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(54) **TOBACCO SMOKE FILTER**

(57) A tobacco smoke filter or filter element comprising: a tobacco smoke filtering material including paper; and a flavour enhancing additive.

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Description

[0001] The present invention relates to tobacco smoke filters (e.g. for cigarettes) and their production.

[0002] Worldwide, cellulose acetate is the dominant material used in tobacco smoke filters. It is also known to use paper as a filtration material in filters, e.g. for cigarettes; paper offers a number of advantages over cellulose acetate in terms of enhanced biodegradability, higher filtration efficiencies at a given pressure drop and lower material cost. Despite these advantages, the use of paper filters is small and generally limited to niche applications. The main reason why paper filters have failed to attract widespread market interest is that they have a deleterious effect on the taste of the cigarette. This so-called 'paper taste' is often considered to impart a harsher, drier sensation to cigarette smoke.

[0003] It would thus be highly desirable to overcome this 'paper taste' and create a smoking sensation from paper-filtered cigarettes that is comparable to that of conventional cellulose acetate filtered cigarettes. In addition, discarded paper butts would degrade much quicker than those of cellulose acetate, resulting in significant environmental improvements. However, any measure to overcome the paper taste must also result in a smoking experience which is comparable to that from a conventional cellulose acetate filtered cigarette. This has not been achieved by previous attempts to overcome 'paper taste' deficiencies (e.g. by adding specific flavouring such as menthol).

[0004] A further limitation with paper filters is their reduced retention of toxic phenolic compounds - for example phenol, cresols, catechol and resorcinol - found in volatile and semi-volatile phases of cigarette smoke, compared to cellulose acetate filters; this results in higher relative yields of phenolic compounds from cigarettes with paper filters. This is caused by the well-known selectivity of cellulose acetate filters towards phenolic compounds rather than any inherent deficiency with paper filters. However, it of course still desirable to enhance phenol retention of paper filters so a smoker would not be exposed to higher levels of phenolic compounds when smoking a paper filtered cigarette compared to a cellulose acetate filtered cigarette.

[0005] It is therefore desirable to provide a filter for a cigarette which has the advantages of a paper filter (biodegradability etc.) without the deleterious paper taste effect and/or with phenolic retention at least similar to that of a cellulose acetate filter.

[0006] According to the present invention in a first aspect there is provided a tobacco smoke filter or filter element comprising: a tobacco smoke filtering material including paper; and a flavour enhancing additive (e.g. selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No.1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database). The filter or filter element may include one or more flavour

enhancing additives.

[0007] Herein, the term "flavour enhancing additive" means an additive which reduces the deleterious "paper taste" effect on the taste of the cigarette and/or reduces smoker perception of a harsher, drier sensation in paper filtered cigarette smoke compared to a known cellulose acetate filtered cigarette. That is, the taste of a paper filtered cigarette containing the flavour enhancing additive should be within the normal cigarette-to-cigarette taste variability associated with commercial brands of cellulose acetate filtered cigarettes. Various attempts have been made to categorise flavouring substances according to their chemical characteristics such that they are distributed in groups of structurally related compounds. To this end, the European Union has compiled a list of 34 chemical groups for flavouring substances - these groups are referenced in Annex 1 of Commission Regulation (EC) No. 1565/2000 and on the EU Flavour Information System ('FLAVIS') database. The present invention uses flavour enhancing additives from Group 11 and/or Group 21 of this list.

[0008] The flavour enhancing additive may be an alicyclic lactone (e.g. an alicyclic lactone having up to 20 carbon atoms, e.g. a C₃-C₂₀ alicyclic lactone); an aromatic lactone (e.g. an aromatic lactone having up to 20 carbon atoms, e.g. a C₆-C₂₀ aromatic lactone); an aromatic ketone (e.g. an aromatic ketone having up to 20 carbon atoms, e.g. a C₆-C₂₀ aromatic ketone), or secondary alcohol or ester thereof. The flavour enhancing additive may be a lactone which is a phthalide, for example an alkylphthalide, for example a (C₁-C₆ branched or straight chain alkyl)-phthalide. The Flavor and Extract Manufacturers Association (FEMA) has compiled a list of materials generally recognised as safe (GRAS) and has assigned numbers (known as FEMA GRAS numbers) to each of these materials. The flavour enhancing additive preferably has a FEMA GRAS number (assigned thereto). The flavour enhancing additive may be a lactone (Group 11) which has a FEMA GRAS number, for example γ -Valerolactone (assigned FEMA GRAS Number FEMA 3103), γ -Hexalactone (FEMA 2556), δ -Hexalactone (FEMA 3167), α -Heptalactone (FEMA 2539), γ -Octalactone (FEMA 2796), δ -Octalactone (FEMA 3214), 4-Hydroxy-3-pentenoic acid lactone (FEMA 3293), 5-Hydroxy-2-decenoic acid δ -lactone (FEMA 3744), 4,4-Dibutyl- γ -butyrolactone (FEMA 2372), Mintlactone (FEMA 3764), Dehydromenthofuro lactone (FEMA 3755), 3-Butylidenephthalide (FEMA 3333), 3-n-Butylphthalide (FEMA 3334) and Whiskey lactone (FEMA 3803). The flavour enhancing additive may also be sedanenolide. The flavour enhancing additive may be included as part of a mixture (e.g. as part of an unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive, for example an essential oil which includes the flavour enhancing additive. The mixture (e.g. the unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive may include one or more

flavour enhancing additives. For example, the flavour enhancing additive (or additives) may be included in the form of celery seed oil (e.g. essential oil of seed of celery). Essential oil of seed of celery includes sedanenolide and 3-butylphthalide. Celery seed oil is known as a flavourant for cigarettes, but the use of celery seed oil with paper-filtered cigarettes has not previously been suggested. Preferably the mixture (e.g. the unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive has a FEMA GRAS number, for example Massoia bark oil (FEMA 3747).

[0009] Preferably the flavour enhancing additive is present in the filter or filter element in an amount which is up to 1% by weight (w/w) of the paper in the filter or filter element.

[0010] The tobacco smoke filter or filter element according to the invention may be of circumference 14 to 28 mm, for example 16 to 26 mm, for example 16 to 17 mm or 24 to 25 mm. A tobacco smoke filter of the invention may be of length 10 to 40 mm, e.g. 15 to 35 mm, e.g. 20 to 30 mm. A tobacco smoke filter element of the invention may be of length 5 to 30mm, e.g. 6 to 20mm, e.g. 8 to 15 mm, e.g. 10 to 12 mm.

[0011] The paper may be any paper (in any form) which is conventionally used in filters or filter elements. The paper may be, for example, filtering paper, aperture paper, crepe paper etc.. The paper may be in the form of a web of paper, e.g. gathered laterally into, and held, in rod form. The fibre of the paper web may be 100% natural fibre (e.g. wood pulp), 100% synthetic fibre, or mixtures of the two (for aperture paper, the paper is preferably 100% natural fibre). When the paper web comprises synthetic fibre, bonding agents (e.g. plasticisers) may be included to increase the hardness of the finished filter or filter element (rod). The paper may be in the form of a longitudinally corrugated and/or fibrillated web of paper, for example gathered laterally into, and held, in rod form, for example as disclosed in GB2075328. The filter or filter element may be (or include) a rod (e.g. cylindrical rod) of filtering material, including (e.g. formed from) the paper (e.g. the web of paper). The filter or filter element may include a tobacco smoke filtering material which includes paper and one or more further filtering materials. The filter or filtering element may include a tobacco smoke filtering material in the form of a coherent web comprising (e.g. formed from materials including) paper and a second filter material and, optionally, one or more further filter materials. The filter or filter element may be (or include) a rod including (e.g. formed from) the coherent web. The second and any further filtering materials may be, for example, cellulose acetate tow, a (further) paper (e.g. different to the other paper in the filter or filter element), a non-woven web made from natural and/or synthetic fibres, other fibre tow, for example polypropylene etc..

[0012] In one example of the invention, the tobacco smoke filter (or filter element) comprising a tobacco

smoke filtering material including paper is of the same or similar structure to that of the filter sold under the trade mark MYRIA (of Filtrona International Limited), and further includes the flavour enhancing additive. In another example, the tobacco smoke filter (or filter element) comprising a tobacco smoke filtering material including paper is of the same or similar structure to that of the filter sold under the trade mark PURACEL (of Filtrona International Limited), and further includes the flavour enhancing additive. In another example, the tobacco smoke filter (or filter element) comprising a tobacco smoke filtering material including paper is of the same or similar structure to that of the filter sold under the trade mark CREST (of Filtrona International Limited), and further includes the flavour enhancing additive.

[0013] The filter or filter element (rod) may be over-wrapped with a wrapper, for example a wrapper of an air-permeable paper. Filters or filter elements according to the invention can be wrapped in the standard range of plugwraps and can be ventilated in any conventional manner.

[0014] The flavour enhancing additive may be located on or in the filter or filter element (e.g. located on or impregnated in the paper and/or the wrapper if present, and/or the second or further filtering material, if present). If more than one flavour enhancing additive is present, the additives may be present in the same location (e.g. both/all in the paper) or in different locations (one flavour enhancing additive on the paper, one on the further filtering material etc).

[0015] The applicants have surprisingly found that inclusion of a flavour enhancing additive or additives as defined above [for example as essential oil of seed of celery (celery seed oil)] in a filter or filter element [or in a cigarette with a paper filter, as described below] may overcome the 'paper taste' sensation and provide a cigarette with sensory characteristics similar to those from cellulose acetate filtered cigarettes.

[0016] The filter or filter element may further comprise a further additive which selectively reduces one or more phenolic compounds found in the volatile and/or semi-volatile phases of cigarette smoke. Herein, the term "further additive which selectively reduces one or more phenolic compounds found in the volatile and/or semi-volatile phases of cigarette smoke" means an additive which proportionally reduces the yield of one or more phenolic compounds (for example, proportionally reduces one or more of phenol, cresol, catechol or resorcinol) in cigarette smoke to a greater extent than the majority of compounds in smoke (e.g. tar). The filter or filter element may include more than one further additive which selectively reduces one or more phenolic compounds found in the volatile and/or semi-volatile phases of cigarette smoke.

[0017] Preferably the further additive which selectively reduces one or more phenolic compounds found in the volatile and/or semi-volatile phases of cigarette smoke is a polyethylene glycol (e.g. PEG200, PEG300, PEG400) or a methoxypolyethylene glycol (e.g.

mPEG350). Preferably the further additive which selectively reduces one or more phenolic compounds found in the volatile and/or semi-volatile phases of cigarette smoke is present in the filter or filter element in an amount which is up to 20% by weight (w/w) of the paper in the filter or filter element. For example, the further additive which selectively reduces one or more phenolic compounds may be present in an amount which is from 1 to 19% by weight (e.g. from 5 to 17% by weight) of the paper in the filter or filter element. If there is more than one further additive (which selectively reduce one or more phenolic compounds found in the volatile and/or semi-volatile phases of cigarette smoke) present in the filter or filter element, it is preferred that the total amount of further additives (which selectively reduce one or more phenolic compounds) is up to 20% by weight (w/w) of the paper in the filter or filter element.

[0018] The further additive which selectively reduces one or more phenolic compounds may be located on or in the filter or filter element (e.g. located on or impregnated in the paper and/or the wrapper, and/or the second or further filtering material, if present). If more than one further additive is present, the additives may be present in the same location (e.g. both/all in the paper) or in different locations (one additive on the paper, one on the further filtering material etc).

[0019] The applicants have found that polyethylene glycols (e.g. PEG200, PEG300 and PEG400) and methoxy-polyethylene glycols (e.g. mPEG 350) are amongst the most effective additives for selectively reducing phenols in tobacco smoke. Surprisingly, the applicants also found that their use in conjunction with a filter or filter element which contains paper, and a flavour enhancing additive or additives as discussed herein, may provide a filter cigarette which has a yield of phenolic compounds which is comparable to that from a conventional cellulose acetate filtered cigarette (i.e. more selective filtration than a conventional paper filter cigarette), and the desirable reduction in paper taste.

[0020] A filter element according to the invention may be used as a segment of a dual, triple, or other multi component (multiple segment), filter. Dual and other multi component filters are known in the art.

[0021] In an example, a dual, triple, or other multi component, filter includes a granular additive(s) such as activated carbon, silica gels, zeolites, ion exchange resins or sepiolite. It is preferred that the granular additive is not included in the filter element of the invention (i.e. is included in one of the other segments of the multi component filter). In an example the filter element of the invention forms the mouth end segment of a dual segment filter, while tobacco end segment of the dual filter includes a granular additive.

[0022] Filters according to the invention may be used in machine made cigarettes (e.g. those mass produced and packaged). Filters according to the invention may also be used as a filter tip for use with a individually rolled cigarette (e.g. a hand rolled cigarette) or a Roll Your Own

or Make-your-own product.

[0023] In a filter cigarette according to the invention, a filter of the invention (or a filter which includes a filter element of the invention) is joined to a wrapped tobacco rod with one end towards the tobacco. The filter may, for example, be joined to the wrapped tobacco rod by ring tipping (which engages around just the adjacent ends of a [wrapped] filter and rod to leave much of the filter wrapper exposed) or by a full tipping overwrap (which engages around the full filter length and adjacent end of the tobacco rod). Any filter or filter cigarette according to the invention may be unventilated, or may be ventilated by methods well known in the art, e.g. by use of a pre-perforated or air-permeable plugwrap, and/or laser perforation of plugwrap and tipping overwrap. The final filter cigarette may be of any circumference range traditionally used in smoking products (e.g. c. 14 to c. 28 mm circumference).

[0024] The present invention also provides a filter cigarette which includes a tobacco smoke filter or filter element of the invention, as disclosed above.

[0025] The filters or filter elements according to the invention may be made as continuous rods, as is well known in the art. The continuous rod as it issues continuously from the production machine outlet is cut into finite lengths for subsequent use. This cutting may be into individual filters or filter elements as defined and described above, each of which is then attached to an individual wrapped tobacco rod to form a filter cigarette. More usually, however the continuously issuing rod is first cut into double or higher multiple (usually quadruple or sextuple) lengths for subsequent use; when the initial cut is into quadruple or higher lengths, then the latter are subsequently cut into double lengths for the filter cigarette assembly - in which the double length filter rod is assembled and joined (by ring tipping or full tipping overwrap) between a pair of wrapped tobacco rods with the combination then being severed centrally to give two individual filter cigarettes. The invention includes (e.g. double and higher) multiple length filter rods (and/ or filter element rods), including a plurality of filter rods (filter element rods), e.g. joined end to end.

[0026] The filter or filter element may include a further flavouring agent (in addition to the flavour enhancing additive(s) selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No. 1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database), for example menthol.

[0027] According to the present invention in a further aspect, there is provided a filter cigarette comprising: a filter or filter element which includes paper; and a wrapped tobacco rod; wherein the filter cigarette further comprises a flavour enhancing additive (e.g. selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No. 1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database). The filter cig-

arette may include one or more flavour enhancing additives.

[0028] The flavour enhancing additive may be an alicyclic lactone (e.g. an alicyclic lactone having up to 20 carbon atoms, e.g. a C₃-C₂₀ alicyclic lactone); an aromatic lactone (e.g. an aromatic lactone having up to 20 carbon atoms, e.g. a C₆-C₂₀ aromatic lactone); an aromatic ketone (e.g. an aromatic ketone having up to 20 carbon atoms, e.g. a C₆-C₂₀ aromatic ketone), or secondary alcohol or ester thereof. The flavour enhancing additive may be a lactone which is a phthalide, for example an alkylphthalide, for example a (C₁-C₆ branched or straight chain alkyl)-phthalide. The flavour enhancing additive may be a lactone (Group 11) which has a FEMA GRAS number, for example γ -Valerolactone (assigned FEMA GRAS Number FEMA 3103), γ -Hexalactone (FEMA 2556), δ -Hexalactone (FEMA 3167), γ -Heptalactone (FEMA 2539), α -Octalactone (FEMA 2796), δ -Octalactone (FEMA 3214), 4-Hydroxy-3-pentenoic acid lactone (FEMA 3293), 5-Hydroxy-2-decenoic acid δ -lactone (FEMA 3744), 4,4-Dibutyl- γ -butyrolactone (FEMA 2372), Mintlactone (FEMA 3764), Dehydromenthofurolactone (FEMA 3755), 3-Butylidenephthalide (FEMA 3333), 3-n-Butylphthalide (FEMA 3334) and Whiskey lactone (FEMA 3803). The flavour enhancing additive may also be sedanenolide. The flavour enhancing additive may be included as part of a mixture (e.g. as part of an unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive, for example an essential oil which includes the flavour enhancing additive. The mixture (e.g. the unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive may include one or more flavour enhancing additives. For example, the flavour enhancing additive (or additives) may be included in the form of celery seed oil (e.g. essential oil of seed of celery). Essential oil of seed of celery includes sedanenolide and 3-butylphthalide. Preferably the mixture (e.g. the unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive has a FEMA GRAS number, for example Masoia bark oil (FEMA 3747).

[0029] The flavour enhancing additive may be located on or in the filter or filter element [e.g. located on or impregnated in the paper and/or the filter wrapper if present, and/or the second or further filtering material, if present], and/or located on or in the tobacco, and/or on or in the wrapper of the wrapped tobacco rod. If more than one flavour enhancing additive is present, the additives may be present in the same location (e.g. both/all in the paper) or in different locations (one flavour enhancing additive on the paper, one on the further filtering material, tobacco etc).

[0030] The filter cigarette may further comprise a further additive which selectively reduces one or more phenolic compounds found in the volatile and/or semi-volatile phases of cigarette smoke, as defined above and disclosed herein. The further additive which selectively re-

duces one or more phenolic compounds may be located on or in the filter or filter element [e.g. located on or impregnated in the paper and/or the filter wrapper if present, and/or the second or further filtering material, if present], and/or located on or in the tobacco, and/or on or in the wrapper of the wrapped tobacco rod.

[0031] According to the present invention in a further aspect there is provided the use of a flavour enhancing additive selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No. 1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database in, or in the manufacture of, a filter, filter element, or filter cigarette. The filter, filter element or filter cigarette may include paper (e.g. may include a tobacco smoke filtering material which includes paper). The filter which includes paper may be, for example, a filter having the same or a similar structure to that of filters sold under the trade mark MYRIA, or filters sold under the trade mark PURACEL, or filters sold under the trade mark CREST. The use according to this aspect of the invention of a flavour enhancing additive or additives as defined above and herein [for example as essential oil of seed of celery (celery seed oil)] in, or in the manufacture of, a filter or filter element which includes paper [or in a cigarette with a paper filter, as described herein] may overcome the 'paper taste' sensation (e.g. as demonstrated by paired sensory comparison tests, as are well known in the art) and/or may provide a cigarette with sensory characteristics similar to those from cellulose acetate filtered cigarettes (e.g. as demonstrated by paired sensory comparison tests, as are well known in the art).

[0032] The flavour enhancing additive may be an alicyclic lactone (e.g. an alicyclic lactone having up to 20 carbon atoms, e.g. a C₃-C₂₀ alicyclic lactone); an aromatic lactone (e.g. an aromatic lactone having up to 20 carbon atoms, e.g. a C₆-C₂₀ aromatic lactone); an aromatic ketone (e.g. an aromatic ketone having up to 20 carbon atoms, e.g. a C₆-C₂₀ aromatic ketone), or secondary alcohol or ester thereof. The flavour enhancing additive may be a lactone which is a phthalide, for example an alkylphthalide, for example a (C₁-C₆ branched or straight chain alkyl)-phthalide. The flavour enhancing additive may be a lactone (Group 11) which has a FEMA GRAS number, for example α -Valerolactone (assigned FEMA GRAS Number FEMA 3103), γ -Hexalactone (FEMA 2556), δ -Hexalactone (FEMA 3167), α -Heptalactone (FEMA 2539), γ -Octalactone (FEMA 2796), δ -Octalactone (FEMA 3214), 4-Hydroxy-3-pentenoic acid lactone (FEMA 3293), 5-Hydroxy-2-decenoic acid δ -lactone (FEMA 3744), 4,4-Dibutyl- γ -butyrolactone (FEMA 2372), Mintlactone (FEMA 3764), Dehydromenthofurolactone (FEMA 3755), 3-Butylidenephthalide (FEMA 3333), 3-n-Butylphthalide (FEMA 3334) and Whiskey lactone (FEMA 3803). The flavour enhancing additive may also be sedanenolide. The flavour enhancing additive may be included as part of a mixture (e.g. as part of an unresolved mixture such as a plant extract or plant oil or seed or nut

oil) which includes the flavour enhancing additive, for example an essential oil which includes the flavour enhancing additive. The mixture (e.g. the unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive may include one or more flavour enhancing additives. For example, the flavour enhancing additive (or additives) may be included in the form of celery seed oil (e.g. essential oil of seed of celery). Essential oil of seed of celery includes sedanolide and 3-butylphthalide. Preferably the mixture (e.g. the unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive has a FEMA GRAS number, for example Mas-soia bark oil (FEMA 3747).

[0033] The applicants have also surprisingly found that a flavour enhancing additive (or additives) selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No.1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database may provide improved taste when used in (or with) smoking articles that heat, rather than burn, tobacco.

[0034] Numerous smoking articles that heat rather than burn tobacco are known. Although such smoking articles generally feature a cellulose acetate filter, they tend to provide a poorer taste in comparison to conventional cigarettes with cellulose acetate filters. The applicants have surprisingly found that inclusion of the specific defined additives in the cellulose acetate filters used in smoking articles that heat rather than burn tobacco results in improved sensory characteristics for these smoking articles.

[0035] According to the present invention in a further aspect there is provided a filter or filter element (e.g. for a smoking article which heats tobacco), comprising: a tobacco smoke filtering material; and a flavour enhancing additive selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No.1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database. Herein, the term "a smoking article which heats tobacco" excludes smoking articles such as cigarettes and cigars, the use of which involves burning of the tobacco.

[0036] According to the invention in a still further aspect there is provided the use of a flavour enhancing additive selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No.1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database in, or in the manufacture of, a filter or filter element for a smoking article which heats tobacco, or in, or in the manufacture of, a smoking article which heats tobacco.

[0037] The flavour enhancing additive may be an alicyclic lactone (e.g. an alicyclic lactone having up to 20 carbon atoms, e.g. a C₃-C₂₀ alicyclic lactone); an aromatic lactone (e.g. an aromatic lactone having up to 20 carbon atoms, e.g. a C₆-C₂₀ aromatic lactone); an aro-

matic ketone (e.g. an aromatic ketone having up to 20 carbon atoms, e.g. a C₆-C₂₀ aromatic ketone), or secondary alcohol or ester thereof. The flavour enhancing additive may be a lactone which is a phthalide, for example an alkylphthalide, for example a (C₁-C₆ branched or straight chain alkyl)-phthalide. The flavour enhancing additive may be a lactone (Group 11) which has a FEMA GRAS number, for example γ -Valerolactone (assigned FEMA GRAS Number FEMA 3103), γ -Hexalactone (FEMA 2556), δ -Hexalactone (FEMA 3167), γ -Heptalactone (FEMA 2539), α -Octalactone (FEMA 2796), δ -Octalactone (FEMA 3214), 4-Hydroxy-3-pentenoic acid lactone (FEMA 3293), 5-Hydroxy-2-decenoic acid δ -lactone (FEMA 3744), 4,4-Dibutyl- γ -butyrolactone (FEMA 2372), Mintlactone (FEMA 3764), Dehydromenthofuro-lactone (FEMA 3755), 3-Butylidenephthalide (FEMA 3333), 3-n-Butylphthalide (FEMA 3334) and Whiskey lactone (FEMA 3803). The flavour enhancing additive may also be sedanolide. The flavour enhancing additive may be included as part of a mixture (e.g. as part of an unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive, for example an essential oil which includes the flavour enhancing additive. The mixture (e.g. the unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive may include one or more flavour enhancing additives. For example, the flavour enhancing additive (or additives) may be included in the form of celery seed oil (e.g. essential oil of seed of celery). Essential oil of seed of celery includes sedanolide and 3-butylphthalide. Preferably the mixture (e.g. the unresolved mixture such as a plant extract or plant oil or seed or nut oil) which includes the flavour enhancing additive has a FEMA GRAS number, for example Mas-soia bark oil (FEMA 3747).

The present invention will now be illustrated with reference to the following Examples.

EXAMPLE 1

[0038] Sample paper filters were made from a cylindrical rod (of length 15 mm and circumference 24.50 mm) of paper formed from a non-aperture porous web of 100% wood pulp fibre according to the method set out in GB2075328A.

[0039] The paper is formed on an inclined wire machine from fibres 2.5 to 6mm in length and has a finished substance (before corrugation) of 15 to 35 grammes per square metre (by the method set out in GB2075328). A flavour solution including a first, flavour enhancing, additive in the form of essential celery seed oil [an unresolved mixture of compounds which includes the flavour enhancing additives sedanolide and 3-butylphthalide], is applied to the continuously advancing finished paper (before corrugation) by conventional methods for applying flavouring to paper (e.g. printing wheel etc.). A further additive in the form of polyethylene glycol is applied to the paper, also by methods well known in the art. The

longitudinally advancing finished web of paper (to which the additives have been applied) is then longitudinally advanced between cooperating rolls having circumferentially-extending corrugations, and thereafter continuously gathered (while longitudinally advancing as a paper web) laterally into rod form. The resulting continuously produced rod is continuously cut transversely into finite lengths to give the product filter or filter rod, by methods which are also known in the art.

[0040] Sample cigarettes were assembled using the sample filters made as set out above. The yield of phenol, o-, m- and p-cresol (collectively termed the mono-hydroxyphenols) were then measured for all samples under ISO smoking conditions. The tar yields from the sample cigarettes were also measured in order that the ratios of phenols to tar could be assessed. The yields were compared with a control cigarette (of equal dimensions but containing a conventional cellulose acetate filter), also smoked under ISO smoking conditions.

[0041] It was found that sample filters according to the invention which include a paper filter selectively reduce phenols; the exposure of the phenol compounds mentioned above was found to be comparable with a cellulose acetate filter cigarette.

EXAMPLE 2

[0042] Taste testing (using methods well known in the art) demonstrated that the deleterious "paper taste" effect on the taste of the cigarette was reduced and even eliminated by the inclusion of a flavour enhancing additive according to one aspect of the invention.

[0043] Sensory testing was carried out by a panel of trained, expert smokers. Samples of a leading brand of commercial cigarettes were purchased in one lot from a retail outlet. The brand in question has a one piece cellulose acetate ('monoacetate') filter and these provided the 'control' cigarettes ('C') for the following.

[0044] The filters were removed from a first group of the cigarettes and replaced with machine-made paper filters of equivalent tar retention. These filters are referred to as unmodified paper-filtered cigarettes ('P'), below.

[0045] The filters were also removed from a second group of the cigarettes and replaced with machine-made paper filters of equivalent tar retention (as with the P group). A metered quantity of a flavour solution including a flavour enhancing additive (e.g including a flavour enhancing additive in the form of essential celery seed oil) was injected into each paper filter and the cigarettes allowed to age for around 3-4 weeks. These filters are referred to as modified paper-filtered cigarettes ('P+'), below.

[0046] Paired sensory comparison tests (known in the art) were then carried out by the panel. The panel compared unmodified paper-filtered cigarettes ('P') with the monoacetate control ('C'); and the modified paper filters ('P+') versus 'C'.

[0047] The panellists considered 'P' to be drier with

less tobacco and overall flavour than 'C'. This was expected. However, the panellists considered that the characteristics of the 'P+' filters (including flavour enhancing additive according to one aspect of the invention) fell within normal pack-to-pack variation of 'C' cigarettes; in other words, the "paper taste" effect on the taste of the cigarette was greatly reduced.

EXAMPLE 3

[0048] Smoking articles which heat, rather than burn, tobacco were tested. A metered quantity of a flavour solution including a flavour enhancing additive (e.g including a flavour enhancing additive in the form of essential celery seed oil) was injected into the cellulose acetate filter of a smoking article that heats, rather than burns, tobacco. A panel of smokers indicated that this resulted in superior sensory characteristics compared to an unmodified version of the same product.

Claims

1. A tobacco smoke filter or filter element comprising:
a tobacco smoke filtering material including paper; and a flavour enhancing additive selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No.1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database.
2. A tobacco smoke filter or filter element according to claim 1 wherein the flavour enhancing additive is an alicyclic lactone, an aromatic lactone, an aromatic ketone, or secondary alcohol or ester thereof.
3. A tobacco smoke filter or filter element according to claim 1 or claim 2 wherein the flavour enhancing additive is a phthalide.
4. A tobacco smoke filter or filter element according to any preceding claim wherein the flavour enhancing additive is γ -Vaterolactone, γ -Hexalactone, δ -Hexalactone, γ -Heptalactone, γ -Octalactone, δ -Octalactone, 4-Hydroxy-3-pentenoic acid lactone, 5-Hydroxy-2-decenoic acid δ -lactone, 4,4-Dibutyl- γ -butyrolactone, Mintlactone, Dehydromenthofurolactone, 3-Butylidenephthalide, 3-n-Butylphthalide, Whiskey lactone or sedanenolide.
5. A tobacco smoke filter or filter element according to any preceding claim wherein the flavour enhancing additive is included in the form of an unresolved mixture of compounds which includes the flavour enhancing additive.
6. A tobacco smoke filter or filter element according to

- claim 5 wherein the unresolved mixture of compounds which includes the flavour enhancing additive is an essential oil.
7. A tobacco smoke filter or filter element according to any of claims 5 or 6 wherein the unresolved mixture of compounds which includes the flavour enhancing additive is essential oil of seed of celery or Massoia bark oil. 5
 8. A tobacco smoke filter or filter element according to any preceding claim wherein the paper is filtering paper, aperture paper or crepe paper.
 9. A tobacco smoke filter or filter element according to any preceding claim wherein the paper is a web of paper which has been gathered laterally into, and held, in rod form. 15
 10. A tobacco smoke filter or filter element according to any preceding claim wherein the tobacco smoke filtering material is a cylindrical rod of filtering material. 20
 11. A tobacco smoke filter or filter element according to any preceding claim wherein the tobacco smoke filtering material includes paper and one or more further filtering materials. 25
 12. A tobacco smoke filter or filter element according to any preceding claim further comprising a further additive which selectively reduces one or more phenolic compounds found in the volatile and/or semi-volatile phases of cigarette smoke. 30
 13. A tobacco smoke filter or filter element according to claim 12 wherein the further additive is a polyethylene glycol or a methoxypolyethylene glycol. 35
 14. A tobacco smoke filter or filter element according to claim 12 or 13 wherein the further additive is present in an amount which is up to 20% by weight (w/w) of the paper in the filter or filter element. 40
 15. A tobacco smoke filter or filter element according to any preceding claim over wrapped with a wrapper. 45
 16. A tobacco smoke filter or filter element substantially as hereinbefore described with reference to the Examples. 50
 17. A filter cigarette comprising a filter according to any preceding claim, or a filter which includes a filter element according to any preceding claim, joined to a wrapped tobacco rod. 55
 18. A multiple length filter rod comprising a plurality of filter or filter elements according to any of claims 1 to 16, e.g. joined together end to end.
 19. A filter cigarette comprising: a filter or filter element which includes paper; and a wrapped tobacco rod; wherein the filter cigarette further comprises a flavour enhancing additive selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No.1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database.
 20. The use of a flavour enhancing additive selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No. 1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database in, or in the manufacture of, a filter or filter cigarette.
 21. A filter or filter element comprising: a tobacco smoke filtering material; and a flavour enhancing additive selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No. 1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database.
 22. A filter or filter element according to claim 21 for a smoking article which heats tobacco.
 23. A filter or filter element according to claim 21 or 22 wherein the flavour enhancing additive is an alicyclic lactone, an aromatic lactone, an aromatic ketone, or secondary alcohol or ester thereof.
 24. A filter or filter element according to claim 21, 22 or 23 wherein the flavour enhancing additive is a phthalide.
 25. A tobacco smoke filter or filter element according to any of claims 21 to 24 wherein the flavour enhancing additive is γ -Valerolactone, γ -Hexalactone, δ -Hexalactone, γ -Heptalactone, γ -Octalactone, δ -Octalactone, 4-Hydroxy-3-pentenoic acid lactone, 5-Hydroxy-2-decenoic acid δ -lactone, 4,4-Dibutyl- γ -butyrolactone, Mintlactone, Dehydromenthofurolactone, 3-Butylidenephthalide, 3-n-Butylphthalide, Whiskey lactone or sedanolide.
 26. The use of a flavour enhancing additive selected from Group 11 or Group 21 of the European Union Chemical Groupings List set out in Annexe 1 of Commission Regulation (EC) No. 1565/2000 and/or on the EU Flavour Information System ("FLAVIS") database in, or in the manufacture of, a filter or filter element for a smoking article which heats tobacco, or in, or in the manufacture of, a smoking article which heats tobacco.



EUROPEAN SEARCH REPORT

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