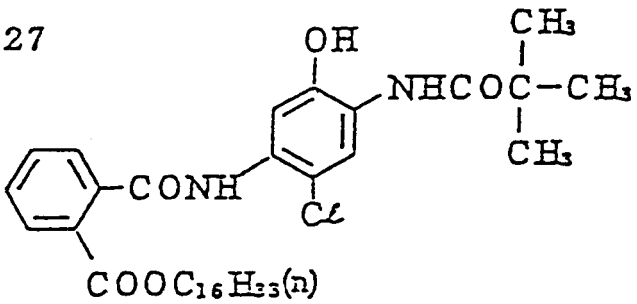
C − 25



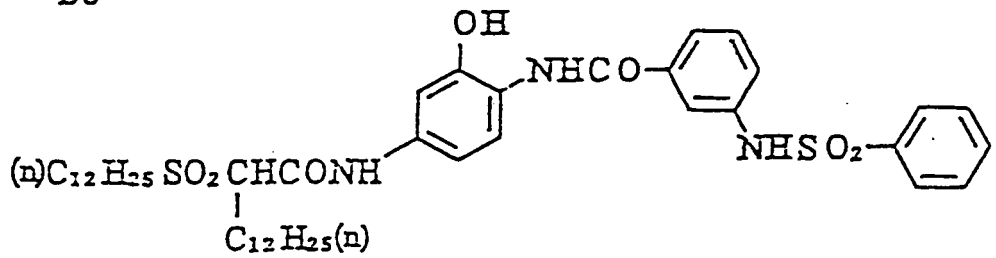
C − 26



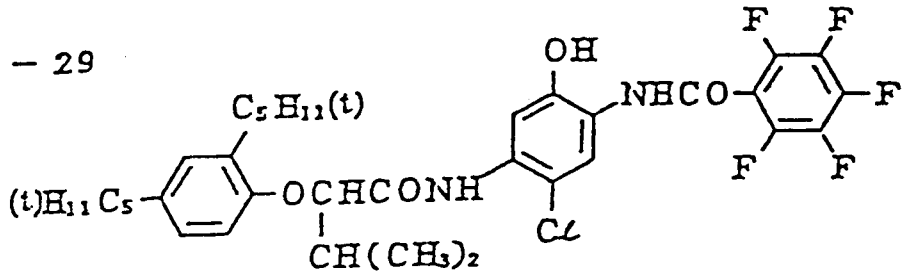
C − 27



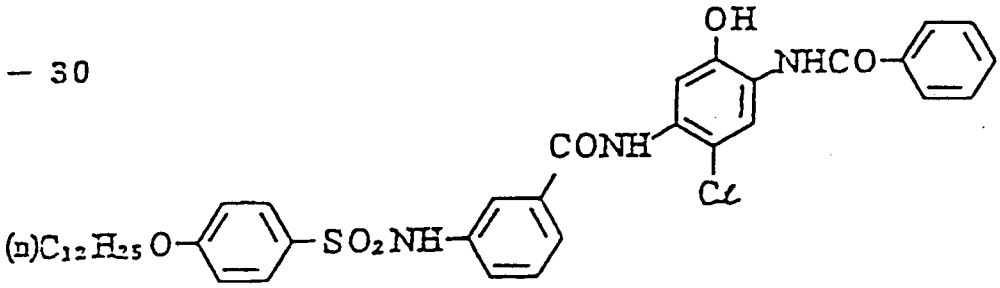
C − 28



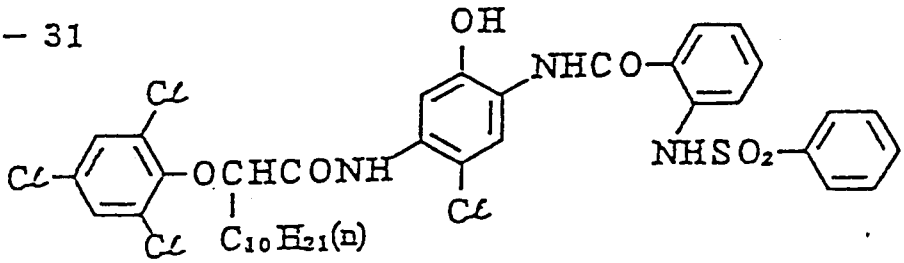
C – 29



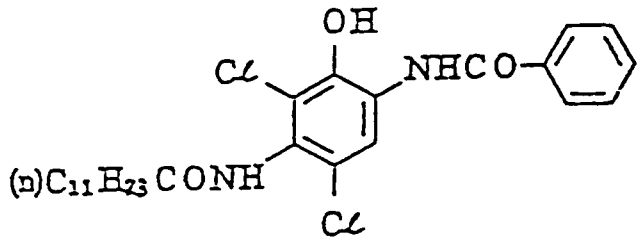
C – 30



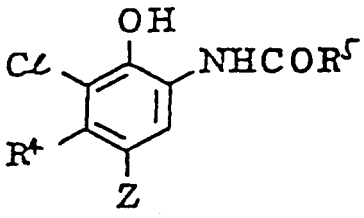
C – 31



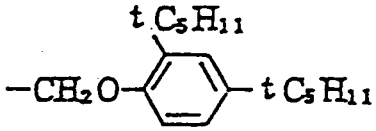
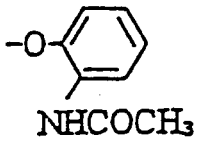
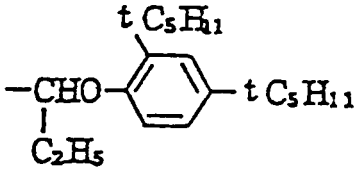
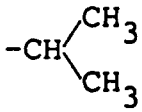
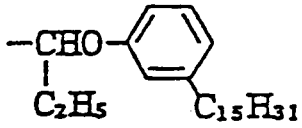
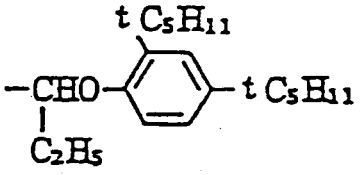
C – 32

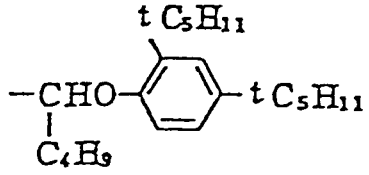
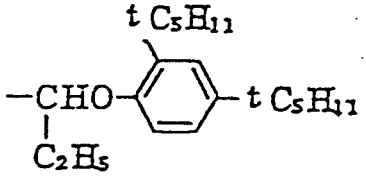
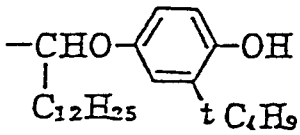
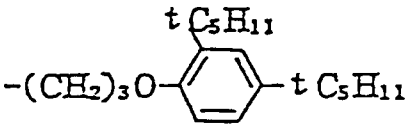
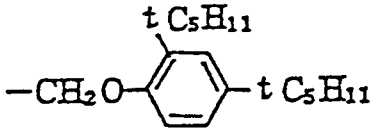


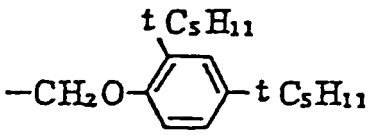
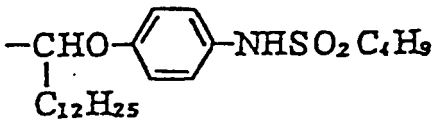
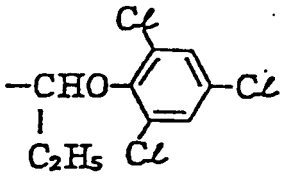
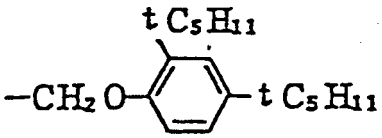
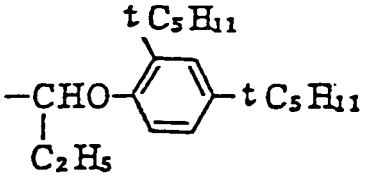
[0141] In the following, representative examples of the cyan coupler represented by the formula [CC - 2] are shown, but they are not limitative.

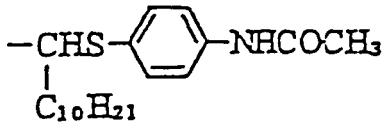
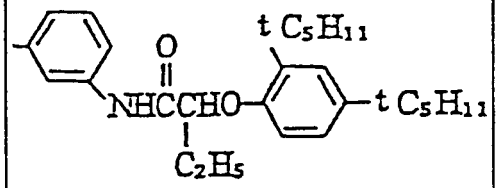
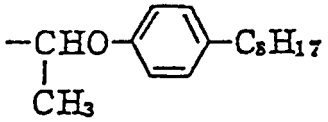
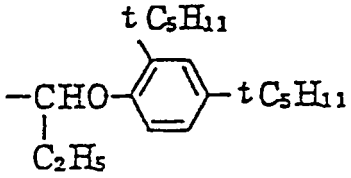
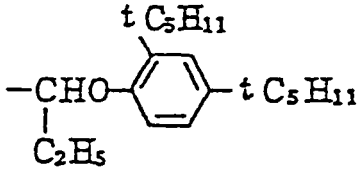


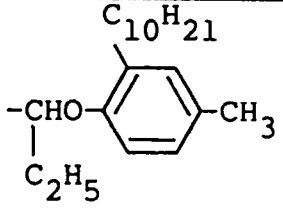
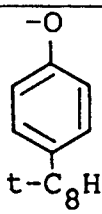
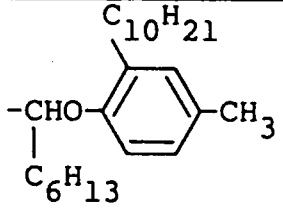
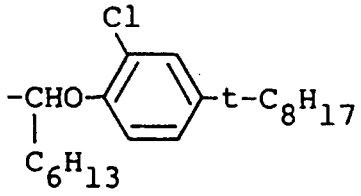
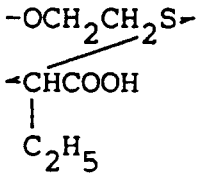
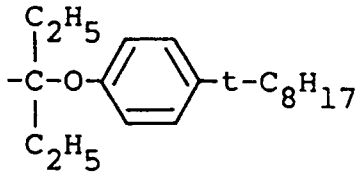
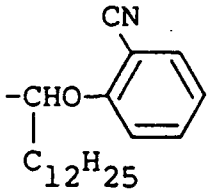
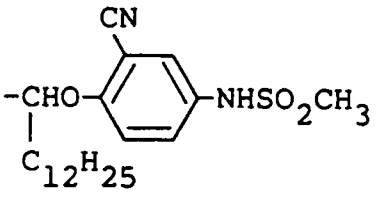
[CC - 2]

Coupler No.	R^4	Z	R^5
C - 33	$-C_2H_5$	-Cl	
C - 34	$-C_2H_5$		
C - 35		-Cl	
C - 36	$-C_2H_5$	-Cl	

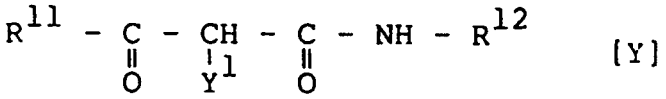
Coupler No.	R^4	Z	R^5
C - 37	$-C_2H_5$	-Cl	
C - 38	$-C_4H_9$	-F	
C - 39	$-C_2H_5$	-F	
C - 40	$-C_2H_5$	-Cl	
C - 41	$-C_2H_5$	-F	

Coupler No.	R^4	Z	R^5
C - 42	$-CH_3$	-Cl	
C - 43	$-C_2H_5$	-Cl	
C - 44	$-C_2H_5$	-Cl	
C - 45	$-CH(CH_3)_2$	-Cl	$-C_{18}H_{37}$
C - 46	$-C_2H_5$	-F	
C - 47	$-CH_3$	-Cl	

Coupler No.	R^4	Z	R^5
C - 48	$-C_2H_5$	-Cl	
C - 49	$-C_3H_7$	-Cl	
C - 50	$-C_3H_7$	-Cl	
C - 51	$-C_2H_4NHCCH_3$ (=O)	-Cl	
C - 52	$-C_3H_6OCH_3$	-Cl	

Coupler No.	R^4	Z	R^5
C - 59	$-C_2H_5$	-Cl	
C - 60	$-C_4H_9$		
C - 61	$-C_2H_5$	-Cl	
C - 62	$-C_2H_5$		
C - 63	$-C_2H_5$	-Cl	
C - 64	$-C_2H_5$	-Cl	

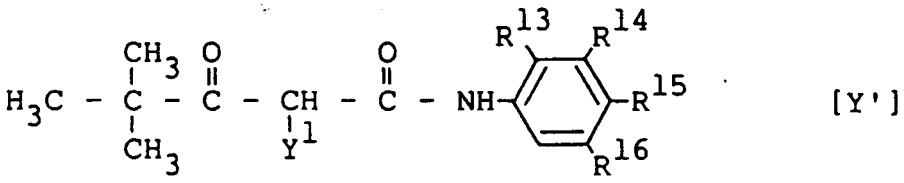
[0142] As the yellow coupler to be used in the present invention, the compound represented by following formula [Y] is preferred.



[Y]

wherein R^{11} represents an alkyl group (e.g., a methyl group, an ethyl group, a propyl group or a butyl group) or an aryl group (e.g., a phenyl group or a p-methoxyphenyl group); R^{12} represents an aryl group; and Y^1 represents a hydrogen group or a group eliminatable through a processing of a color developing reaction.

[0143] Further, particularly preferred compound as the yellow coupler is the compound represented by the following formula [Y^1]:



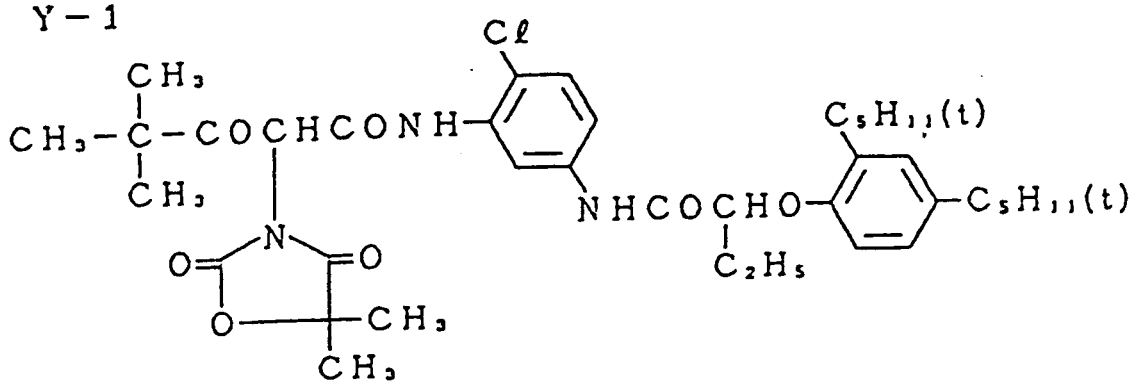
[Y']

wherein R^{13} represents a halogen atom, an alkoxy group or an aryloxy group; R^{14}, R^{15} and R^{16} each represent a hydrogen atom, a halogen atom, an alkyl group, an alkenyl group, an alkoxy group, an aryl group, an aryloxy group, a carbonyl group, a sulfonyl group, a carboxyl group, an alkoxycarbonyl group, a carbamyl group, a sulfone group, a sulfamyl group, a sulfonamide group, an acylamide group, an ureido group or an amino group; and Y^1 have the same meaning as defined above.

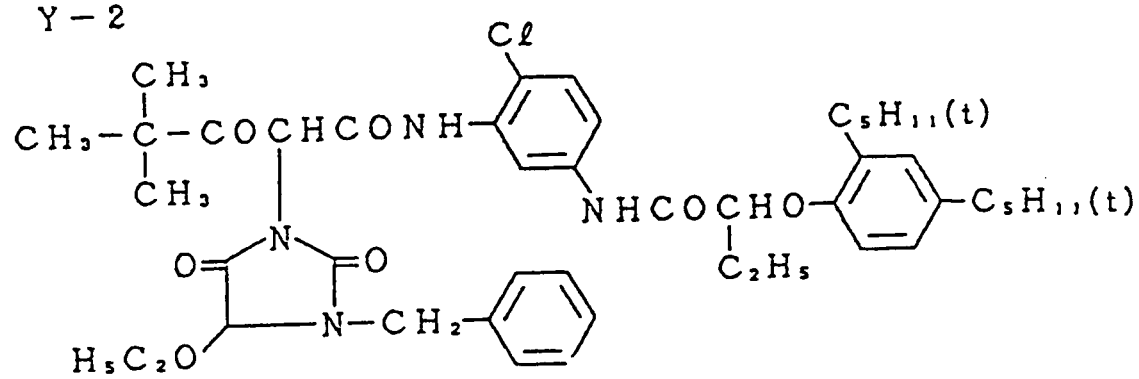
[0144] These couplers are disclosed in, for example, U.S. Patents No. 2,778,658, No. 2,875,057, No. 2,908,573, No. 3,227,155, No. 3,227,550, No. 3,253,924, No. 3,265,506, No. 3,277,155, No. 3,341,331, No. 3,369,895, No. 3,384,657, No. 3,408,194, No. 3,415,652, No. 3,447,928, No. 3,551,155, No. 3,582,322, No. 3,725,072 and No. 3,894,875; West German Offenlegunsschrifts No. 15 47 868, No. 20 57 941, No. 21 62 899, No. 21 63 812, No. 22 18 461, No. 22 19 917, No. 22 61 361 and No. 22 63 875; Japanese Patent Publication No. 13576/1974; Japanese Provisional Patent Publications No. 29432/1973, No. 66834/1973, No. 10736/1974, No. 122335/1974, No. 28834/1975 and No. 132926/1975.

[0145] In the following, representative examples of the yellow couplers represented by the formula [Y] are shown, but they are not limitative.

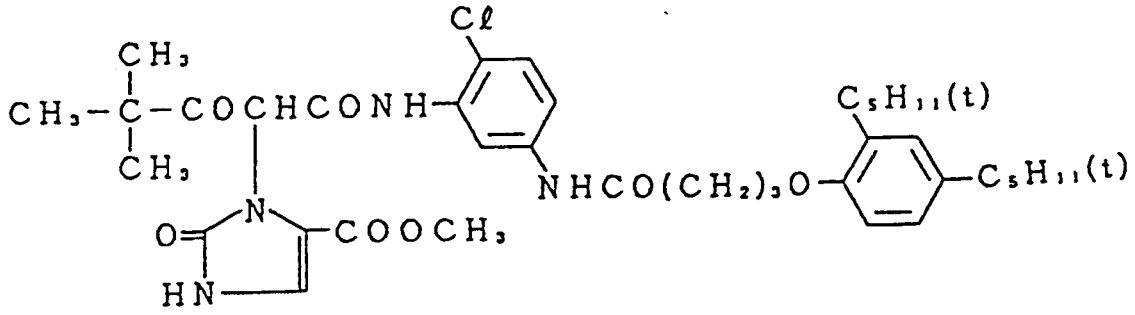
Y − 1



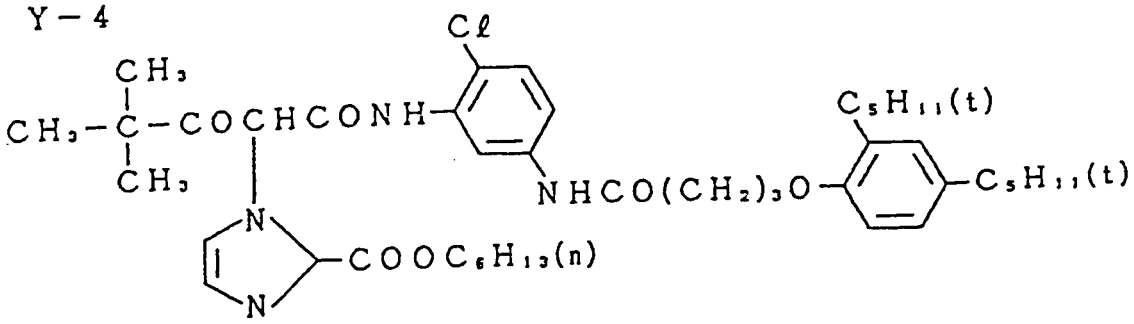
Y − 2



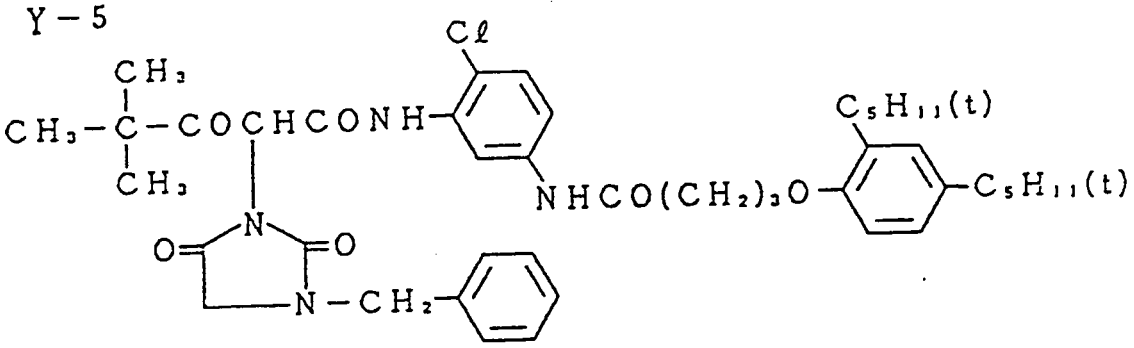
Y－3



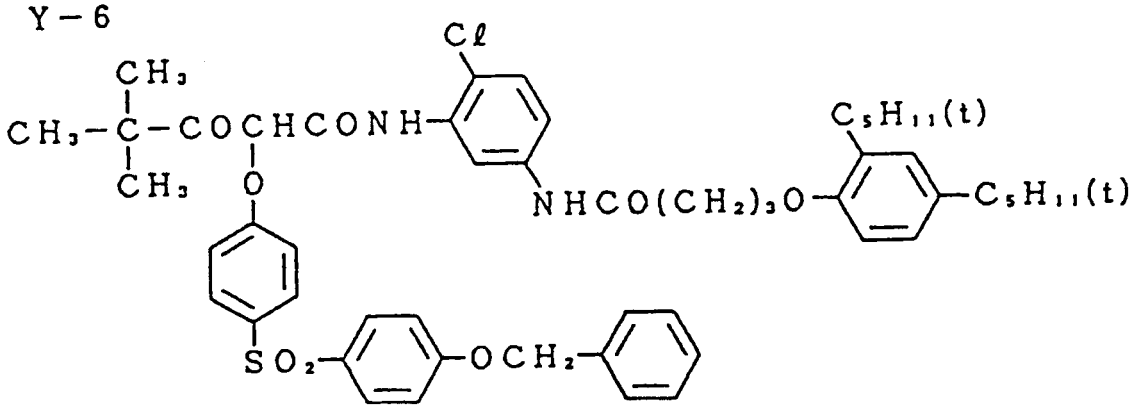
Y－4



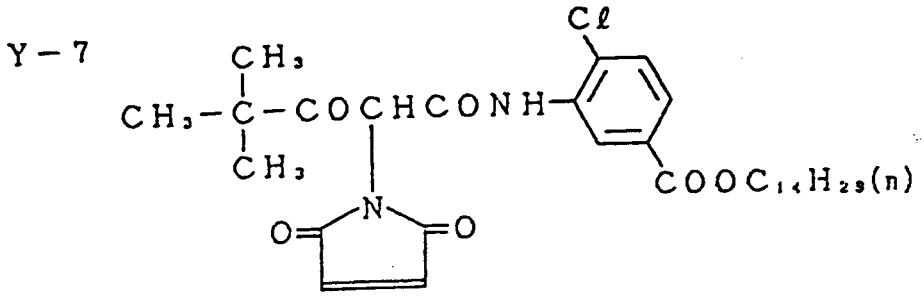
Y－5



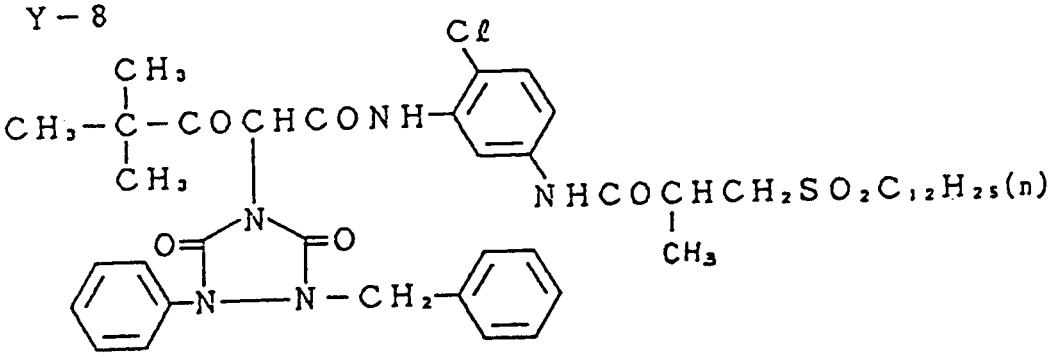
Y-6



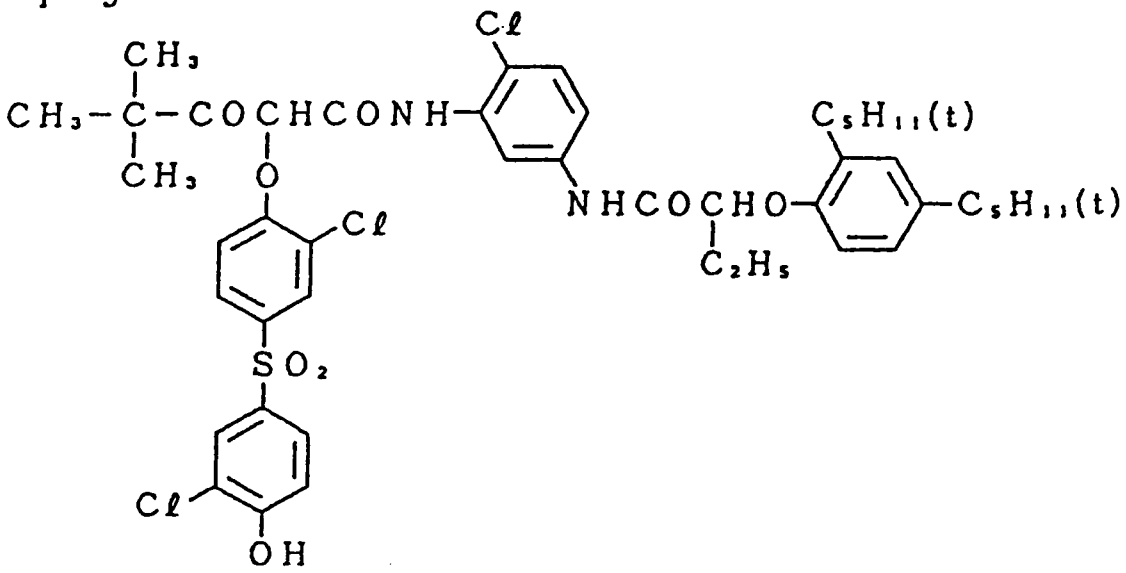
Y-7



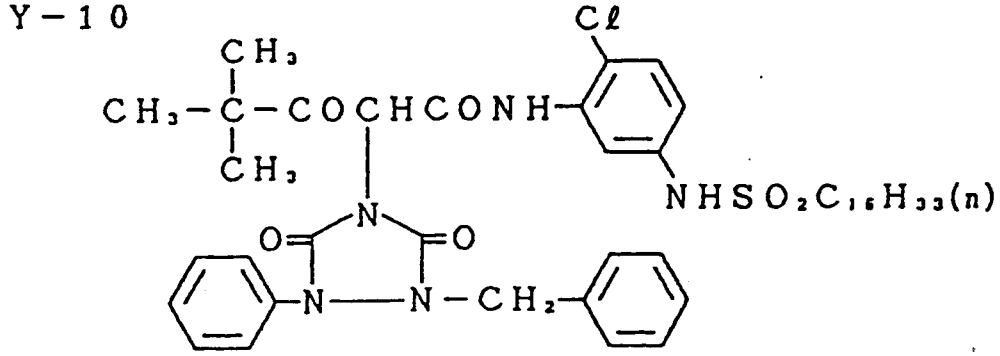
Y-8



Y－9



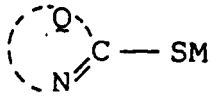
Y－10



[0146] Amounts of these cyan coupler and yellow coupler to be added are each in the range of 0.05 to 2 moles, preferably 0.1 to 1 mole per mole of silver halide. The addition method of these cyan coupler and yellow coupler to a light-sensitive silver halide photographic material may be employed the aforesaid addition method of the magenta coupler according to the present invention as well.

[0147] In the present invention, the total amount of gelatin contained in the silver halide emulsion layer containing the magenta coupler according to the present invention and the photographic constituent layers more distant to said layer viewed from the reflective support may be 5.0 to 15.0 g/m^2, and the range of 5.2 to 10.0 g/m^2 is particularly preferred. If the amount is less than 5.0 g/m^2, it causes a tendency of wearing a reddish at from the white ground (non-colored portion) to the high-light portion which would be caused by magenta color foming generated during the early stage of a bleach-fixing process after a color development. On the other hand, if it exceeds 15.0 g/m^2, a lowering in the curling characteristic or the development progress of the light-sensitive material would be caused.

[0148] In the aforesaid light-sensitive silver halide photographic material according to the present invention, in order to enhance the effect of the present invention, that is, maintaining the improved effect in the rapid processing suitability, color forming characteristic and light resistance, and suppressing the minimum concentration of the dye image to be formed within low range, it is preferred to use the compound represented by the following formula [S]:

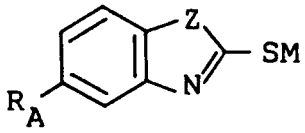


[S]

wherein Q represents a 5- or 6-membered heterocyclic ring or atoms necessary for forming a 5- or 6-membered heterocyclic ring fused with a benzene ring; and M represents a hydrogen atom, an alkali metal atom or an ammonium group.

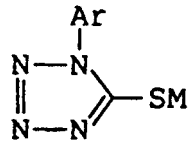
[0149] In the formula [S], as the 5-membered heterocyclic ring represented by Q, there may be mentioned, for example, an imidazole ring, a tetrazole ring, a thiazole ring, an oxazole ring, a selenazole ring, a benzoimidazole ring, a naphthoimidazole ring, a benzothiazole ring, a naphthothiazole ring, a benzoselenazole ring, a naphthoselenazole ring and a benzoxazole ring; and as the 6-membered heterocyclic ring represented by Q, there may be mentioned a pyridine ring, a pyrimidine ring and a quinoline ring; and these 5- or 6-membered heterocyclic rings may contain those having a substituent or substituents.

[0150] Of these compounds represented by the formula [S], particularly preferred compounds are those represented by the formulae [SA] and [SB]:



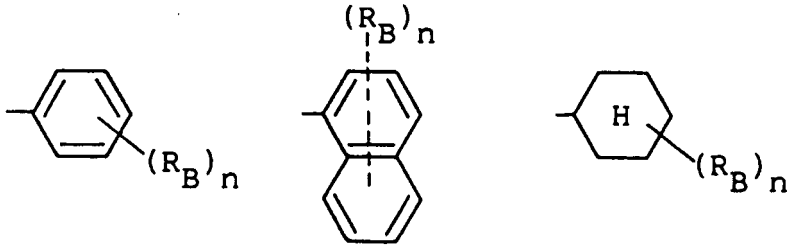
[SA]

wherein R_A represents a hydrogen atom, an alkyl group, an alkoxy group, an aryl group, a halogen atom, a carboxyl group or its salt, a sulfo group or its salt, or an amino group; Z represents -NH-, -O- or -S-; and M has the same meaning as the M in the formula [S],



[SB]

wherein Ar represents

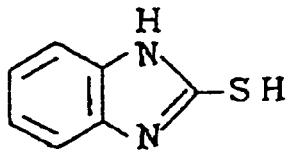


[0151] R_B represents an alkyl group, an alkoxy group, a carboxyl group or its salt, a sulfo group or its salt, a hydroxyl group, an amino group, an acylamino group, a carbamoyl group or a sulfonamide group; n is an integer of 0 to 2; and M has the same meaning as the M in the formula [S].

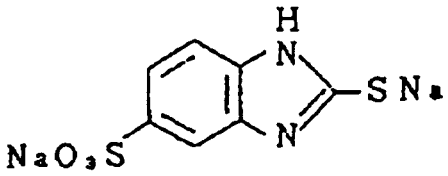
[0152] The above alkyl group, alkoxy group, aryl group, amino group, acylamino group, carbamoyl group, sulfonamide group may further contain those having a substituent or substituents.

[0153] In the following, representative examples of the compounds represented by the formula [S] are shown.

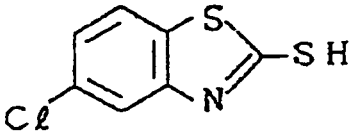
S − 1



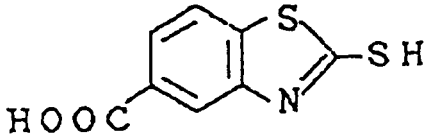
S − 2



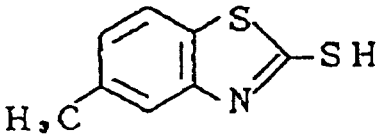
S − 3



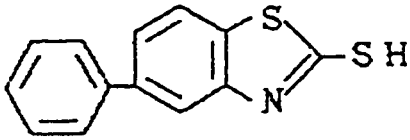
S − 4



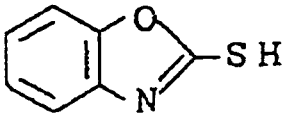
S − 5



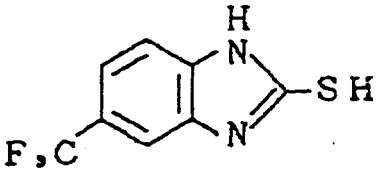
S − 6



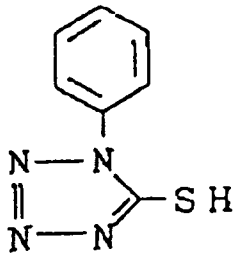
S − 7



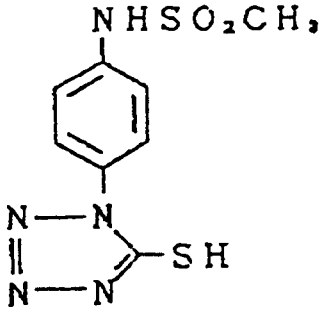
S − 8



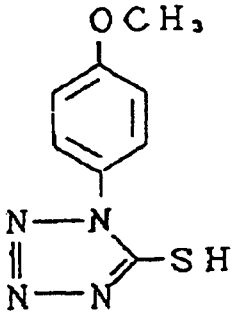
S-9



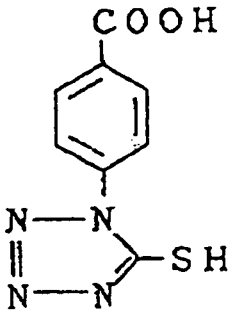
S-10



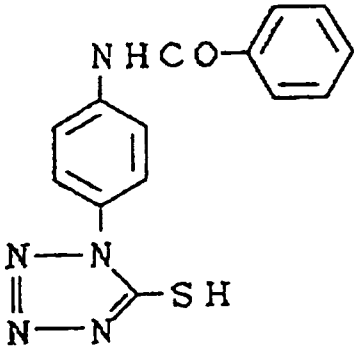
S-11



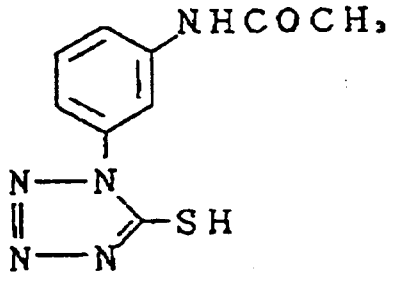
S-12



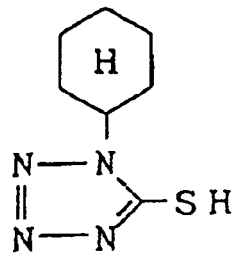
S-13



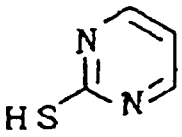
S-14



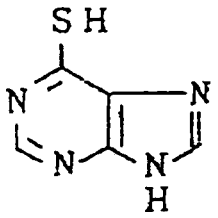
S-15



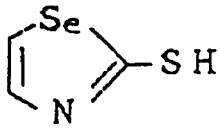
S-16



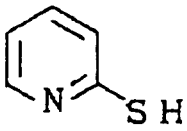
S-17



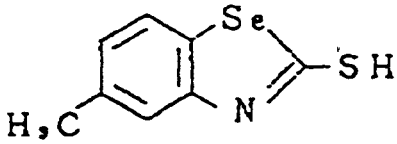
S-18



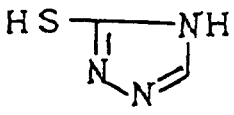
S-19



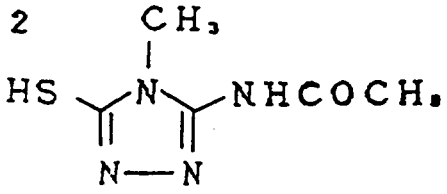
S-20



S-21



S-22



[0154] The compound represented by the above formula [S] (hereinafter referred to as "compound [S]") includes the compounds disclosed in, for example, Japanese Patent Publication No. 28496/1965; Japanese Provisional Patent Publication No. 89034/1975; Journal of Chemical Society, Vo. 49, p. 1748 (1927); Ibid., p. 4237 (1952), Journal of Organic Chemistry, Vol. 39, p. 2469 (1965); U.S. Patent No. 2,824,001; Journal of Chemical Society, p. 1723 (1951); Japanese Provisional Patent Publication No. 111846/1981; GB-A-1,275,701; U.S. Patent No. 3,266,897 and No. 2,403,927 and can be synthesized in accordance with the methods as disclosed in the above references.

[0155] As the method of existing the compound [S] at the color developing, there are a method of adding it to a color developing solution and a method of previously adding it to the light-sensitive silver halide photographic material and

dissolving out by a continuous processing to exist therein, and either method can be employed. From the viewpoint of uniformity of concentration during the continuous processing, it is preferred to add to the light-sensitive silver halide photographic material.

[0156] As the method of adding the compound [S] to the light-sensitive silver halide photographic material (or silver halide emulsion layer) and/or the color developing solution, after dissolving it in water or an organic solvent such as methanol or ethanol, which is miscible with water with optional ratio, it is added thereto. As the layer to be added, there may be either or both of light-sensitive layers and non-light-sensitive layers. The compound [S] may be used singly or may be used combinedly with the other compounds represented by the formula [S], or stabilizers or antifoggants which are others than the compound [S].

[0157] As the time of adding the compound [S], it may be an optional period of before formation of silver halide grains, during formation of silver halide grains, during the course between the completion of formation of silver halide grains and before starting of chemical ripening, during the course of chemical ripening, after completion of chemical ripening, and during the course between after the completion of chemical ripening and before coating. Preferably, it is added thereto during chemical ripening, at the completion of chemical ripening, or during the course between after the completion of chemical ripening and before coating. The addition may be carried out at one period with the whole amount or may be carried out repeatedly by dividing the amount to be added.

[0158] As the place to be added, the compound [S] may be added directly to a silver halide emulsion or a coating solution of the silver halide emulsion, or may be contained in the silver halide emulsion layer of the present invention by adding it to a coating solution for an adjacent non-light-sensitive hydrophilic colloidal layer to diffuse it during multi-layer coating.

[0159] An amount of the compound [S] to be contained is not particularly limited, but it is generally used, when it is added to the light-sensitive silver halide photographic material, within the range of 1×10^{-6} mole to 1×10^{-1} mole, preferably 1×10^{-5} mole to 1×10^{-2} mole per mole of the silver halide, and when it is added to the color developing solution, within the range of 1×10^{-10} mole/l to 1×10^{-2} mole/l, preferably 1×10^{-9} mole/l to 1×10^{-3} mole/l.

[0160] In the total amount of gelatin, an amount of gelatin derivatives is contained when the gelatin derivatives are contained in photographic constituent layers as a binder. As the binder for the photographic constituent layers of the light-sensitive silver halide photographic material to be used in the present invention, gelatin is usually employed, but in addition thereto, gelatin derivatives, a graft polymer of gelatin and other polymers, protein, saccharid derivatives, cellulose derivatives, or hydrophilic colloids such as synthetic hydrophilic polymer materials, e.g., homo- or copolymers may be used.

[0161] The light-sensitive silver halide photographic material to be used in the present invention should have a swelling degree at the terminating point of a color development processing is within the range of 220 % to 350 %, preferably within the range of 230 % to 340 %.

[0162] In the present invention, the swelling degree is defined by the ratio of a film thickness (μm) of a light-sensitive silver halide photographic material at the terminating point of the color development processing step and a film thickness (μm) of the light-sensitive silver halide photographic material before the color development processing step and indicated by the following equation:

$$\text{Swelling degree (\%)} = \frac{\begin{array}{c}\text{Film thickness (}\mu\text{m) of a light-sensitive} \\ \text{silver halide photographic material at the terminating point} \\ \text{of the color development processing step}\end{array}}{\begin{array}{c}\text{Film thickness (}\mu\text{m) of a light-sensitive} \\ \text{silver halide photographic material before} \\ \text{the color development processing step)}\end{array}}$$

[0163] Also, it is needless to say that the aforesaid swelling degree is generally determined by a light-sensitive material and color development processing conditions. Any combination of the preparative method of a light-sensitive material and conditions of the color development processing may be employed as long as the swelling degree of the present invention is within the range of 220 % to 350 %.

[0164] In the following, an example of an embodiment which provides the swelling degree of the present invention being 220 % to 350 % is shown.

[0165] The total amount of gelatin contained in the aforesaid light-sensitive material is 5.0 to 30 g/m^2 and the amount of a hardening agent is 5 to 50 mg per gram of the gelatin, and hardening the film can be promoted by heating and humidifying said light-sensitive material.

[0166] As the color development processing conditions of said light-sensitive material, it can be carried out by, for example, effecting at a pH of 10.0 to 11.0, a temperature of 30 °C to 40 °C for a development time of 30 seconds or more.

[0167] A silver halide emulsion layer and other hydrophilic colloidal layers of the light-sensitive silver halide photographic material to be used in the present invention can be hardened by cross-linking binder molecules (or protective colloids) and singly or combinedly using a hardening agent which heighten the film strength. According to this process, an improvement of the above swelling degree can be effected. The hardening agent may desirably be added thereto with an amount capable of hardening the light-sensitive material and in such a degree that the hardening agent is not necessarily added to a processing solution, but the hardening agent can be added in the processing solution. As kinds of the hardening agent, many kinds of them have been known. In the light-sensitive silver halide photographic material to be used in the present invention, any kind of hardening agents may be employed, but vinylsulfon type hardening agents and/or chlorotriazine type hardening agents may preferably be used.

[0168] In the light-sensitive silver halide photographic material to be used in the present invention, any reflective support having surface reflective characteristics of $L \geqq 88$, $-1.0 \leqq a \leqq 1.5$ and $-5.0 \leqq b \leqq -2.0$, more preferably in the range of $L \geqq 88$, $-1.0 \leqq a \leqq 0.5$ and $-4.5 \leqq b \leqq -2.0$ may be used.

[0169] The surface reflective characteristics L, a and b of the reflective support herein mentioned means a value measured by a method prescribed in JIS-Z-8722-82 and indicated by a method prescribed in JIS-Z-8730-80, and L represents brightness. Higher numerical value of L indicates higher brightness. Also, a represents a tinge of red and a higher numerical value thereof indicates a stronger tinge of red. b represents a tinge of yellow and a higher numerical value thereof indicates a stronger tinge of yellow.

[0170] A whiteness of the reflective support generally depends on three parameters of L, a and b, but in a reflective support having a low L value which shows brightness characteristics, the whiteness greatly depends on not only a and b values which show the hue but also L value. However, in the reflective support having a large L value, the whiteness is almost decided by the values of a and b, and the whiteness becomes to substantially depend on the hue of the reflective support.

[0171] Accordingly, in a paper support having the L value of 88 or more, values of a and b become particularly important.

[0172] A whiteness of a non-color formed portion of a color development processed light-sensitive silver halide photographic material is influenced by, in addition to the whiteness of the reflective support itself, a fluorescent brightening agent in photographic constituent layers of the light-sensitive silver halide photographic material remaining therein after processing, fog or stain generating at the color development processing, and gelatin, an ultraviolet absorber or a filter dye which are not decolored by processing, while there exist various kinds as factors. As to whiteness of the light-sensitive silver halide photographic material which is produced and processed under relatively controlled conditions, since the whiteness of the reflective support becomes a particularly decisive factor, the surface reflective characteristics of the reflective support are particularly important.

[0173] The surface reflective characteristics in the present invention are measured by obtaining a surface reflectivity with the use of Hitachi 607 Type Color Analyzer (trade name, produced by Hitachi Co., Ltd., light source: halogen lamp) and carried out a colorimetry calculation under the conditions of 2° visual field and C light source.

[0174] As the reflective support to be used in the light-sensitive silver halide photographic material according to the present invention, anyone may be used but a paper support coated with a polyolefin resin is preferred.

[0175] The reflective support with respect to the present invention can be obtained by, for example, adding a white pigment and other colorants to a polyolefin resin.

[0176] As the white pigment, titanium dioxide is preferred and an anatase type one is particularly preferred.

[0177] Also, to the polyolefin resin, colorants such as blue, red or magenta may preferably be added.

[0178] As the colorants to be used in the polyolefin resin, known inorganic or organic pigments used for photography may be used. Examples of such colorants may include compounds as described in U.S. patents No. 3,501,298 and No. 3,743,531; Japanese Provisional Patent Publications No. 117/1978 and No. 19021/1978; "Plastic Handbook", revised new edition, pp. 693 to 701 (1969); and "Paint Handbook", edited by Nikkan Kogyo Shinbunsha, pp. 1 to 84 (1969).

[0179] As specific examples of such compounds may be mentioned ultramarine, prussian blue, cobalt blue, phthalocyanine blue, manganese blue, cerulean blue, tungsten blue, molybdenum blue, anthraquinone blue, indanthrene blue, ultramarine blue, antimony blue, egyptian blue, manganese violet, mars violet, ultramarine violet, ultramarine red, cobalt red, anthraquinone red, isoindolinone red, ultramarine red or ultramarine pink. These colorants may be used singly or in combination of two or more, and particularly preferably a blue pigment and a red pigment are combinedly used. An amount of colorants to be used may be 0.0001 to 1 % by weight, preferably 0.001 to 0.1 % by weight based on the polyolefin resin.

[0180] In the polyolefin resin, a fluorescent brightening agent may further be contained. As the fluorescent brightening agent, known compounds such as stilbene type, imidazole type, carbostyryl type, oxadiazole type, coumarin type, triazole type, carbazole type or imidazolone type and these may optionally be selected depending on the purposes. Since they are heated to 200 °C or more when melting the polyolefin resin, those stable at such temperatures are preferable and there may be mentioned, for example, dialkylaminocoumarin, bisdimethylaminostilbene, bisbenzoxa-

zolylethylene, 4-alkoxy-1,8-naphthalenedicarboxylic acid-N-alkylimide or dialkylstilbene. An amount of the fluorescent brightening agent may preferably be about 0.005 to 10 % by weight, more preferably about 0.02 to 5 % by weight based on the polyolefin resin.

[0181] The silver halide (hereinafter referred to as silver halide emulsion) to be used in the light-sensitive silver halide photographic material used for the present invention (hereinafter referred to merely as light-sensitive silver halide photographic material) may include any of those conventionally used for silver halide emulsions such as silver bromide, silver iodobromide, silver iodochloride, silver chlorobromide or silver chloride.

[0182] To the silver halide emulsions, a compound known in the photographic field as an antifoggant or a stabilizer may be added during the course of chemical ripening and/or after completion of chemical ripening, but before coating of a silver halide emulsion, for the purpose of preventing fogs and/or keeping stable photographic performances during the course of the preparation of photographic materials, during storage thereof or during the course of photographic processing.

[0183] A plasticizer may be added for the purpose of enhancing the flexibility of the silver halide emulsion layer and/or other hydrophilic colloid layer in the light-sensitive material.

[0184] A dispersion of water-insoluble or hardly soluble synthetic polymer (a latex) may be contained for the purpose of improving the silver halide photographic emulsion layer or for the purpose of improving the dimensional stability in an aqueous colloid layer.

[0185] It may occur that an oxidized product of a developing agent or an electron-transferring agent is transferred between the emulsion layers (between layers having same color sensitivity and/or between layers having different color sensitivity) of the light-sensitive silver halide photographic material, to cause color turbidity or make conspicuous the deterioration in sharpness and the graininess. In order to present these, a color fog preventive agent may be used.

[0186] The color fog preventive agent may be used in the emulsion layer itself, or an intermediate layer may be provided between contiguous layers to use it in the intermediate layer.

[0187] In the light-sensitive silver halide photographic material, an image stabilizer may be used in order to prevent deterioration of a dye image.

[0188] In hydrophilic colloid layers such as a protective layer and an intermediate layer of the light-sensitive silver halide photographic material, an ultraviolet absorbing agent may be contained for the purpose of preventing fog due to discharge which is caused by charging the light-sensitive material due to friction or preventing deterioration of an image due to UV-ray.

[0189] In the light-sensitive silver halide photographic material of the present invention, it is possible to provide an auxiliary layer such as a filter layer, antihalation layer and/or an antiirradiation layer. In these layers and/or emulsion layers, a dyestuff may also be contained, which is either flow out of a light-sensitive color material or bleached, during the course of developing processing.

[0190] To the silver halide emulsion layer and/or other hydrophilic colloid layer of the light-sensitive silver halide photographic material, a matting agent may be added in order to decrease gloss of the light-sensitive material, enhance inscribability on the light-sensitive material or prevent light-sensitive materials from sticking to each other.

[0191] A lubricant may be added to decrease sliding friction of the light-sensitive silver halide photographic material.

[0192] For the purpose of preventing the light-sensitive silver halide photographic material from electrostatic charge, an antistatic agent may be added thereto. The antistatic agent may sometimes be used in an antistatic layer which is on the side of a support which is not provided with emulsion layers, or may be used also in a protective colloid layer other than the emulsion layers or in emulsion layers which are on the side provided with emulsion layers.

[0193] In the photographic emulsion layers and/or the other hydrophilic colloid layers of the light-sensitive silver halide photographic material, various surface active agents may be used for the purpose of improvement in coating property, prevention of electrostatic discharge, improvement in lubricity, emulsification dispersion, prevention of sticking and improvement in other photographic properties (such as development acceleration, achievement of high contrast or sensitization).

EXAMPLES

[0194] The present invention is described in more detail by referring to the following Examples, by which the embodiments of the present invention are not limited at all.

Example 1

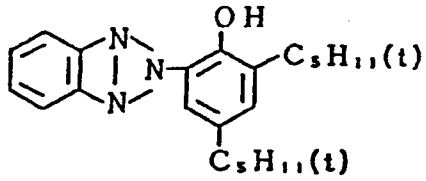
[0195] Coating solutions for the respective layers were prepared so as to become the constitution shown in Table 1, and coated successively from a support side to prepare multi-layer light-sensitive silver halide color photographic materials.

Table 1

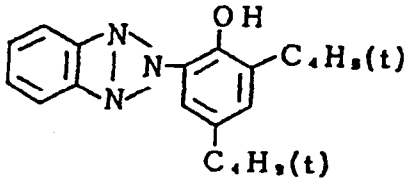
Layers	Constitution	
Seventh layer (Protective layer)	Gelatin	(1.0 g/m^2)
	Sodium 2,4-dichloro-6-hydroxy-S-triazine	(0.04 g/m^2)
Sixth layer (Third intermediate layer)	Gelatin	(1.0 g/m^2)
	Ultraviolet absorber UV-1	(0.2 g/m^2)
	Ultraviolet absorber UV-2	(0.2 g/m^2)
	Anti-stain agent AS-1	(0.02 g/m^2)
	High boiling point solvent S-6	(0.2 g/m^2)
Fifth layer (Red-sensitive layer)	Gelatin	(1.2 g/m^2)
	Silver chlorobromide emulsion [containing 70 mole % of AgBr]	(0.25 g/m^2)
	Cyan coupler C-29	(0.4 mole per mole of silver halide)
	Anti-stain agent AS-1	(0.02 g/m^2)
	High boiling point solvent S-6	(0.2 g/m^2)
Fourth layer (Second intermediate layer)	Gelatin	(1.5 g/m^2)
	Ultraviolet absorber UV-1	(0.5 g/m^2)
	Ultraviolet absorber UV-2	(0.2 g/m^2)
	Anti-stain agent AS-1	(0.03 g/m^2)
	High boiling point solvent S-6	(0.3 g/m^2)
	Sodium 2,4-dichloro-6-hydroxy-S-triazine	(0.04 g/m^2)
Third layer (Green-sensitive layer)	Gelatin	(1.5 g/m^2)
	Silver chlorobromide emulsion [containing 70 mole % of AgBr]	(0.35 g/m^2)
	Magenta coupler (Table 3)	(0.4 mole per mole of silver halide)
	Anti-stain agent AS-1	(0.01 g/m^2)
	Anti-fading agent A-1	(50 mole % per coupler)
	High boiling point solvent S-2	(0.25 g/m^2)
Second layer (First intermediate layer)	Gelatin	(1.0 g/m^2)
	Anti-stain agent AS-1	(0.07 g/m^2)
	High boiling point solvent S-8	(0.04 g/m^2)
First layer (Blue-sensitive layer)	Gelatin	(2.0 g/m^2)
	Silver chlorobromide emulsion [containing 90 mole % of AgBr]	(0.3 g/m^2)
	Yellow coupler Y-5	(0.8 g/m^2)
	Anti-stain agent AS-1	(0.02 g/m^2)
	High boiling point solvent S-6	(0.3 g/m^2)
Support	Polyethylene coated paper	

[0196] Numerical values in the parenthesis represents a coated amount or an added amount.

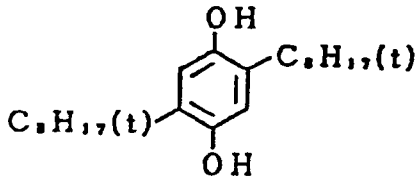
Ultraviolet absorber UV-1



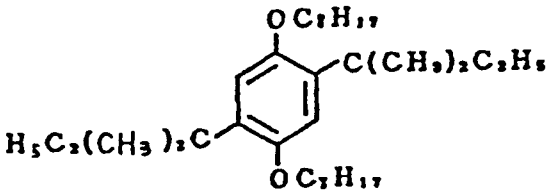
Ultraviolet absorber UV-2



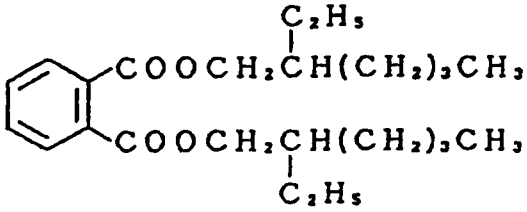
Anti-stain agent AS-1



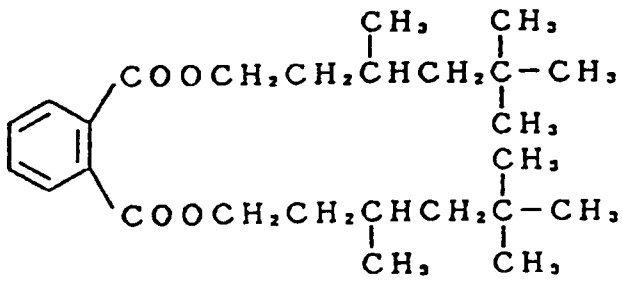
Anti-fading agent A-1



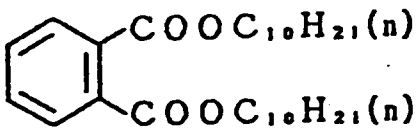
S-2



S-6



S-8



[0197] Also, a polyethylene coated paper is prepared as shown below and to make A to F.

[0198] To a mixture of a polyethylene having an average molecular weight of 30,000 and a density of 0.945 and a polyethylene having an average molecular weight of 5,000 and a density of 0.93 was added an anatase type titanium dioxide so as to become an amount of 13.5 % by weight based on the polyethylene. Further, by varying a ratio and amounts of a purple type colorant DV-1 (trade name, produced by Daiichi Kasei Kogyo Co.) and a reddish ultramarine blue No. 1500 (6 levels), a coated layer was provided on a surface of a fine quality paper (water content of 8.0 % by weight) having a basis weight of 180 g/m^2 with a thickness of 0.040 mm by the extrusion coating method. Also, a back surface of the support was coated with polyethylene containing no titanium dioxide and colorant with a thickness of 0.045 mm. Spectral reflective characteristics of the surface of the resulting polyethylene laminated papers are shown in Table 2.

Table 2

Support No.	L	a	b
A	91.5	- 0.75	- 1.50
B	91.0	- 1.61	- 3.39
C	90.6	+ 1.23	- 2.63
D	90.8	+ 1.05	- 4.15
E	90.4	- 0.62	- 2.72
F	90.7	+ 0.08	- 3.47

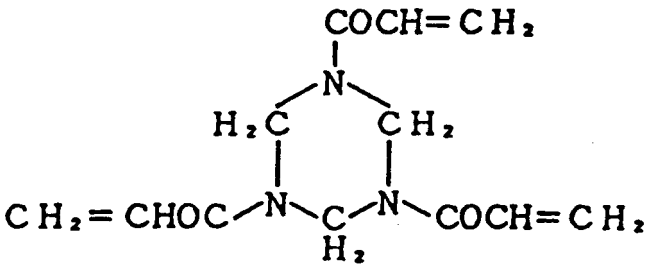
[0199] To the thus obtained samples, the following 5 kinds of heating treatments were effected and then the hardening treatment was carried out.

a: 30 °C, 60 % RH for 12 hours
a': 30 °C, 60 % RH for 14 hours
b: 40 °C, 60 % RH for 24 hours
c: 50 °C, 60 % RH for 24 hours
c': 50 °C, 60 % RH for 20 hours

[0200] According to this hardening treatment and a color development processing conditions mentioned hereinbelow, a swelling degree can be varied.

[0201] By varying the magenta coupler in the third layer and the support as shown in Table 3, Samples 1 to 27 were obtained. Further, Sample 28 was obtained in the same manner as in Sample 27 except that the hardening agent used in Sample 27 was changed with equivalent mole of the following H-1.

H-1



[0202] These samples were exposed through a color negative film which had been already processed and then the following processings were effected.

Standard processing steps: (processing temperature and processing time)

[0203]

Color developing	38 °C	3 min. 30 sec.
Bleach-fixing	33 °C	1 min. 30 sec.
Water washing	25 to 30 °C	3 min.
Drying	75 to 100 °C	about 2 min.

Compositions of processing solutions:

(Color developing solution)

[0204]

Benzyl alcohol	15 ml
Ethylene glycol	15 ml
Potassium sulfite	2.0 g
Potassium bromide	0.7 g
Sodium chloride	0.2 g
Potassium carbonate	30.0 g
Hydroxylamine sulfate	3.0 g
Polyphosphoric acid (TPPS)	2.5 g
3-Methyl-4-amino-N-ethyl-N-(β-methanesulfonamidoethyl)-aniline sulfate	5.5 g
Fluorescent brightening agent (4,4'-diaminostylbene sulfonic acid derivatives)	1.0 g
Potassium hydroxide	2.0 g

[0205] Made up to 1 liter with addition of water and adjusted to pH 10.20.

(Bleach-fixing solution A)

[0206]

Ferric ethylenediaminetetraacetate ammonium dihydrate	60 g
Ethylenediaminetetraacetic acid	3 g
Ammonium thiosulfate (70 % solution)	100 ml
Ammonium sulfite (40 % solution)	27.5 ml

[0207] Adjusted to pH 7.1 with potassium carbonate or glacial acetic acid and made up to 1 liter with addition of water.

(Bleach-fixing solution B)

[0208] A solution mixing 1 liter of the bleach-fixing solution A and 300 ml of the color developing solution is made as the bleach-fixing solution B. The bleach-fixing solution B is a model bleach-fixing solution supposed a continuous processing.

[0209] With respect to respective resulting samples, a whiteness at the white ground portion and color reproducibility at a high-light portion and a shadow portion were measured visually and the results are shown in Table 3.

Table 3

	Sample No.	Third layer magenta coupler	Support	Swelling degree (%)	Bleach-fixing solution A			Bleach-fixing solution B			Total evaluation
					Whiteness	Color reproducibility		Whiteness	Color reproducibility		
						High-light portion	Shadow portion		High-light portion	Shadow portion	
Comparative	1	Comparative magenta coupler 1	A	290	Yellowish	Good	Low in chroma	Yellow to reddish	Strongly reddish	Low in chroma	X
Comparative	2	Ditto	B	288	Green-blue-green	Good	Low in chroma	Good	Strongly reddish	Low in chroma	X
Comparative	3	Ditto	C	287	Yellow to reddish	Good	Low in chroma	Reddish	Strongly reddish	Low in chroma	X
Comparative	4	Ditto	D	288	Good	Good	Low in chroma	Yellow to reddish	Strongly reddish	Low in chroma	X
Comparative	5	Ditto	E	288	Good	Good	Low in chroma	Yellow to reddish	Strongly reddish	Low in chroma	X
Comparative	6	Ditto	F	289	Good	Good	Good	Yellow to reddish	Strongly reddish	Low in chroma	X
~~This invention~~ Comparative	7	44	A	288	Slightly yellowish	Slightly bluish	Good	Slightly yellowish	Slightly bluish	Good	△
~~This invention~~ Comparative	8	44	B	288	Slightly greenish to blue-green	Slightly bluish	Good	Good	Slightly bluish	Good	△

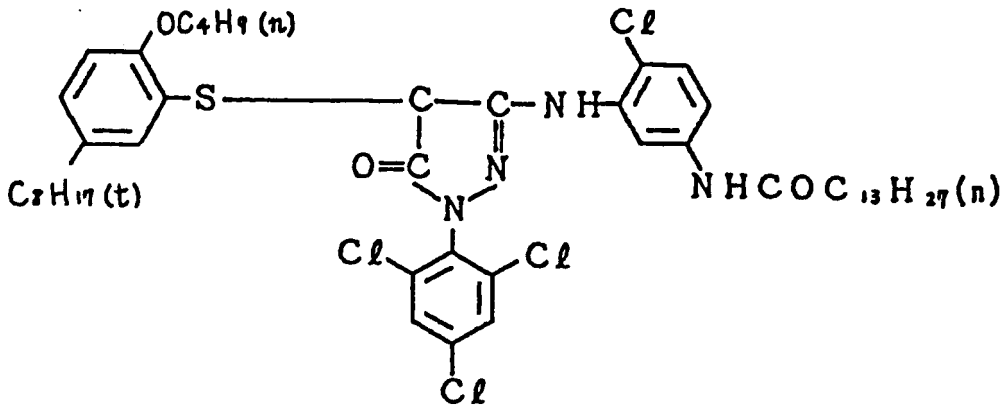
Table 3 (Contd)

	Sample No.	Third layer magenta coupler	Support	Swelling degree (%)	Bleach-fixing solution A			Bleach-fixing solution B			Total evaluation
					Whiteness	Color reproducibility		Whiteness	Color reproducibility		
						High-light portion	Shadow portion		High-light portion	Shadow portion	
This invention	9	44	C	289	Good	Slightly bluish	Good	Good	Good	Good	○
This invention	10	44	D	288	Good	Slightly bluish	Good	Good	Good	Good	○
This invention	11	44	E	289	Good	Good	Good	Good	Good	Good	○
This invention	12	44	F	288	Good	Good	Good	Good	Good	Good	○
Comparative	13	44	F	374	Good	Good	Good	Reddish	Yellow-reddish	Good	X
Comparative	14	44	F	212	Yellowish	Yellowish	Good	Yellowish	Yellow-reddish	Good	X
Comparative	15	59	F	372	Good	Good	Good	Yellowish	Yellow-reddish	Good	X
This invention	16	59	F	340	Good	Good	Good	Good	Good	Good	○
This invention	17	59	F	287	Good	Good	Good	Good	Good	Good	○
This invention	18	59	F	230	Good	Good	Good	Good	Good	Good	○

Table 3 (Contd)

	Sample No.	Third layer magenta coupler	Support	Swelling degree (%)	Bleach-fixing solution A			Bleach-fixing solution B			Total evaluation
					Whiteness	Color reproducibility		Whiteness	Color reproducibility		
						High-light portion	Shadow portion		High-light portion	Shadow portion	
Comparative	19	59	F	211	Yellowish	Yellowish	Good	Yellowish	Yellowish	Good	X
This invention	20	5	F	288	Good	Good	Good	Good	Good	Good	○
This invention	21	18	F	290	Good	Good	Good	Good	Good	Good	○
This invention	22	99	F	287	Good	Good	Good	Good	Good	Good	○
This invention	23	104	F	288	Good	Good	Good	Good	Good	Good	○
This invention	24	127	F	288	Good	Good	Good	Good	Good	Good	○
This invention	25	130	F	287	Good	Good	Good	Good	Good	Good	○
This invention	26	157	F	289	Good	Good	Good	Good	Good	Good	○
This invention	27	172	F	288	Good	Good	Good	Good	Good	Good	○
This invention	28	172	F	290	Good	Good	Good	Slightly yellowish	Good	Good	○

Comparative magenta coupler 1



[0210] From the results in Table 3, while the Samples 1 to 6 which had been used the comparative magenta coupler have low chroma at the shadow portion and deterioration of the whiteness is large when the bleach-fixing solution B had been used whereby they are not preferred, the Samples 7 to 12 which had been used the magenta coupler of the present invention show good chroma at the shadow portion, and particularly in the Samples 9 to 12 which had been used supports C, D, E and F, excellent results in the total evaluation have been shown. On the other hand, in the Samples 13, 14, 15 and 19 which are out of this invention in the swelling degree, when the swelling degree is too small (Samples 14 and 19), it is not preferred since from a white ground to a high-light portion tend to be yellowish even when the bleach-fixing solution A had been used. To the contrary, when the swelling degree is too large (Samples 13 and 15), it revealed the defect that from a white ground to a high-light portion tend to be yellow-reddish when the bleach-fixing solution B had been used while good results can be obtained when the bleach-fixing solution A had been used.

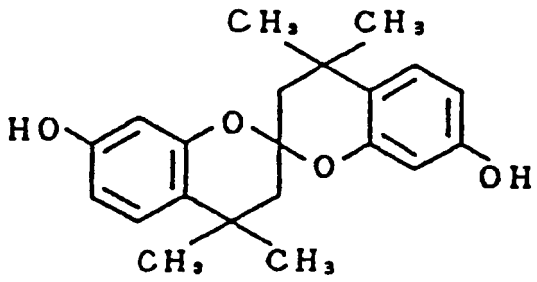
[0211] From the results as mentioned above, it is clear that only the Samples of the present invention show good color reproducibility at both of a high-light portion and a shadow portion and good whiteness even when either the fresh processing solution or the processing solution continuously processed had been used.

Example 2

[0212] In the same manner as in Sample 17 in Example 1 except that amounts of gelatin at the fourth, sixth and seventh layers were changed to 0.5 g/m^2, respectively, Sample 29 was prepared. Similarly, by changing amounts of gelatin at the fourth, sixth and seventh layers of Sample 17 to 2.0 g/m^2, respectively, Sample 30 was prepared. Similarly, by excluding the seventh layer of Sample 17, and changing amounts of gelatin at the fourth and sixth layers thereof to 0.5 g/m^2, respectively, Sample 31 was prepared. Also, in the same manner as in Sample 17 except that the anti-fading agent in the third layer of Sample 17 was changed from A-1 to A-2, Sample 32 was prepared. Also, in the same manner as in Sample 26 except that the anti-fading agent in the third layer of Sample 26 was changed from A-1 to A-2, Sample 33 was prepared. Further, by changing amount of gelatin at the fourth layer of Sample 17 to 1.0 g/m^2, at the sixth layer to 0.8 g/m^2 and at the seventh layer to 0.5 g/m^2, respectively, Sample 34 was prepared.

[0213] Incidentally, in the above Samples 29 to 34, as the hardening agent, equivalent mole of $O(CH_2CH_2SO_2CH=CH_2)_2$ was used in place of sodium 2,4-dichloro-6-hydroxy-S-triazine used in Example 1.

Anti-fading agent A-2



[0214] With respect to Samples 29 to 34, same processings were carried out in Example 1 and evaluations were carried out. The results are shown in Table 4.

Table 4

	Sample No.	Third layer magenta coupler	Support	Swelling degree (%)	Total amount of gelatin* (g/m^2)	Bleach-fixing solution A			Bleach-fixing solution B			Total evaluation
						Whiteness	Color reproducibility		Whiteness	Color reproducibility		
							High-light portion	Shadow portion		High-light portion	Shadow portion	
Comparative	29	59	F	289	4.2	Slightly reddish	Good	Good	Reddish	Slightly reddish	Good	X
This invention	30	59	F	288	8.7	Good	Good	Good	Good	Good	Good	○
Comparative	31	59	F	283	3.7	Slightly reddish	Good	Good	Reddish	Slightly reddish	Good	X
This invention	32	59	F	286	6.2	Good	Good	Good	Good	Good	Good	○
This invention	33	157	F	287	6.2	Good	Good	Good	Good	Good	Good	○
This invention	34	59	F	288	5.0	Good	Good	Good	Good	Good	Good	○

* In the table, "Total amount of gelatin" means total mounts of gelatin contained in a layer containing the magenta coupler and photographic constituent layers more distant to said layer viewed from the reflective support.

[0215] From the results in Table 4, in Samples 29 and 31 in which the total amount of gelatin contained in a layer containing the magenta coupler and photographic constituent layers more distant to said layer viewed from the reflective support is not more than 5.0 g/m^2, it is clear that they cannot be used for practical use since the whiteness thereof

is inferior even when the bleach-fixing solution A had been used and yet when the bleach-fixing solution B had been used, deterioration of color reproducibility at from a white ground to a high-light portion is also remarkable.

[0216] To the contrary, it is clear that the Samples of the present invention show good results even when continuous processings were carried out.

Example 3

[0217] In the same manner as in Sample 28 in Example 1 except that the composition at the third layer of Sample 28 was replaced with as shown in Table 5, Samples 35 to 42 were prepared. In these samples, used amounts of the compound represented by the formula [S] was 5×10^{-6} mole/m^2.

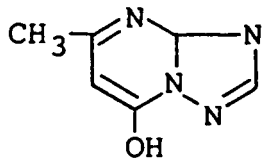
[0218] With respect to Samples 35 to 42, same processings were carried out in Example 1 and evaluations of the whiteness and color reproducibility at the high-light portion were also carried out, provided that the whiteness was shown by the aforesaid back-surface reflective characteristic in order to compare in more detail. The results are shown in Table 5.

Table 5

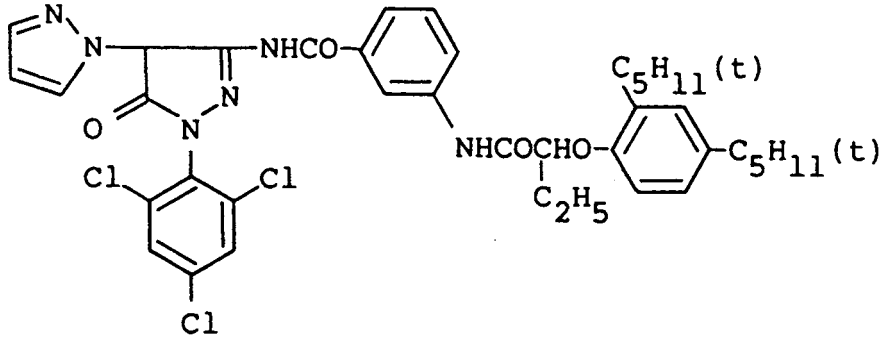
Sample No.	The third layer		Bleach-fixing solution A				Bleach-fixing solution B			
	Magenta coupler	Compound [S]	whiteness		Color reproducibility		whiteness		Color reproducibility	
			a	b	High-light portion	Shadow portion	a	b	High-light portion	Shadow portion
28	172	--	+ 0.5	- 1.0	Good	Good	+ 0.5	- 0.8	Good	Good
35	172	S - 9	+ 0.5	- 1.2	Good	Good	+ 0.5	- 1.2	Good	Good
36	172	S - 11	+ 0.4	- 1.2	Good	Good	+ 0.4	- 1.2	Good	Good
37	172	S - 14	+ 0.5	- 1.2	Good	Good	+ 0.5	- 1.2	Good	Good
38	172	S - 22	+ 0.5	- 1.1	Good	Good	+ 0.5	- 1.1	Good	Good
39	172	*	+ 0.5	- 1.0	Good	Good	+ 0.5	- 0.8	Good	Good
40	**	--	+ 0.5	- 0.8	Good	Good	+ 0.4	- 0.6	Strongly reddish	Low in chroma
41	**	S - 22	+ 0.5	- 0.9	Good	Good	+ 0.5	- 0.7	Strongly reddish	Low in chroma
42	**	*	+ 0.5	- 0.8	Good	Good	+ 0.4	- 0.6	Strongly reddish	Low in chroma

*) Comparative compound N - 1
**) Comparative magenta coupler 2

Comparative compound N - 1



Comparative magenta coupler 2



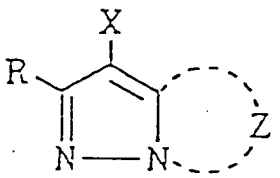
[0219] As clearly seen from Table 5, Samples No. 28, No. 35 to No. 39 according to this invention show excellent results, particularly, in Samples No. 35 to No. 38, the whiteness and color reproducibility of the high-light poriton when using the bleach-fixing solution B are improved. On the other hand, in Samples No. 40 to No. 42 which are out of the present invention, the whiteness and color reproducibility of the high-light poriton when using the bleach-fixing solution B are inferior to those of the present invention.

[0220] Further, when the compound represented by the formula [S] was employed in the developing solution, the same effects as the above can be obtained.

Claims

1. A processing method for a light-sensitive silver halide photographic material in which a light-sensitive silver halide photographic material having at least one silver halide emulsion layer on a reflective support is image-wise exposed and color developed and then immediately bleach-fixed without effecting a water washing step, characterised in that :

1) a magenta coupler represented by the following formula (I) is contained in at least one of the silver halide emulsion layers,



(I)

wherein Z represents a group of non-metallic atoms necessary for forming a nitrogen-containing heterocyclic ring which may have a substituent; X represents a hydrogen atom or a substituent eliminatable through the reaction with the oxidized product of a color developing agent; and R represents a hydrogen atom or a substituent,

2) the total gelatin amount contained in the silver halide emulsion layer containing said magenta coupler and a

photographic constituent layer more distant to said layer viewed from the reflective support is 5.0 g/m^2 to 15.0 g/m^2, and

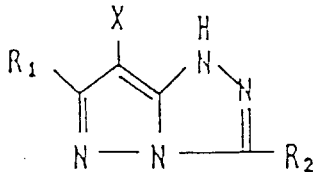
3) a swelling degree (ratio of a film thickness (μm) of a light-sensitive silver halide photographic material at the terminating point of the color development processing step and a film thickness (μm) of the light-sensitive silver halide photographic material before the color development processing step and indicated by the following equation:

$$\text{Swelling degree (\%)} = \frac{\begin{array}{c}\text{Film thickness (μm) of a light-sensitive}\\ \text{silver halide photographic material at the terminating point}\\ \text{of the color development processing step}\end{array}}{\begin{array}{c}\text{Film thickness (μm) of a light-sensitive}\\ \text{silver halide photographic material before}\\ \text{the color development processing step)}\end{array}}$$

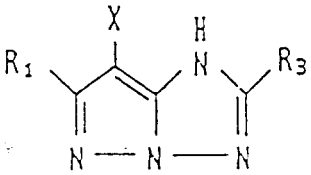
of the light-sensitive silver halide photographic material at the end of said color development processing step is within the range of 220 % to 350 %, and

4) said reflective support has surface reflective characteristics of $L \geqq 88$, $-1.0 \leqq a \leqq 1.5$ and $-5.0 \leqq b \leqq -2.0$ when the values are measured by a method prescribed in JIS-Z-8722-82 and indicated by a method prescribed in JIS-Z-8730-80.

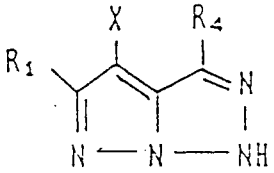
2. A processing method of a light-sensitive silver halide photographic material according to Claim 1, wherein said magenta coupler represented by the formula (I) is compounds represented by the formulae (II) through (VIII):



(II)



(III)



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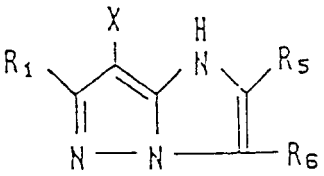
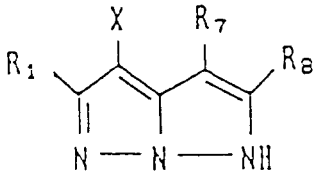
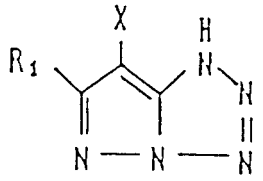


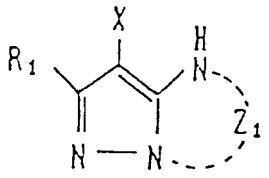
(V)



(VI)



(VII)



(VIII)

wherein R_1 to R_8, X and Z_1 have the same meanings as defined in Claim 1.

3. A processing method of a light-sensitive silver halide photographic material according to Claim 1, wherein the total gelatin amount contained in the silver halide emulsion layer containing said magenta coupler and a photographic constituent layer more distant to said layer viewed from the reflective support is within the range of 5.2 to 10.0 g/m^2.

4. A processing method of a light-sensitive silver halide photographic material according to Claim 1, wherein said swelling degree of the light-sensitive silver halide photographic material is within the range of 230 % to 340 %.

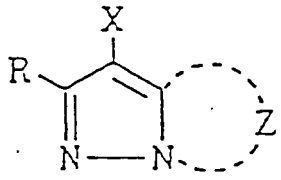
5. A processing method of a light-sensitive silver halide photographic material according to Claim 4, wherein a total amount of gelatin contained in the light-sensitive material is 5.0 to 30 g/m^2 and an amount of a hardening agent is 5 to 50 mg per gram of the gelatin.

6. A processing method of a light-sensitive silver halide photographic material according to Claim 1, wherein said color development processing is carried out under the conditions of a pH of 10.0 to 11.0, a temperature of 30 °C to 40 °C for a development time of 30 seconds or more.

Patentansprüche

1. Behandlungsverfahren für ein lichtempfindliches photographisches Silberhalogenid-Aufzeichnungsmaterial, bei welchem ein lichtempfindliches photographisches Silberhalogenid-Aufzeichnungsmaterial mit mindestens einer Silberhalogenidemulsionsschicht auf einem reflektierenden Schichtträger bildgerecht belichtet und farbentwickelt und danach unmittelbar anschließend ohne Wässern bleichfixiert wird, dadurch gekennzeichnet, daß

1. in mindestens einer der Silberhalogenidemulsionsschichten ein Purpurrot-Kuppler der folgenden Formel (I)



(I)

worin bedeuten:

Z eine zur Bildung eines gegebenenfalls substituierten, stickstoffhaltigen heterocyklischen Rings erforder-

liche Gruppe nichtmetallischer Atome;

X ein Wasserstoffatom oder einen bei der Umsetzung mit dem Oxidationsprodukt einer Farbentwicklerverbindung abspaltbaren Substituenten und

R ein Wasserstoffatom oder einen Substituenten, enthalten ist,

2. die Gesamtgelatinemenge in der den Purpurrot-Kuppler enthaltenden Silberhalogenidemulsionsschicht und einem, von dem reflektierenden Schichtträger aus gesehen, zu dieser Schicht weiter entfernten photographischen Schichtbestandteil 5,0 g/m^2 bis 15,0 g/m^2 beträgt,

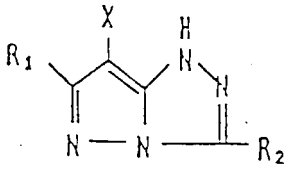
3. der Quellungsgrad (Verhältnis der Flimdicke (µm) eines lichtempfindlichen photographischen Silberhalogenid-Aufzeichnungsmaterials am Endpunkt der Farbentwicklung und der Filmdicke (µm) des lichtempfindlichen photographischen Silberhalogenid-Aufzeichnungsmaterials vor der Farbentwicklung, ausgedrückt durch folgende Gleichung:

$$\text{Quellungsgrad (\%)} = \frac{\text{Filmdicke (µm) eines lichtempfindlichen photographischen Silberhalogenid – Aufzeichnungsmaterials am Endpunkt der Farbentwicklungsbehandlungsstufe}}{\text{Filmdicke (µm) eines lichtempfindlichen photographischen Silberhalogenid – Aufzeichnungsmaterials von der Farbentwicklungsbehandlungsstufe)}}$$

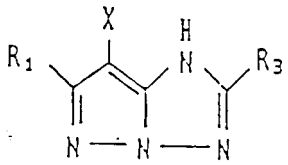
des lichtempfindlichen photographischen Silberhalogenid-Aufzeichnungsmaterials am Ende der Farbentwicklung im Bereich von 220 % bis 350 % liegt, und

4. der reflektierende Schichtträger folgende gemäß der japanischen Industriestandardvorschrift JIS-Z-8722-82 bestimmte und gemäß der japanischen Industriestandardvorschrift JIS-Z-8730-80 angegebene Oberflächenreflexionseigenschaften aufweist: $L \geq 88$, $-1{,}0 \leq a \leq 1{,}5$ und $-5{,}0 \leq b \leq -2{,}0$.

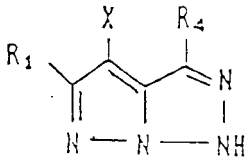
2. Behandlungsverfahren eines lichtempfindlichen photographischen Silberhalogenid-Aufzeichnungsmaterials nach Anspruch 1, wobei der Purpurrot-Kuppler der Formel (I) durch Verbindungen der Formeln (II) bis (VIII) wiedergegeben wird:



(II)



(III)



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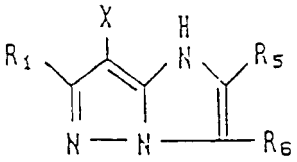

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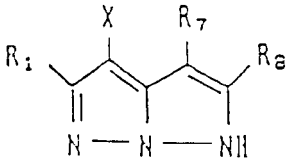
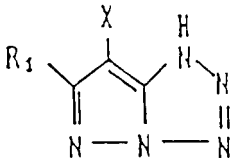
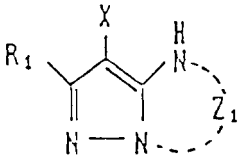


(VI)



(VII)



(VIII)

worin R_1 bis R_8, X und Z_1 die in Anspruch 1 angegebene Bedeutung besitzen.

3. Behandlungsverfahren eines lichtempfindlichen photographischen Silberhalogenid-Aufzeichnungsmaterials nach

Anspruch 1, wobei die Gesamtgelatinemenge in der den Purpurrot-Kuppler enthaltenden Silberhalogenidemulsionsschicht und einem, von dem reflektierenden Schichtträger aus gesehen, zu dieser Schicht weiter entfernten photographischen Schichtbestandteil im Bereich von 5,2 bis 10,0 g/m^2 liegt.

4. Behandlungsverfahren eines lichtempfindlichen photographischen Silberhalogenid-Aufzeichnungsmaterials nach Anspruch 1, wobei der Quellungsgrad des lichtempfindlichen photographischen Silberhalogenid-Aufzeichnungsmaterials im Bereich von 230 % bis 340 % liegt.

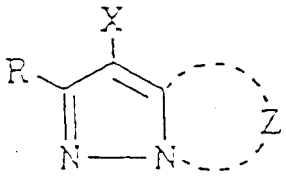
5. Behandlungsverfahren eines lichtempfindlichen photographischen Silberhalogenid-Aufzeichnungsmaterials nach Anspruch 4, wobei die Gesamtgelatinemenge des lichtempfindlichen Aufzeichnungsmaterials 5,0 bis 30 g/m^2 beträgt und die Härtungsmittelmenge 5 bis 50 mg pro Gramm Gelatine ausmacht.

6. Behandlungsverfahren eines lichtempfindlichen photographischen Silberhalogenid-Aufzeichnungsmaterials nach Anspruch 1, wobei die Farbentwicklung bei einem pH-Wert von 10,0 bis 11,0 und einer Temperatur von 30° bis 40 °C während einer Entwicklungsdauer von 30 s oder mehr durchgeführt wird.

Revendications

1. Un procédé de traitement d'un matériau photographique à l'halogénure d'argent sensible à la lumière, dans lequel un matériau photographique à l'halogénure d'argent sensible à la lumière, présentant au moins une couche d'émulsion à l'halogénure d'argent sur un support réfléchissant, est exposé de manière à former une image et développé en couleur, puis immédiatement fixé par blanchiment sans effectuer une étape de lavage à l'eau, caractérisé en ce que :

1) un coupleur magenta représenté par la formule (I) est contenu dans au moins l'une des couches d'émulsion à l'halogénure d'argent,



(I)

dans laquelle Z représente un groupe d'atomes non-métalliques nécessaires pour former un cycle hétérocyclique ne contenant pas d'azote, qui peut avoir un substituant ; X représente un atome d'hydrogène ou un substituant éliminable par la réaction avec le produit oxydé d'un agent de développement de couleur ; et R représente un atome d'hydrogène ou un substituant,

2) la quantité totale de gélatine contenue dans la couche d'émulsion à l'halogénure d'argent contenant ledit coupleur magenta et une couche de constituant photographique plus éloignée de ladite couche, par observation depuis le support réfléchissant, est de 5,0 g/m^2 à 15,0 g/m^2, et

3) le degré de gonflement (rapport de l'épaisseur de pellicule (μm) d'un matériau photographique à l'halogénure d'argent sensible à la lumière au point terminal de la phase de traitement de développement couleur et de l'épaisseur de pellicule (μm) du matériau photographique à l'halogénure d'argent sensible à la lumière avant la phase de traitement de développement couleur et indiqué par l'équation suivante :

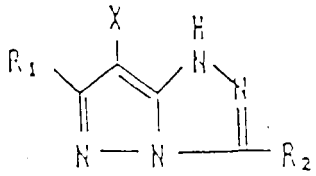
$$\text{Degré de gonflement (\%)} = \frac{\text{Epaisseurde pellicule (μm) d'un matériau photographique à l'halogénure d'argent sensible à la lumière au point terminal de la phasede traitement de développement couleur}}{\text{Epaisseurde pellicule (μm) d'un matériau photographique à l'halogénure d'argent sensible à la lumière avant la phase de traitement de développement couleur)}}$$

du matériau photographique à l'halogénure d'argent sensible à la lumière, à la fin de ladite phase de traitement de développement couleur, est compris dans la plage de 220% à 350%, et

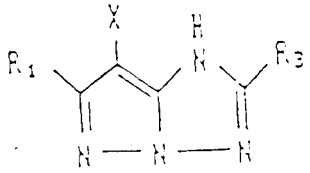
4) ledit support réfléchissant présente des caractéristiques réfléchissantes de surface de $L \geq 88$, $-1,0 \leq a \leq 1,5$

et - 5,0 ≤ b ≤ - 2,0 lorsque les valeurs sont mesurées par une méthode prescrite dans la norme JIS-Z-8722-82 et indiquées par une méthode prescrite dans la norme JIS-Z-8730-80.

2. Un procédé de traitement d'un matériau photographique à l'halogénure d'argent sensible à la lumière selon la revendication 1, dans lequel ledit coupleur magenta représenté par la formule (I) comporte les composés représentés par les formules (II) à (VIII) :



(II)



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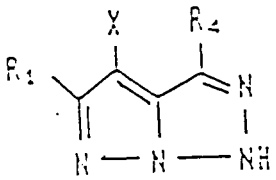

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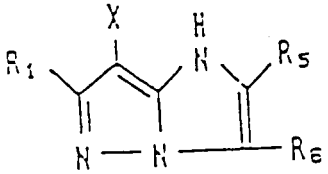

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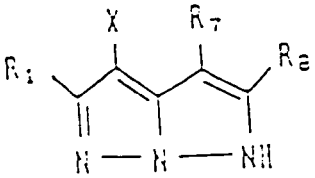

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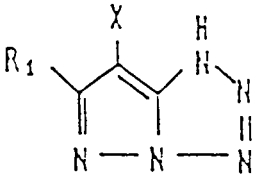

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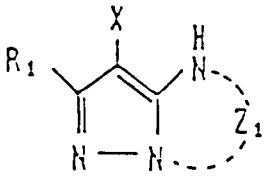

(VIII)

dans lesquelles R_1 à R_8, x et Z_1 ont les mêmes significations que définies dans la revendication 1.

3. Un procédé de traitement d'un matériau photographique à l'halogénure d'argent sensible à la lumière selon la revendication 1, dans lequel la quantité totale de gélatine contenue dans la couche d'émulsion à l'halogénure d'argent contenant ledit coupleur magenta et une couche de constituant photographique plus éloignée de ladite couche, en observation depuis le support réfléchissant, est située dans la plage de 5,2 à 10,0 g/m^2.

4. Un procédé de traitement d'un matériau photographique à l'halogénure d'argent sensible à la lumière selon la revendication 1, dans lequel ledit degré de gonflement du matériau photographique à l'halogénure d'argent sensible à la lumière est situé dans la plage de 230% à 340%.

5. Un procédé de traitement d'un matériau photographique à l'halogénure d'argent sensible à la lumière selon la

revendication 4, dans lequel la quantité totale de gélatine contenue dans le matériau sensible à la lumière est comprise entre 5,0 et 30 g/m^2 et la quantité d'un agent de durcissement est de 5 à 50 mg par gramme de gélatine.

6. Un procédé de traitement d'un matériau photographique à l'halogénure d'argent sensible à la lumière selon la revendication 1, dans lequel ledit traitement de développement couleur est effectué dans les conditions d'un pH de 10,0 à 11,0, d'une température de 30°C à 40°C pour une durée de développement de 30 secondes ou plus.