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(54) **Smoking article**

(57) A smoking article (1) comprises a smokable tobacco rod (2), which includes tobacco and a wrapper, and a filter (3) having a first end (4) and a second end (5). The filter (3) comprises a first filter segment (11) extending to the first end (4) of the filter (3) and placed at an end of the tobacco rod (2) and a second filter segment (12) extending to the second end (5) of the filter (3). The first filter segment (11) comprises cut or shredded plant material. The second filter segment (12) comprises a cellulose material as filtering material and has a length in the range of from 3 mm to 12 mm. The filter (3) is biodegradable according to OECD 301 B.

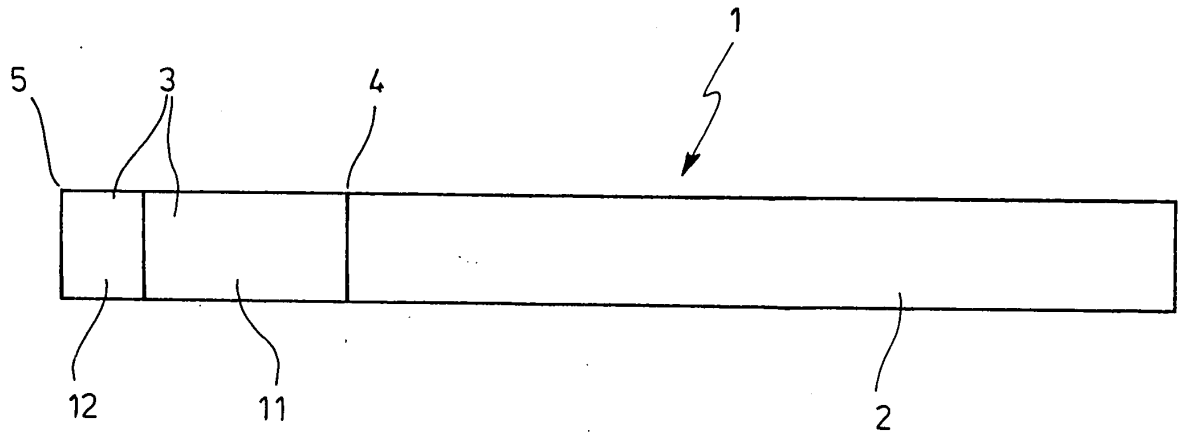

FIG. 1

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Description

[0001] The invention relates to a smoking article with a biodegradable filter.

[0002] Smoking articles, such as cigarettes, usually comprise a smokable tobacco rod wrapped in a wrapper (such as a cigarette paper) and a filter attached to that rod by means of a tipping paper. A perforation of the layers that surround the filter material can be applied to achieve a filter ventilation that dilutes the mainstream smoke with air.

[0003] Filters for smoking articles often consist of two or more segments that are axially aligned to achieve special filter characteristics. Depending on the number of filter segments, such filters are known as dual, triple, etc. filters.

[0004] Cellulose acetate is the most commonly used filter material for smoking articles. However, cellulose acetate has a poor biodegradability either in composting environments or in standardised tests like OECD 301 B. Filter materials with improved biodegradability are also known, such as paper, other nonwoven (e.g. air-laid) cellulose fibres, or regenerated cellulose like lyocell or viscose.

[0005] The problem of the latter filter materials is that they have a much higher filtration efficiency for the particulate matter ("tar") of the mainstream smoke than cellulose acetate. Since the amount of carbon monoxide in the mainstream smoke is not influenced by filtration, the ratio between the yield of carbon monoxide (in mg per smoking article) and the yield of particulate matter (in mg per smoking article) increases with increasing filtration efficiency. Here and in the following, particulate matter is measured as PMWNF ("particulate matter (water and nicotine free)"). As there exist upper limits on the yield of carbon monoxide and the yield of PMWNF in regulations of numerous countries and of the EU, such filter materials restrict PMWNF levels. The use of so-called LIP ("low ignition propensity") papers has further attributed to this situation because these papers tend to increase CO yields at constant PMWNF levels.

[0006] Using tobacco as a filter material is known from prior art, e.g. from FR 1 270 093 or from cigarettes of the brand "Gitanes Mais". Tobacco filters are mainly used to influence the taste of the smoking articles or to achieve a special appearance of the cigarette mouth end that resembles a filter-less cigarette. With the increasing use of filter cigarettes, however, consumers' preference has nowadays switched towards a white colour of the visible filter end.

[0007] WO 02/45531 A1 discloses a smoking product comprising a tobacco filter with a hollow mouthpiece. Optionally, a cellulose-based filter section can be placed between the tobacco rod of the smoking product and the tobacco filter.

[0008] The object of the invention is to provide a smoking article with a biodegradable filter, which has an acceptable white appearance at its mouth-sided end and which provides a filtration efficiency for particulate matter that is low enough to resemble that of the usual cellulose acetate filters.

[0009] This object is achieved by a smoking article having the features of claim 1. Claim 11 relates to a filter tube for the self-production of a smoking article, which results in a smoking article as defined in claim 1. Advantageous versions of the invention follow from the dependent claims.

[0010] The smoking article according to the invention comprises a smokable tobacco rod, which includes tobacco wrapped in a wrapper, and a filter having a first end and a second end. Preferably, the smoking article is a cigarette and the wrapper is a cigarette paper, but other kinds of smoking articles, e.g. a cigarillo, are conceivable as well. The filter comprises a first filter segment extending up to the first end of the filter and placed at an end of the tobacco rod (rod-sided filter segment), as well as a second filter segment extending up to the second end of the filter (mouth-sided filter segment). The first filter segment comprises cut or shredded plant material. The second filter segment comprises a cellulose material as filtering material. A cellulose material in the sense of the invention is a material based on natural cellulose or regenerated cellulose, but not a cellulose derivate like cellulose acetate. The length of the second filter segment is in the range 3 mm to 12 mm. Moreover, the filter of the smoking article according to the invention is biodegradable according to OECD 301 B.

[0011] OECD 301 is an OECD guideline for testing chemicals (adopted by the Council on 17 July 1992) and describes several methods that permit the screening of chemicals for ready biodegradability in an aerobic aqueous medium. One of these methods is referred to as OECD 301 B. In this test, the CO_2 evolution due to a test sample in an aqueous medium under aerobic conditions is measured and related to the theoretical CO_2 production of the test compound assuming full degradation. Roughly, the test will be considered as passed if the ratio of measured CO_2 to theoretical CO_2 increases from 10% to 60% or more within a period of 10 days. For detailed information, see the OECD 301 guideline, which includes the description of OECD 301 B.

[0012] Since the second or mouth-sided filter segment comprises a cellulose material, its appearance is generally white or whitish, similar to the mouth-sided end of an ordinary cigarette with a cellulose acetate filter. This filter segment is rather short so that the generally high filtration efficiency per unit length of cellulose materials does not result in an overall filtration efficiency of the second filter segment which is too high. The first or rod-sided filter segment generally does not add much to the overall filtration efficiency of the filter, but it adds some length to the filter so that the total length of the filter looks familiar to the consumer and facilitates the handling of the filters during production. Moreover, the cut or shredded plant material of the first filter segment may influence the taste of the smoking article.

[0013] Preferably, the filter is a dual filter. That means, it does not comprise further segments in addition to the first filter segment and the second filter segment, wherein each filter segment is considered as having a generally non-

variable constitution along the longitudinal axis of the smoking article.

[0014] Generally, the constitution of each filter segment can be largely homogeneous, i.e. non-variable along the longitudinal axis and across cross-sectional areas.

[0015] Examples for the cellulose material of the second filter element are paper, air-laid cellulose or regenerated cellulose like lyocell or viscose. Mixtures or blends of such materials are also possible. Moreover, the second filter element may contain an admixture of an adsorbent to reduce gas-phase constituents of the main stream smoke, preferably as a constituent of a paper material, e.g. a paper containing activated carbon.

[0016] In advantageous embodiments of the invention, the first or rod-sided filter segment comprises cut tobacco or cut (or shredded) herbs, e.g. mint, eucalyptus, and/or tea. Mixtures or blends of tobacco and cut or shredded herbs (like mint, eucalyptus, and/or tea) are conceivable as well. There are multiple ways of influencing the overall taste of the smoking article by selecting an appropriate plant material, e.g. an appropriate blend, for the first filter segment.

[0017] The first filter segment may have a density in the range of from 0.20 g/cm^3 to 0.35 g/cm^3. This is generally somewhat greater than the density of the tobacco in the tobacco rod of the smoking article. By adjusting the density, the filtration efficiency and the taste provided by the first filter segment can be influenced. Moreover, a denser filter feels harder, more like a usual cellulose acetate filter, and a denser filter is more rigid during the manufacturing process, wherein the tendency of losing plant particles from the end sides of the first filter segment is decreased.

[0018] In accordance with recent regulations, and in particular if the smoking article is a cigarette, the wrapper of the smokingg article can be a cigarette paper, which comprises at least one zone having a permeability less than a basic permeability of the cigarette paper. That means, the original or basic permeability of the cigarette paper is decreased in certain zones, e.g. by applying a coating. The low-permeability zones can be arranged, e.g., in a ring pattern. In this way, a low-ignition propensity ("LIP") of the smoking article is achieved so that the smoking article, preferably, fulfils the requirements of ASTM E2187 and/or EN 16156:2010. Generally, low-ignition propensity smoking articles are well known in the art.

[0019] As already mentioned further above, the CO yield or level of a smoking article is hardly influenced by the filter (except for by ventilation), whereas the PMWNF yield (level) can be controlled via the filter. In the present invention, the latter can be accomplished, e.g., via the density or kind of the cellulose material in the second filter segment or via the length of the second filter segment. If the smoking article has a PMWNF level of more than or equal to 8 mg, the ratio of CO/PMWNF is preferably less than 1.3, when smoked according to ISO conditions. If the smoking article has a PMWNF level of less than 8 mg, the ratio of CO/PMWNF is preferably less than 1.1, when smoked according to ISO conditions. Here, CO/PMWNF is expressed as the total yield of CO in mg per smoking article divided by the total yield of PMWNF in mg per smoking article. The relevant norm is ISO 4387.

[0020] The filter explained so far can also be used with a filter tube for the self-production of a smoking article, which comprises a wrapper adapted to accommodate tobacco. The only difference between a smoking article according to the invention and such smoking article filter tube is that, in the latter, the tobacco is missing in the rod in the state to be marketed, wherein the consumer fills in the tobacco by herself or himself. The filter of the smoking article filter tube can have all the properties of the filter of the smoking article according to the invention.

[0021] A smoking article according to the invention can be manufactured, e.g., in the following way:

[0022] Filter base rods for the second filter segments are manufactured on a standard paper filter maker from a paper web, a plug wrap and glue. As known to a skilled person, the pressure drop and retention of this element can be controlled through the width of the paper web and an optional embossing or crimping of that web. Depending on the intended type of filter ventilation, the plug wrap can either be porous or non-porous.

[0023] Tobacco filter base rods for the first filter segments are manufactured on a standard cigarette maker from a cut or shredded tobacco blend, a wrapper and glue. Such tobacco blends usually comprise cut Virginia, Burley and/or Oriental tobacco leaf. The tobacco blend can further comprise cut tobacco stems. All tobacco materials can be expanded using processes that are familiar to a skilled person. The wrapper can be a porous or non-porous filter plug wrap paper.

[0024] From those filter base rods, a dual filter rod can be manufactured with a standard filter combining machine using a second porous or non-porous wrapper and glue.

[0025] The combustible tobacco rod is produced on a standard filter cigarette maker from tobacco, cigarette paper and glue. The dual filters are attached to that rod by a tipping paper that covers the filter as well as a part of the smokable tobacco rod.

[0026] Thus, in this example, each filter segment comprises a plug wrap, both filter segments are combined by means of an additional wrapper, and the resulting dual filter is attached to the smokable tobacco rod by means of a tipping paper.

[0027] In the following, the invention is further described by means of embodiments. The drawings shows in

Figure 1 a schematic view of an embodiment of the smoking article according to the invention and

Figure 2 a graphical representation of the degradation of cigarette filter segments of paper, tobacco and cellulose acetate as a function of time, when measured as described in OECD 301 B.

[0028] Figure 1 illustrates an embodiment of a smoking article in a schematic view. The smoking article is a cigarette 1 comprising a smokable tobacco rod 2 (tobacco wrapped in a cigarette paper) and a dual filter 3. The dual filter 3 is attached to the smokable tobacco rod 2 by means of a tipping paper (not shown in Figure 1). The dual filter 3 has a first end 4 adjacent to the tobacco rod 2 and a second end 5 as the mouth-sided filter end.

[0029] The dual filter 3 comprises a rod-sided first filter segment 11 and a mouth-sided second filter element 12. The first filter segment 11 contains cut or shredded plant material (in the embodiment tobacco), whereas the second filter segment 12 contains a cellulose material as filtering material (in the embodiment paper). Each filter segment 11, 12 comprises a plug wrap, and both filter segments 11, 12 are combined by means of an additional wrapper (not shown in Figure 1).

[0030] In the embodiment, the dual filter 3 is ventilated by a circumferentially extending row of ventilation holes placed in the area of the first filter segment 11.

[0031] As examples, cigarette samples were produced with the parameters indicated below and listed in Table 1. The columns "Reference" and "Reference II" relate to samples having a conventional filter of cellulose acetate ("Mono-AC") or a paper filter, respectively, for comparison purposes. The remaining four columns ("Tobacco-Paper Filter Samples") relate to samples according to the invention.

[0032] All cigarettes included in Table 1 are standard king size cigarettes with a total length of the filter of 21 mm, a total length of the smokable tobacco rod of 62 mm and a diameter of 7,88 mm. In all cases, the tipping length (length of the tipping paper) is 25 mm. In the tobacco rod, all cigarettes of Table 1 contain a standard American blend with a rod weight of 670 mg. In all ventilated samples, the filter ventilation is positioned 13 mm from the mouth-sided end of the filter. Moreover, all samples contain a LIP cigarette paper with a base porosity of 70 CU (Coresta units). The smoke yields of the cigarettes in Table 1 were tested according to ISO 4387. For the measurements of the pressure drop ("PD"), the ventilation perforations were open; 1 mmWG = 9.8 Pa.

[0033] In the samples according to the invention, the tobacco used for the tobacco filter segment (tobacco filter plug) is a dark air-cured blend containing 60% of expanded stems.

[0034] The last column ("+25% mint") in Table 1 relates to a sample including mint leaf within the tobacco filter segment. In this case, 25% of the lamina part of the tobacco blend in the filters of samples 1 to 3 has been replaced by threshed mint leaf.

[0035] The aim of providing CO/NFDPM ratios of below 1.3 is achieved by all samples according to the invention.

[0036] The biodegradability of the paper filter segment, the tobacco filter segment and the cellulose acetate filter of the samples according to Table 1 was tested according to the OECD 301 B method. The results are shown in Figure 2. The graphical representations display the amount of degradation during progress of time. The degradation is expressed as the ratio of CO_2 production due to the respective test sample to the theoretical CO_2 production of the test sample assuming full degradation, as described in detail in the OECD 301 guideline.

[0037] As is evident from Figure 2, tobacco and paper passed the test whereas cellulose acetate failed.

Table 1 Data of reference cigarettes and of cigarettes according to the invention having a dual filter comprising a tobacco and a paper segment

		Reference	**Reference II**	**Tobacco-Paper Filter Samples**			
		Mono-Ac	**Paper Filter**	**1**	**2**	**3**	**+25% Mint**
Filter Parameters							
Length paper plug	mm	-	21	6	6	6	6
Weight paper plug	mg	-	152	45	40	45	45
PD paper plug	mmWG	-	75	18	15	18	18
Length tobacco plug	mm	-	-	15	15	15	15
Weight tobacco plug	mg	-	-	183	194	183	186
PD tobacco plug	mmWG	-	-	27	34	27	26
Length Mono-Ac filter	mm	21	-	-	-	-	-
PD Mono-Ac filter	mmWG	70	-	-	-	-	-

(continued)

		Reference	Reference II	Tobacco-Paper Filter Samples			
		Mono-Ac	**Paper Filter**	**1**	**2**	**3**	**+25% Mint**
Filter Ventilation	%	43	35	0	29	50	27
Smoke Data							
Puff number		7.9	7.4	7.9	7.9	9.0	8.1
NFDPM (Tar)	mg/Cig	8.7	6.9	11.4	10.2	6.4	8.6
Smoke nicotine	mg/Cig	0.84	0.49	0.84	0.85	0.60	0.75
Carbon monoxide (CO)	mg/Cig	7.8	9.9	14.6	9.2	6.9	10.5
CO/Tar		0.89	1.43	1.28	0.90	1.08	1.22

Claims

1. Smoking article, comprising a smokable tobacco rod (2), which includes tobacco and a wrapper, and a filter (3) having a first end (4) and a second end (5), wherein the filter (3) comprises

- a first filter segment (11) extending to the first end (4) of the filter (3) and placed at an end of the tobacco rod (2), wherein the first filter segment (11) comprises cut or shredded plant material, and
- a second filter segment (12) extending to the second end (5) of the filter, wherein the second filter segment (12) comprises a cellulose material as filtering material and has a length in the range of from 3 mm to 12 mm,
- wherein the filter (3) is bio-degradable according to OECD 301 B.

2. Smoking article according to claim 1, **characterised in that** the filter is a dual filter (3).

3. Smoking article according to claim 1 or 2, **characterised in that** the second filter segment (12) comprises at least one of the cellulose materials selected from the following group: paper, paper containing an adsorbent, paper containing activated carbon, air-laid cellulose, regenerated cellulose, lyocell, viscose.

4. Smoking article according to anyone of claims 1 to 3, **characterised in that** the first filter segment (11) comprises cut tobacco.

5. Smoking article according to anyone of claims 1 to 4, **characterised in that** the first filter segment (11) comprises at least one of the materials selected from the following group: cut or shredded herbs, cut or shredded mint leaves, eucalyptus, tea.

6. Smoking article according to anyone of claims 1 to 5, **characterised in that** the first filter segment (11) has a density in the range of from 0.20 g/cm^3 to 0.35 g/cm^3.

7. Smoking article according to anyone of claims 1 to 6, **characterised in that** the wrapper is a cigarette paper comprising at least one zone having a permeability less than a basic permeability of the cigarette paper and is adapted to provide low-ignition propensity to the smoking article.

8. Smoking article according to claim 7, **characterised in that** the smoking article (1) fulfils the requirements of ASTM E2187 and/or EN 16156:2010.

9. Smoking article according to anyone of claims 1 to 8, **characterised in that** the smoking article (1) has a PMWNF level of more than or equal to 8 mg and a ratio of CO/PMWNF of less than 1.3 when smoked according to ISO conditions.

10. Smoking article according to anyone of claims 1 to 8, **characterised in that** the smoking article (1) has a PMWNF

level of less than 8 mg and a ratio of CO/PMWNF of less than 1.1 when smoked according to ISO conditions.

11. Smoking article filter tube for the self-production of a smoking article according to claim 1, comprising a wrapper adapted to accommodate tobacco to provide a smokable tobacco rod, and a filter having a first end and a second end, wherein the filter comprises

- a first filter segment extending to the first end of the filter and placed at an end of the tobacco rod, wherein the first filter segment comprises cut or shredded plant material, and
- a second filter segment extending to the second end of the filter, wherein the second filter segment comprises a cellulose material as filtering material and has a length in the range of from 3 mm to 12 mm,
- wherein the filter is bio-degradable according to OECD 301 B.

12. Smoking article filter tube according to claim 11, **characterised by** the characterising features of anyone of claims 2 to 7.

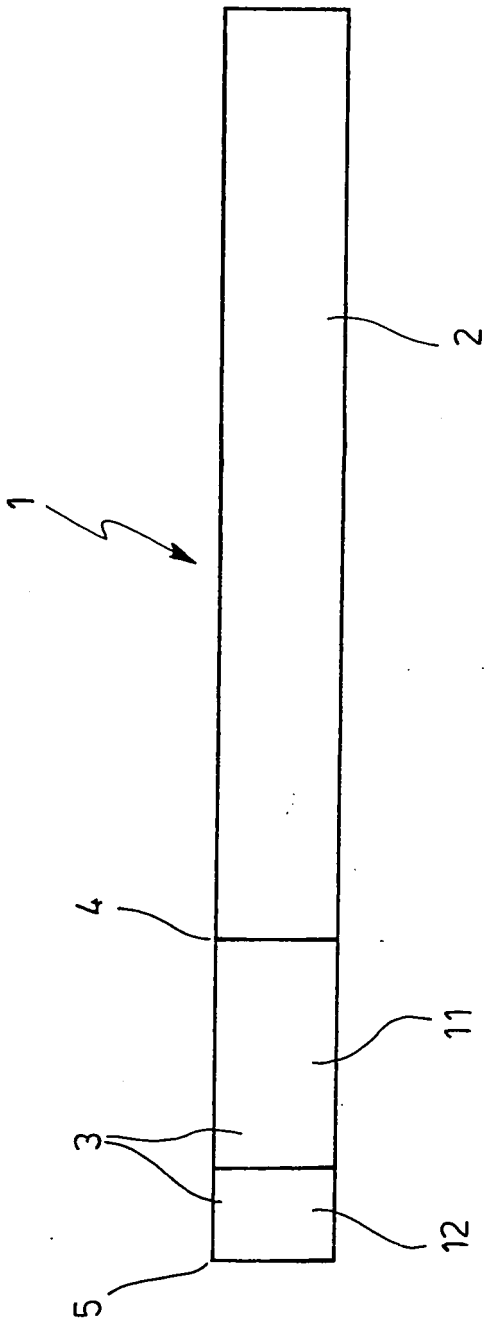

FIG. 1

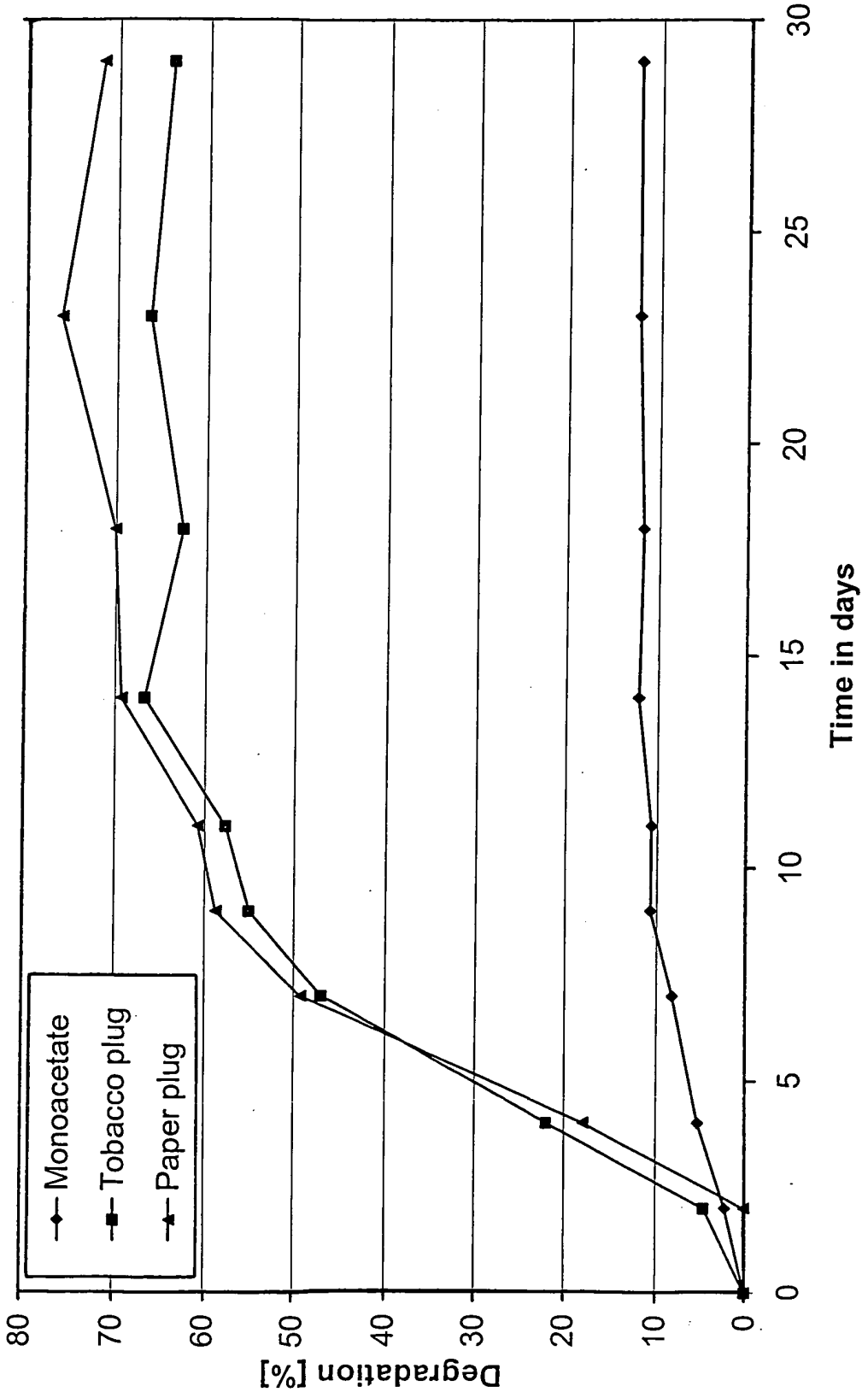
Monoacetate
Tobacco plug
Paper plug
Degradation [%]
0
10
20
30
40
50
60
70
80
Time in days
0
5
10
15
20
25
30

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	7 March 2013	Dimoula, Kerasina

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X : particularly relevant if taken alone
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