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④ Improvements in and relating to packaging.

⑤ The present invention relates to packaging material which contains one or more ceramic powders. The powders are able to emit long wave infrared radiation. The packaging material takes the form of paper, film and the like, and may be used on its own or in combination with other known packaging materials. The advantage of packaging material according to the present invention is its ability to at least assist in increasing the shelf life of products packaged therewithin. Packaging material of the present invention may be used to contain and interact with gases forming a controlled atmosphere within the packaging.

EP 0 330 431 A1

Description

Improvements in and Relating to Packaging

This invention relates to packaging materials and more particularly to packaging materials which assist in increasing the shelf life of products such as vegetables, flowers, meat and the like.

5 It is often necessary to package fresh foods, such as meat, (including fish and poultry), vegetables, dairy products, fruit, nuts, bakery products, flowers, foliage, herbs and the like (hereinafter referred to as "produce") for display and sale in markets, shops and other points of sale. The packaging allows the produce to be displayed in a suitable and convenient manner. One major problem encountered with fresh produce is, however, its shelf life. It is desirable to provide means whereby the shelf life of fresh produce can be increased.

10 One such means is to provide suitable packaging materials and methods. Many different packaging products and materials are available, and are used in the packaging of fresh produce. While such packaging products and materials are suitable for packaging fresh produce, previously available packaging materials have not generally been provided with properties which significantly increase the shelf life of the produce.

15 It is an object therefore of one aspect of the present invention to provide packaging materials and methods which go some way toward overcoming or minimising the abovementioned problems, or at least provide the public with a useful alternative.

Other objects of the invention will become apparent from the following description.

According to one aspect of the present invention there is provided packaging material, including one or more ceramic powders able to emit long wave infrared radiation.

20 According to a further aspect of the present invention there is provided a packaging paper, said paper including one or more ceramic powders able to emit long wave infrared radiation.

According to a still further aspect of the present invention there is provided a plastic packaging film, including one or more ceramic powders able to emit long wave infrared radiation, said one or more powders extruded within one or more layers of said film.

25 According to a still further aspect of the present invention there is provided a method of packaging including the step of at least partly containing said produce within packaging material, wherein said packaging material includes one or more ceramic powders able to emit long wave infrared radiation.

30 According to a still further aspect of the present invention there is provided a method of packaging produce including the step of containing said produce within a package, said package including at least some packaging material which includes one or more ceramic powders able to emit long wave infrared radiation; and creating within said package a controlled atmosphere environment.

Further aspects of the invention will become apparent from the following description, which is given by way of example only, and with reference to the accompanying drawings, in which:

35 Figure 1: shows a schematic view of protein found in fresh produce, such as meat, vegetables and the like.

Figure 2: shows a schematic view of packaging material according to one aspect of the present invention.

Figure 3: shows packaging material according to a further aspect of the present invention.

Figure 4: shows packaging material according to a still further aspect of the present invention.

40 Figure 5: shows packaging material according to a still further aspect of the present invention.

Figure 6: shows a portion of a cardboard carton or container, according to one aspect of the present invention.

Figure 7: shows the long wave infrared radiation emission efficiencies of type A and B powder, when compared to a theoretical black box at 100 C.

45 Figure 8: shows the gas adsorption properties of type A and B powders for various gases over time.

There is provided by the present invention packaging material which includes ceramic powder able to emit long wave infrared radiation. Such packaging material has application in the packaging of fresh produce and the like and assists in extending the shelf life of the produce.

50 Packaging material according to the present invention includes semi-rigid or flexible packaging material. Produce such as fruit, vegetables, flowers and the like, and meat products are composed of organic compounds including proteins, and also of water.

A large percentage of these products may comprise water and protein. Referring to Figure 1 of the accompanying drawings a typical composition, at a molecular level, is protein 1 surrounded by a number of layers of water molecules 2.

55 The degradation of produce after harvesting, processing and the like, is due to the decomposition of the protein 2 by bacteria 3. The decomposition is generally caused by bacteria 3 attacking the layers of water 2, and thus penetrating the protein 1, to expose the carbon 4 which is at the core of the protein. The result is often discharges forming in the bottom of a pack or package containing such produce.

60 Surprisingly it has been discovered that long wave infrared radiation has the most suitable range of wavelengths for absorption by organic substances, such as water. In particular, water's peak absorption of infrared radiation occurs at wavelengths of between three and nine microns.

When meat, vegetables, fruit, flowers and the like are radiated with long wave infrared radiation, the living enzymes 5 (as shown in figure 1) and the layers of water 2 are activated, thus slowing down the activity of the

bacteria 3.

The long wave infrared radiation emitted by the packaging material according to the present invention excites the molecules of the produce contained therewithin. This increases the activity of the water molecules bound to proteins 1. The result is an increase in density of water molecules and thus an increase in the natural resistance of the proteins to degradation by bacteria and enzyme growth.

The radiation causes the water molecules binding to the meat proteins to achieve a high activity state, thus preventing the bacteria from entering the molecule, or at least slowing down this process.

The packaging material according to the present invention is provided with ceramic powders able to emit long wave infrared radiation. The term "ceramic powders" when used throughout the specification includes naturally occurring minerals and non-naturally occurring minerals, and combinations of the same (all of which are able to emit long wave infrared radiation).

Referring now to suitable ceramic powders, it has been found that packaging material including non metallic mineral powders in combination with one or more mineral hydrated silicates of aluminium, calcium or sodium are particularly preferred.

Specific examples of ceramic powders which have the characteristic of long wave infrared radiation are:

Type A: $(\text{Na Al}(\text{OH})_2\text{CO}_3)$

hereafter called Dorsonite or Type A

Type B: $6 \text{ Ca O} \cdot 6 \text{ Si O}_2 \cdot \text{H}_2\text{O}$

$\text{Al}(\text{OH})_3$ hereafter called Type B

The long wave infrared radiation emission efficiencies of Type A and Type B powder when compared to a theoretical black box at 100°C are contained in the graphs in Figure 7. The radiation efficiencies in wavelengths between four and nine microns range from 71% to 91% for Type A powder and range from 73% to 93% for Type B powder. These efficiencies in the emissions of long wave infrared radiation are surprisingly high in comparison to other known compounds when measured spectographically.

Other suitable powders are:

a) $\text{Ca}_3(\text{Si}_6\text{O}_{15}) \cdot 8\text{H}_2\text{O} + \text{Al}(\text{OH})_3$

b) $\text{Ca}_6(\text{Si}_6\text{O}_{17})(\text{OH})_2 + \text{Al}(\text{OH})_3$

c) $\text{Ca}_4(\text{Si}_3\text{O}_9)(\text{OH})_2 + \text{Al}(\text{OH})_3$

d) $\text{Ca}_5(\text{Si}_6\text{O}_{18}) \cdot 8\text{H}_2\text{O} + \text{Al}(\text{OH})_3$

e) $\text{Ca}_6(\text{SiO}_4)(\text{Si}_2\text{O}_7)(\text{OH})_2 + \text{Al}(\text{OH})_3$

In addition to emitting longwave infrared radiation, it is known that ceramic powders may form molecular sieves, which may assist in the removal or discharge of waste products such as hormones, oxygen, ethylene gas and excessive carbon dioxide. Thus, combination of one or more suitable ceramic powders into packaging materials may assist in moisture regulation and oxygen level regulation. The result is an extension in the shelf life of the produce packaged in packaging material according to the present invention.

In one example meat wrapped in a packaging material of the present invention and lying in contact with such material has a shelf life extended by up to 50%, and retains an appropriate colour for a considerably extended period.

The graphs contained in figure 8 demonstrate the gas adsorption properties of Type A and Type B powders for various gases over time. Type A and Type B powders have a comparative surface area of 50-100 square meters per gram which is available for the adsorption of gases. Type A and Type B powders are surprisingly efficient in the adsorption of ethylene gas, H_2S , acetaldehyde gas, trimethylamine gas and benzene when measured over time compared to other known compounds.

The fundamental building-block of a molecular sieve crystal structure is a tetrahedron of four oxygen anions surrounding a smaller silicon or aluminium cation. The sodium ions or other cations serve to make up the positive charge deficit in the alumina tetrahedra. Each of the four oxygen anions is shared, in turn, with another silica or alumina tetrahedron to extend the crystal lattice in three dimensions.

The resulting crystal is unusual in that it is honey-combed with relatively large cavities, each cavity connected with six adjacent ones through apertures or pores. The water of hydration is contained within these cavities. Type A for example, contains roughly spherical cavities approximately eleven angstroms in diameter and about 925 cubic angstroms in volume, that account for almost half of the total crystalline volume. This volume is available for adsorption. The free aperture size in the sodium-bearing type 1 is 3.5 angstroms in diameter. At usual operating temperatures, this allows the passage of molecules with an effective diameter as large as 4 angstroms.

Molecular sieves retain adsorbates by strong physical forces rather than by chemisorption. This means that when the adsorbed molecule is desorbed by the application of heat or by displacement with another material, it leaves the crystal in the same chemical state as when it is entered.

The external surface area of the molecular sieve crystal is available for adsorption of molecules of all sizes, whereas the internal area is available only to molecules small enough to enter the pores. The external area is only about 1 per cent of the total surface area. Materials which are too large to be adsorbed internally will commonly be adsorbed externally to the extent of 0.2 to weight per cent.

In one preferred form of the invention, packaging material is provided in the form of a paper. The paper includes one or more of the ceramic powders described. In one form of the invention, the paper includes appropriate fibrous substances, soaked in a suitable ceramic powder, for example Type A.

Referring now to Figure 2 of the accompanying drawings, the paper according to the present invention

comprises fibrous material 6 which may be for example plant fibres, synthetic fibres, animal fibres or inorganic fibres.

Type A powder 7 is added to the fibrous mixture and there may also be added connector and stabilising agents which are required to form the finished paper. These additives will depend on the requirements of the paper, and its ultimate use.

The components required to form the paper are formed into a slurry, and thereafter formed into a suitable paper product, by a suitable method such as for example the method of dry non-woven cloth.

It should be appreciated that the proportion of Type A added to the slurry depends on the final use of the paper product.

In one preferred form of the invention, a paper-leaf shaped product is formed.

In the preferred form of the invention shown in Figure 2 of the accompanying drawings, the Type A powder 7 is dispersed through the paper 6. In a further form of the invention, however, and as shown in Figure 3 of the accompanying drawings, the Type A may be sandwiched between layers of the fibrous material. The Type A containing paper may also be coated with a plastic polyethylene material 8 on both sides thereof, as shown in Figure 5 of the accompanying drawings.

Examples of a method of forming a packaging paper according to the present invention are given below.

Example 1:

50 parts by weight of Type A and 50 parts by weight of pulp material, for example wooden fibres, jute fibres, and/or synthetic fibres, are agitated in 1000 parts of water by volume.

As a binder, solid SBR-Latex is preferably added (3 parts w/v) and one part w/v of sulphuric acid. Thereafter, 0.5 parts (w/v) of tita-gum as a water filtration reagent may be added. The mixture is thereafter stirred or agitated for a further 5 to 10 minutes.

In this particular example, 30 parts (w/v) of wooden pulp are added and 20 parts (w/v) of synthetic fibres are used, thus forming the 50 parts (w/v) of pulp material, as required.

The physical properties of paper formed by the method are shown in Table 1:

TABLE 1

Item		Test No.		
		1	2	3
BALANCE-WEIGHT	(g/m)	155	180	230
THICKNESS	(m/m)	0.35	0.39	0.53
DENSITY	(g/cm)	0.44	0.46	0.44
TENSILE STRENGTH	(kg/15mm)	2.60	2.75	3.00
PERMEABILITY	(sec/100cc)	8.5	9.7	12.0
ASH	(%)	30	29.6	29.8

The results of Test No 2 as outlined above were obtained by measuring the adsorption efficiency of acetic acid, with the method being conducted in accordance with the weight-volume method in ambient temperature at saturated steam pressure.

In addition, the adsorption efficiencies of activated charcoal-containing paper, asbestos-absorbed paper and the paper according to this invention were measured, with the result being shown in Table 2. These results can be compared with the properties shown in Test No. 2, in Table 1.

TABLE 2

(UNIT g/g)

	/(HR)	20	80	150	300	650
		0.15	0.22	0.30	0.38	0.54
ABSORBENT OF THIS INVENTION						
ACTIVATED CHARCOAL PAPER		0.13	0.16	0.28	0.19	0.19
ASBESTOS PAPER		0.07	0.10	0.12	0.14	0.15
PAPER		0.06	0.09	0.10	0.11	0.11

As is shown from the above results, paper according to the present invention has an increased absorption capability, when compared with previously available papers.

Furthermore, the results show that the longer the ageing time lapsed, the more efficient the absorption of the paper according to the present invention.

Example 2:

Both 30-50 parts (w/v) pulp and 20 parts (w/v) of synthetic fibres are placed in 1000 parts (w/v) of water, and thereafter agitated or stirred. A known paper manufacturing process is thereafter used to form a normal paper with a weight/volume of 80-115g/m². This paper forms a base paper for paper according to the present invention. Thereafter, a slurry is formed containing ingredients substantially as described in Example 1 above, and this slurry is coated onto the base paper. The Type A slurry is absorbed into the base paper. The slurry is such that between 70-115g/m² thereof is absorbed on top of the base paper. The final product is thus a paper weight after drying of 150-230g/m².

In a further preferred form of the invention, a paper may be provided which includes a foil laminate on one side. This foil may be used for cooking processed meats at between 60° C and 200 °C, and then maintaining freshness during cold or frozen storage. This paper foil may also be used to directionally orientate the wavelength emission of infrared radiation, in one field only.

As shown in Figure 5 of the accompany drawings, in one form of the invention the paper may be coated with two sides of polyethylene 3. Such a product is particularly suitable for storage of fresh meats and vegetables. The packaging material in this form of the invention may also be provided with perforations therein, which allow for absorption of any moisture within the package, and assists in absorption of gases such as ethylene and carbon dioxide.

The packaging paper according to the present invention has application in a large number of uses, including as soaker pads in retail packages of red meat, pork, fish and chicken. A further use is as liner pads for all retail packaged fruits and vegetables. Packaging paper according to the present invention may also be used at a carton liner for bulk shipments of tomatoes, green leaved vegetables, fruit, mushrooms and the like.

A further use is as liner pads for bulk fresh meat distribution for a bag in a box type arrangement, or for box in a bag bulk packaging of meats, poultry, fish and the like.

As discussed above, in a further preferred form of the invention there is provided a packaging film. Packaging film according to the present invention has particular application to the packaging of leafy plants and vegetables, which naturally respire during transportation and storage. A key factor in prolonging shelf life and appearance of such products is controlling the respiration rate of the fruit and vegetables, as well as establishing an environment which continually eliminates unwanted gases and by-products out of the package.

A plastic packaging film according to the present invention is preferably a permeable film, including ceramic powders as defined previously. The combination of the ceramic powders in the plastic packaging film help with the adsorption of ethylene gas and also allows oxygen or nitrogen to pass through the film into the package itself. Thus, the ceramic powders provided in a film according to the present invention adsorb unwanted gases, or stop adsorption when certain levels are reached, thus acting like a filter to control the environment inside the package.

The infrared emission of the ceramic powders inhibit enzyme and bacterial activity. The film is sufficiently permeable to allow for proper air permeation and moisture permeation, while at the same time controlling water evaporation so that vegetables, leafy plants and the like, will be maintained in a fresh condition. This also prevents moisture accumulating on the inside of the film.

There may also be provided impermeable films, which are also be referred to as barrier films.

Thus, packaging film according to the present invention may be used in conjunction with a controlled atmosphere or environment, to substantially increase the shelf life of products packaged therein. Packaging films according to the present invention may be used with or without paper according to the present invention.

A controlled atmosphere is defined as the generation and/or maintenance of a gas or a combination of gases in the package, adapted to enhance the shelf life of the produce. Gases may be injected during packaging and may or may not interact with ceramic powders to create the desired controlled atmosphere.

In one form of the invention, the packaging film is extruded in flexible tubes. Packaging bags and the like may be formed from such film.

In a further preferred form of the invention, and as shown in Figure 4, a packaging film may be provided which includes a 5 layer extruded film, which includes layers of ceramic powders 7. However, films according to the present invention may include from one to seven layer film extrusions.

In a further preferred form of the invention there is provided at least one wall of a cardboard carton, which includes an uncoated ceramic powder paper according to the present invention, the ceramic powder paper including one or more ceramic powders. Cardboard cartons are generally made of various layers of paper with "flutes" provided therebetween, to give strength. In this preferred form of the invention ceramic powder paper according to the present invention is applied by adhesive to one or more of the inner layers of the cardboard carton. In this way, there may be provided a cardboard carton or container which includes one or more layers of ceramic powder paper. Such a cardboard carton or container allows for an increased shelf life of the product.

The carton or container may or may not be used on conjunction with a plastic film and the plastic film may or may not contain ceramic powders according to the present invention.

An appropriate cardboard carton or container is shown in Figure 6 of the accompanying drawings. The

ceramic powder paper material may be put in any or all of the layers of the corrugation, depending on the application or the degree of either the effect of the ceramic powders required for the specific product application.

Storage tests have shown that at 15 °C packaging bags according to the present invention will allow for 3 to 4 times the shelf life for spinach, 2 to 3 times shelf life for mushrooms, and 3 to 4 times the shelf life for whole lettuces, when compared with the shelf life of these products packaged in polyethylene bags.

The following examples illustrate the use and efficiency of packaging material according to the present invention, without limiting the invention.

1) Sixteen pears harvested at the same time from the same tree were segregated into one group of 8 pears which were surrounded by Type A paper as described in this invention and one control group of 8 pears which were not wrapped. Storage temperature was held between 18° C - 23° C. Four pears from each group were cut in half after 5 days storage to measure effectiveness of packaging material of the invention. There was no discernible difference between control pears and pears packaged with Type A paper. Four more pears from each group were cut in half after 12 days storage to measure effect. All pears in the control group were brownish in appearance on the cut surface of the pear due to spoilage. On a visual appearance scale of 1 to 5 signifies excellent visual quality and 5 signifies spoiled and unappealing, 3 of 4 pears from control group were rated 5 while the remaining control pear rated 4. The four pears which were wrapped in Type A paper were also visually rated on the same one to five scale. Three Type A paper packaged pears were rated a 2, with the remaining pear rated a 3.

2) Clear polyethylene plastic film was extruded incorporating Type B powder in the film extrusion. The Type B powder impregnated plastic film was then formed into bag form with an opening at one end. A test was conducted with various produce to compare the Type B powder impregnated plastic film effectiveness in regulation and absorption of gases compared with conventional polyethylene packaged product. A visual appearance scale of 1 to 5 was established where on signified excellent visual quality and 5 signified spoiled and visually unappealing. Tests were conducted with strawberries, broccoli and mushrooms. Four Type B powder impregnated bags were filled with strawberries, broccoli and mushrooms respectively and then were sealed in each bag by closing the open end. The same packaging procedure was utilised by placing strawberries, broccoli and mushrooms in conventional polyethylene plastic film of the same thickness as the Type B powder impregnated film to utilise as control. The packages were then stored at 18° - 23° C and visually inspected at two day intervals.

In the case of strawberries, surface mold and spoilage on conventional polyethylene packaged product began to appear on day 2, product was visually rated 3 while strawberries packaged in Type B powder impregnated film showed no signs of degradation and were visually rated 1. After four days storage the strawberries packaged in conventional polyethylene were visually rated 4, while the Type B powder impregnated film packaged strawberries rated a 2. At six days the conventionally polyethylene packaged strawberries were rated 5 with severe surface mold growth. The Type B powder impregnated film packaged strawberries were rated 2 exhibiting some change in colour but still commercially saleable.

The same procedure was used in testing broccoli and mushrooms. In the case of broccoli conventional polyethylene packaged product was rated a 2 by day 2 and a 5 by day 10. Type B powder impregnated film packaged product was visually rated 1 on day 2 and rated 2 on day 10.

3) Type A paper was laminated to the interior surface of corrugated cardboard cartons and each filled with 1 kilogram of mushrooms. Tests were conducted using conventional non-laminated cardboard cartons filled with mushrooms as a control. Storage temperature was held at 10° C. Mushrooms contained in the Type A paper coated cartons visually spoiled at a rate one half of that of controlled mushrooms.

4) Cuts of beef were placed on a piece of Type A paper and then placed on a styrofoam tray and then overwrapped with commercially available permeable PVC film. Control beef cuts were packaged in the same manner but substituting a commercially available soaker pad instead of Type a paper. The pH of the commercially available soaker pad was 6.0 or neutral, while the pH of the Type A paper ranged between 8.5 to 9.0. Four individual trays of each product were then placed in a flexible non shrink barrier bag with an opening on one end. The barrier bags were then evacuated to remove substantially all the oxygen, and 100% nitrogen gas was then injected into the barrier bags and sealed. After 14 days storage at 2° C the masterpacks were opened. The beef cuts packaged with Type A paper after 5 hours exposure at 2° C to oxygen in air regained a red meat surface colour which was noted as being significantly superior to control. After exposure to air for 3 days at 2° C control beef cuts began to turn brown in colour and were visually rated as unappealing. Type A paper packaged beef cuts did not begin to turn brown in colour until day 4.

5) Pork loins were individually packaged in a permeable plastic film incorporating Type B powder. Loins were placed in the bag at open end and the bag was then evacuated and sealed. Four pork loins packed as above were then placed in a impermeable plastic bag, the bag evacuated, and a 100% CO₂ gas injected into the masterpack, and the bag was sealed. Storage temperature was held at 0-2° C.

The pork loins as previously packaged achieved a shelf life of 30 days with good surface colour on the meat and no undesirable odours, when compared to packaged used as control which did not use Type B film but were packaged in a similar manner.

6) Diced onions were placed in a permeable plastic bag incorporating Type B powder. The packaged was then evacuated and a gas mixture of 5% O₂, 15% CO₂, 80% N₂ by volume injected into the package and heat sealed. Control product was packaged in the same manner but in a permeable film not incorporating Type B

powder. Storage temperature was held at 8°C. Diced onions stored in control bags began deteriorating within 2 days and bags had a strong odour emanating from them almost immediately upon packaging. Onions packaged in Type B powder film did not start deteriorating until day 5 and the bags had little or no odour emanating from them.

Packaging film according to the present invention may be formed, in one preferred form of the invention, by any suitable or appropriate technique.

Thus, by this invention there is provided a packaging material which allows for a substantially increases shelf life of products packaged therewithin.

Although the invention has been described by way of example, and with particular reference to various embodiments thereof, it should be appreciated that variations and modifications may be made thereto, without departing from the scope of the thereof as defined in the appended claims.

Claims

1. Packaging material including one or more ceramic powders able to emit long wave infrared radiation.
2. Packaging material as claimed in claim 1, in the form of a packaging paper.
3. Packaging material as claimed in claim 1, in the form of a plastic packaging film of one or more layers, said one or more powders extruded within one or more layers of said film.
4. Packaging material as claimed in claim 3, wherein said film is permeable to gases.
5. Packaging materials as claimed in claim 3, wherein said film is impermeable to gases.
6. Packaging material as claimed in claim 1, wherein said one or more ceramic powders emit infrared radiation with an efficiency of 50-95% of 100 °C in wavelengths of from three microns, up to and including nine microns and have a crystalline structure which has a comparative surface area of between 50 and 100 square meters per gram of powder.
7. Packaging material as claimed in claim 6, wherein said one or more ceramic powders emit infrared radiation with an efficiency of 71-93% at 100° C in wavelengths of from four microns, up to and including nine microns and have a crystalline structure which has a comparative surface area of between 50 and 100 square meters per gram of powder.
8. Packaging material as claimed in any one of the preceding claims wherein said one or more ceramic powders include $\text{NaAl}(\text{OH})_2\text{CO}_3$ and/or $6\text{CaO} \cdot 6\text{SiO}_2 \cdot \text{H}_2\text{O} \cdot \text{Al}(\text{OH})_3$.
9. Packaging material as claimed in any one of the preceding claims, wherein said one or more ceramic powders are selected from:
 - a) $\text{Ca}_3(\text{Si}_6\text{O}_{15}) \cdot 8\text{H}_2\text{O} + \text{Al}(\text{OH})_3$;
 - b) $\text{Ca}_6(\text{Si}_6\text{O}_{17})(\text{OH})_2 + \text{Al}(\text{OH})_3$;
 - c) $\text{Ca}_4(\text{Si}_3\text{O}_9)(\text{OH})_2 + \text{Al}(\text{OH})_3$;
 - d) $\text{Ca}_5(\text{Si}_6\text{O}_{18}) \cdot 8\text{H}_2\text{O} + \text{Al}(\text{OH})_3$;
 - e) $\text{Ca}_6(\text{SiO}_4)(\text{Si}_2\text{O}_7)(\text{OH})_2 + \text{Al}(\text{OH})_3$.
10. Packaging, including packaging material as claimed in claim 1, containing and interacting with gases of a controlled atmosphere environment.
11. A method of packaging, including the step of containing a product in packaging including at least a component of packaging material including one or more ceramic powders able to emit long wave infrared radiation.
12. A method as claimed in claim 11, wherein said packaging material is as claimed in any one of the preceding claims 2-9.
13. A method of forming packaging paper containing one or more ceramic powders, including the steps of:
 - a) mixing one or more ceramic powders with pulp material;
 - b) optically mixing in additives including a binder, and/or water filtration reagent;
 - c) stirring the resulting mixture for a predetermined period of time; and
 - d) thereafter forming said packaging paper.
14. A method of forming layers of packaging film containing one or more ceramic powders, including the step of mixing said one or more ceramic powders with plastics material and thereafter extruding the resulting mixture into said layers of packaging film.
15. A method of forming packaging material which prolongs the shelf life of perishable produce which comprises incorporating therein an effective amount of one or more ceramic powders able to emit long wave infrared radiation.
16. Perishable produce when packaged in packaging or packaging material as claimed in any of claims 1 to 10.

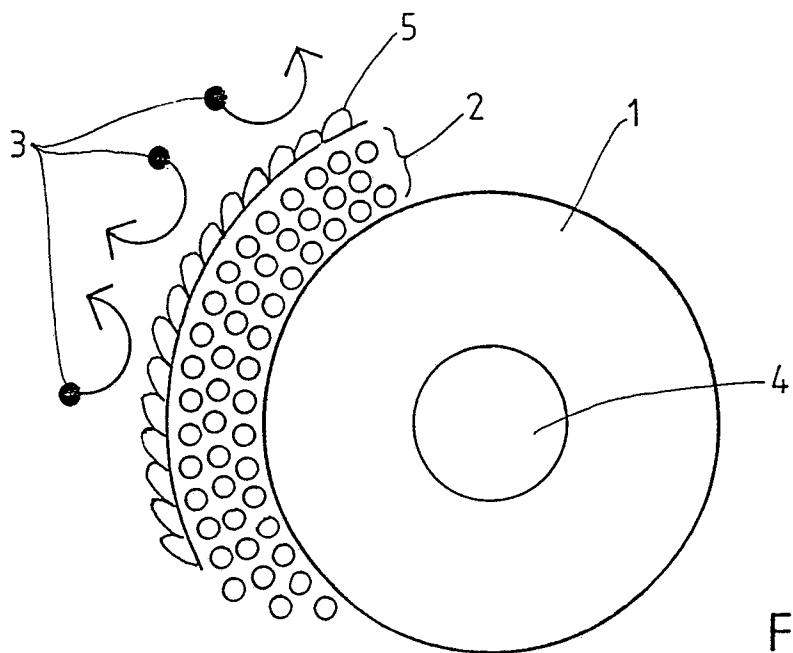


FIG. 1.

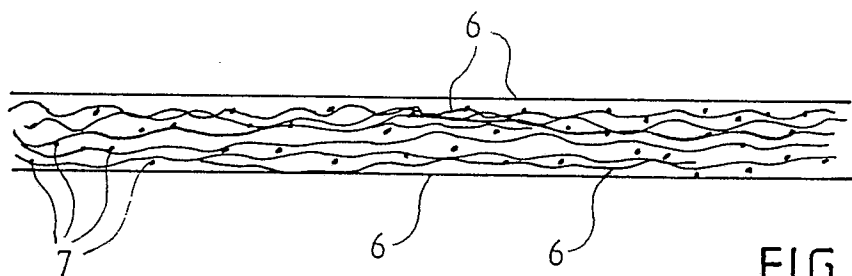


FIG. 2.

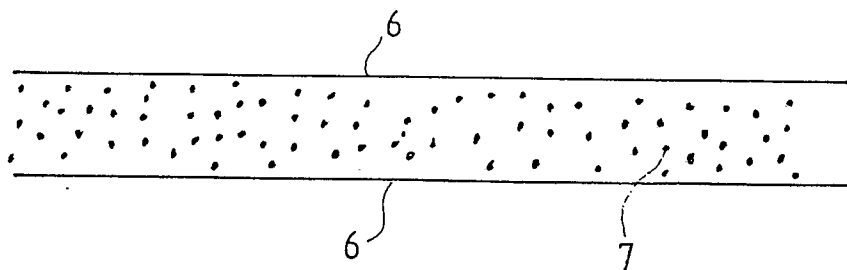


FIG. 3.

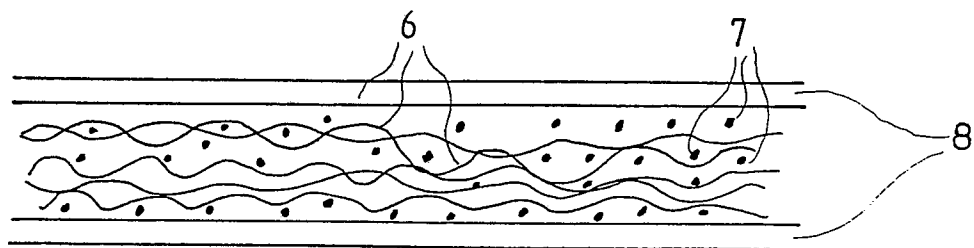


FIG. 5.

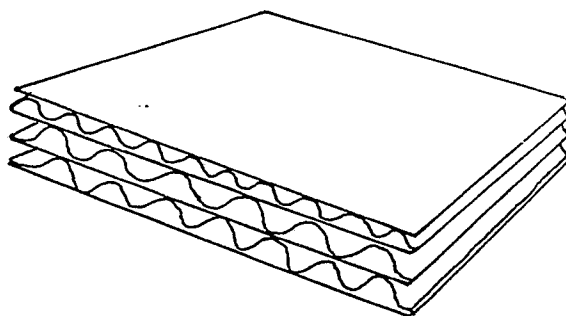


FIG. 6.

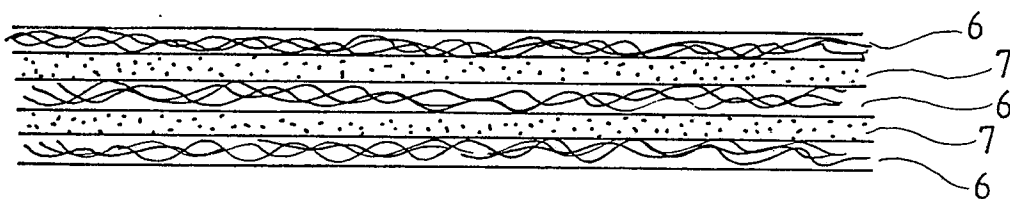
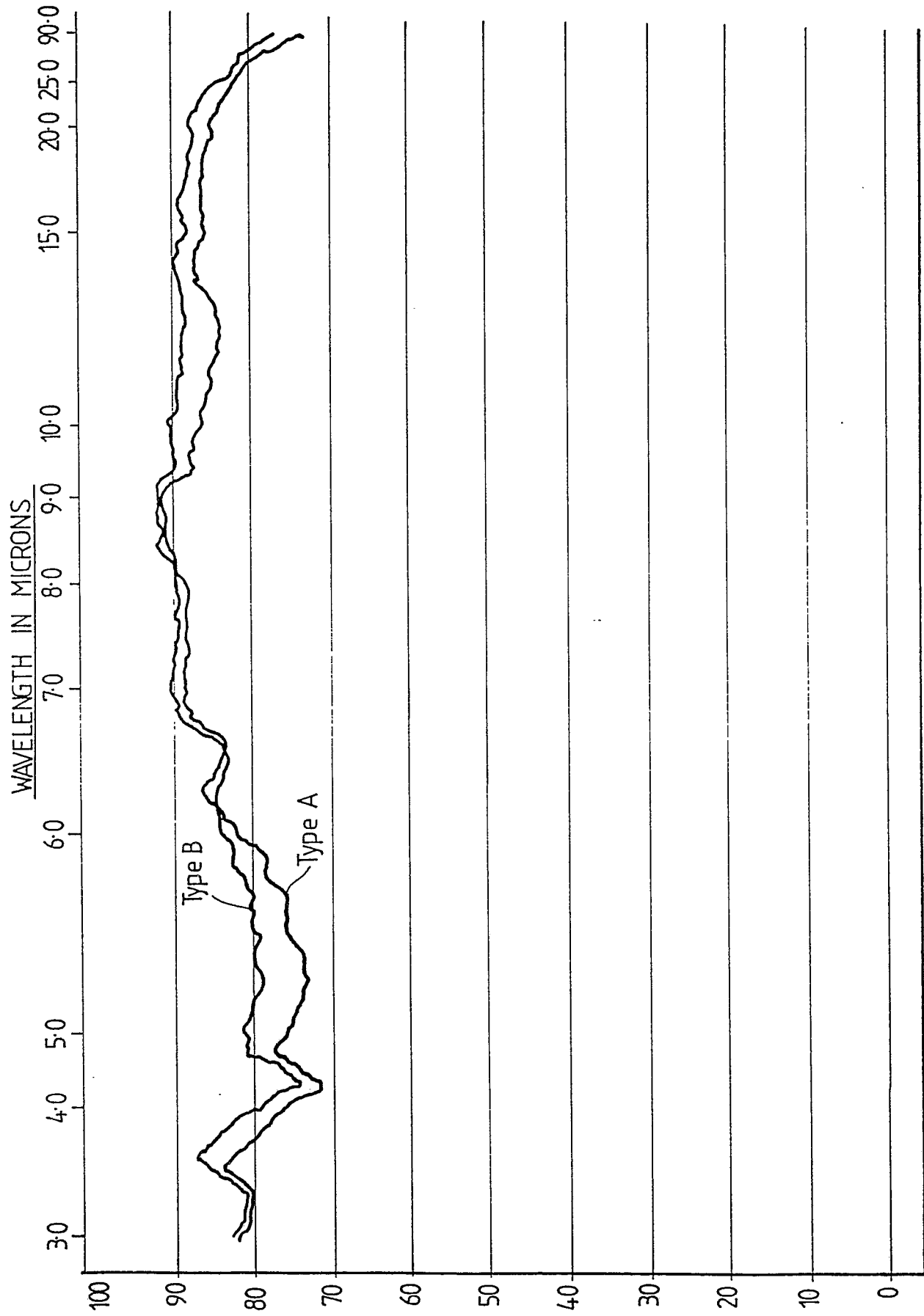


FIG. 4.

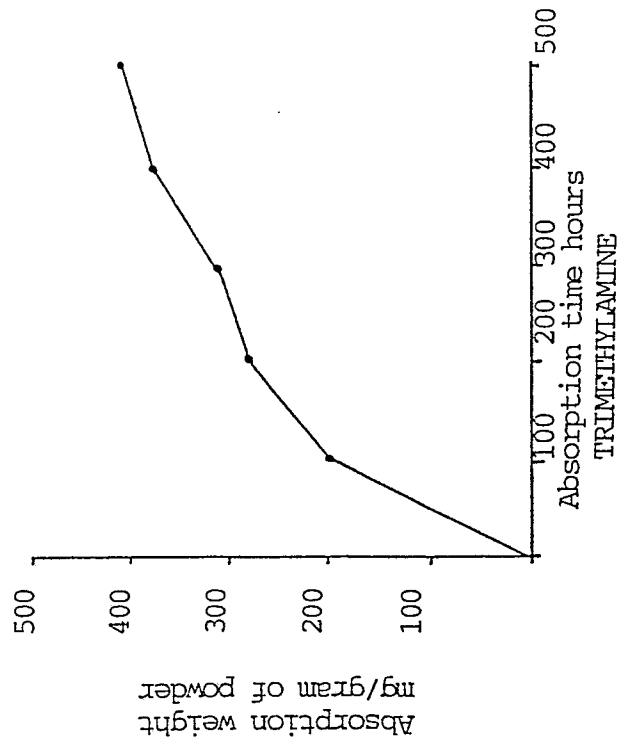
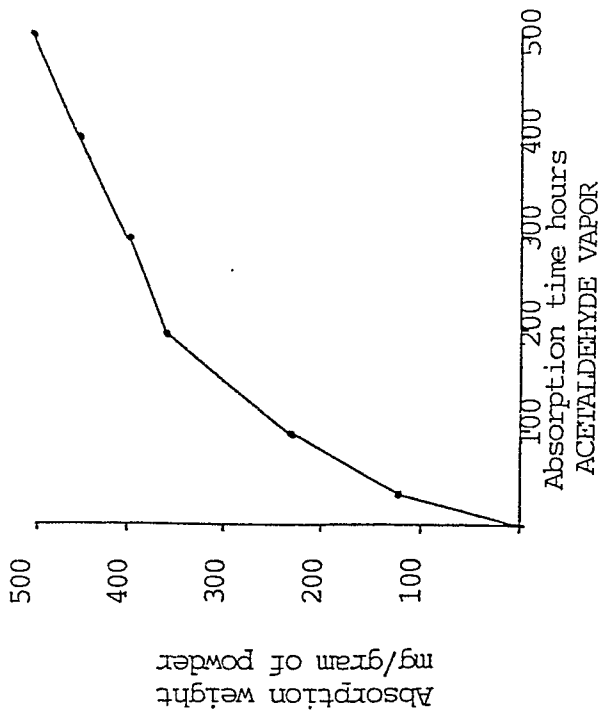
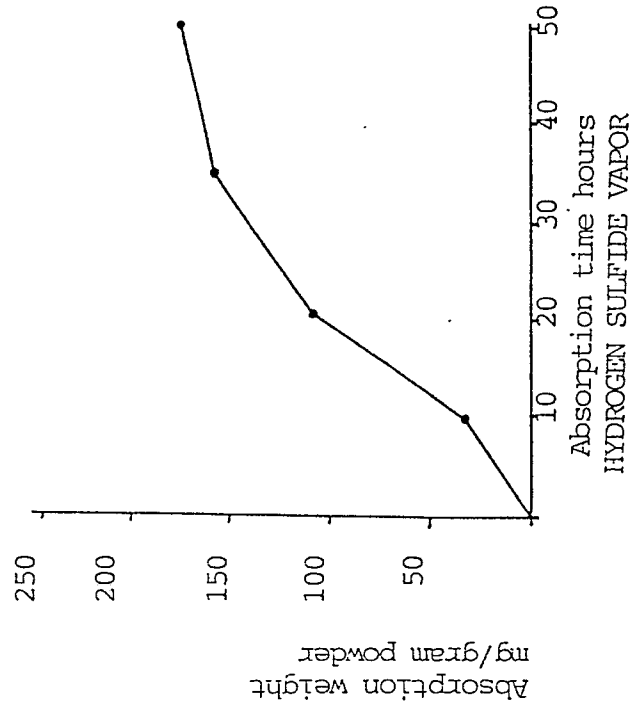
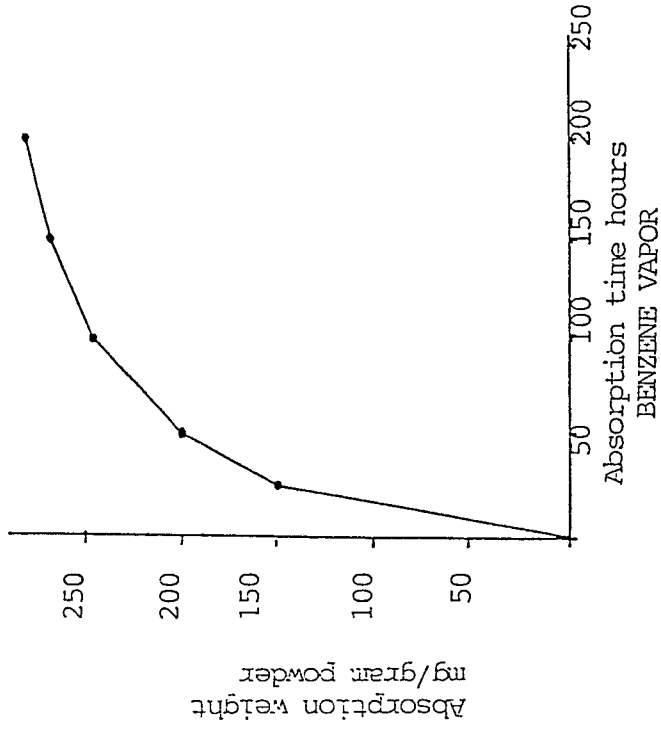


MEASURED SPECTROGRAPHICALLY
@ 100°C

FIG.7

FIG. 8

NOTES:
All
measurements
done by weight
method at 20°C





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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 4)
X,P	CHEMICAL ABSTRACTS, vol. 109, no. 20, 9th June 1988, page 66, abstract no 171883p, Columbus, Ohio, US; T. MASUDA et al.: "Infrared ray-emitting polyethylene films for fruit packagings" * Abstract * ---	1,3,15, 16	B 65 D 81/24 D 21 H 3/78
X,P	CHEMICAL ABSTRACTS, vol. 109, no. 18, 9th June 1988, page 75, abstract no. 151086c, Columbus, Ohio, US; & JP-A-63 137 962 (MITSUI TOATSU CHEMICALS, INC.) 09-06-1988 * Abstract * ---	1,3,15, 16	
A	ABSTRACT BULLETIN OF THE INSTITUTE OF PAPER CHEMISTRY, vol. 55, no. 3, September 1984, abstract no. 3498, Appleton, Wisconsin, US; T. KATSUSHIMA et al.: "Filter paper" ---	2,8,13, 4	
A	ABSTRACT BULLETIN OF THE INSTITUTE OF PAPER CHEMISTRY, vol. 57, no. 6, December 1986, abstract no. 7800, Appleton, Wisconsin, US; S. NAKAMURA: "Paper containing inorganic filter" ---	2,13,16	TECHNICAL FIELDS SEARCHED (Int. Cl.4) B 65 D D 21 H A 23 B
A	US-A-3 422 183 (H.J. ELLISON) * Column 1, lines 31-35,51-70; column 3, lines 47-56; claims 1,9 * -----	1-3,13	
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 08-05-1989	Examiner PERNICE, C.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			