



US 20250017263A1

(19) **United States**

(12) **Patent Application Publication**
QOLBI et al.

(10) **Pub. No.: US 2025/0017263 A1**

(43) **Pub. Date: Jan. 16, 2025**

(54) **PAPER FILTER**

Publication Classification

(71) Applicant: **FILTRONA PTE. LTD.**, Singapore (SG)

(51) **Int. Cl.**
A24D 3/06 (2006.01)
A24D 3/04 (2006.01)
A24D 3/10 (2006.01)

(72) Inventors: **Rosi Ana QOLBI**, Sidoarjo (ID); **Arief RAHMAN**, Sidoarjo (ID); **Ilham Fadila RAMADHAN**, Sidoarjo (ID); **Ian ANINDYA**, Sidoarjo (ID); **Agus FAHRONI**, Sidoarjo (ID); **Giyanto -**, Sidoarjo (ID)

(52) **U.S. Cl.**
CPC *A24D 3/068* (2013.01); *A24D 3/04* (2013.01); *A24D 3/10* (2013.01)

(21) Appl. No.: **18/712,862**

(22) PCT Filed: **Nov. 23, 2022**

(86) PCT No.: **PCT/EP2022/082959**

§ 371 (c)(1),

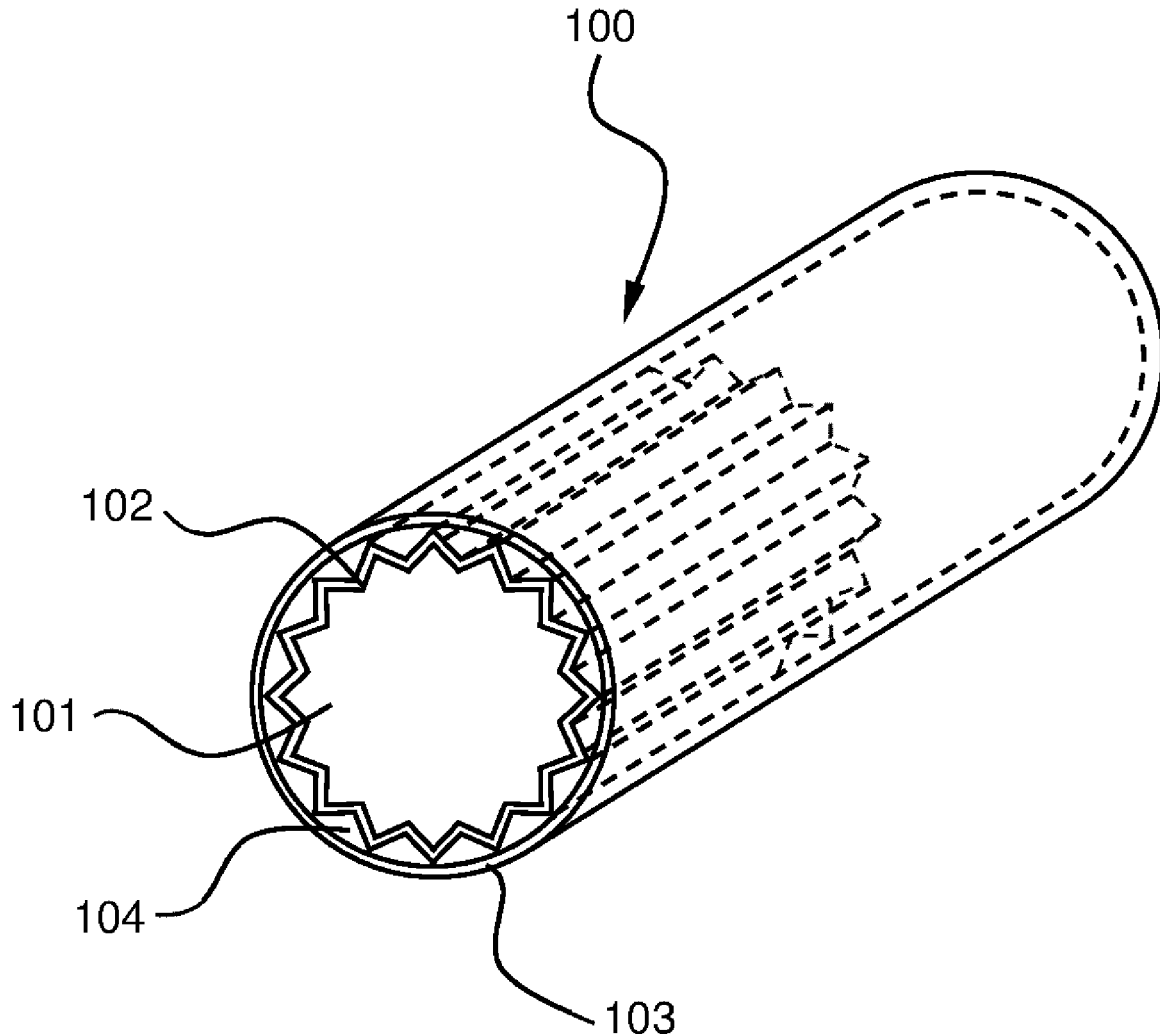
(2) Date: **May 23, 2024**

(57) **ABSTRACT**

A mouthpiece, filter or filter element comprising a longitudinally extending core of paper or other biodegradable (e.g., non-cellulose acetate containing) filtering material, a first wrapper engaged around the peripheral surface of the core, and a second wrapper engaged around the first wrapper, the first wrapper defining at least with the second wrapper a plurality of channels extending longitudinally from the upstream end of the mouthpiece, filter or filter element and/or a plurality of channels extending longitudinally from the downstream end of the mouthpiece, filter or filter element.

(30) **Foreign Application Priority Data**

Nov. 23, 2021 (GB) 2116870.3



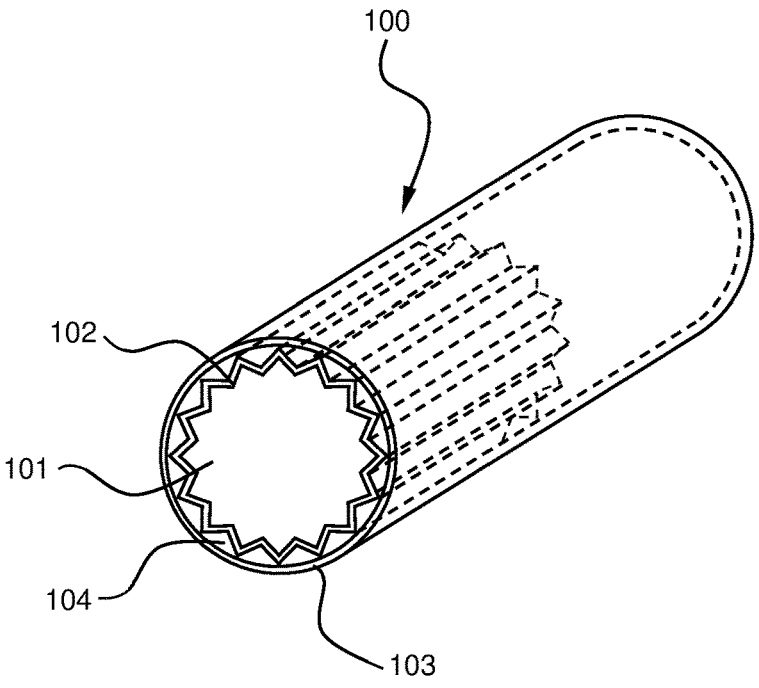


Figure 1

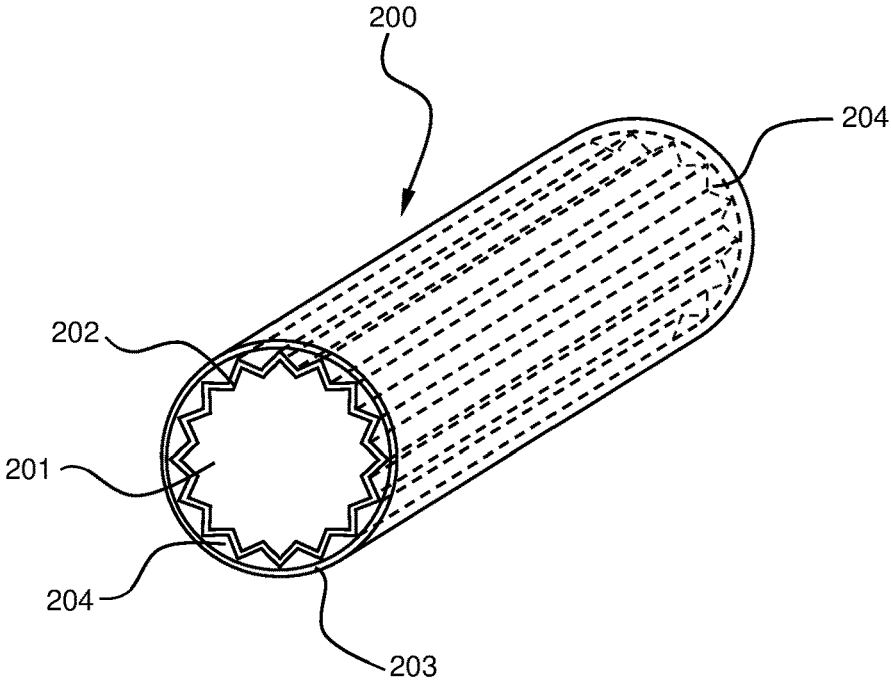


Figure 2

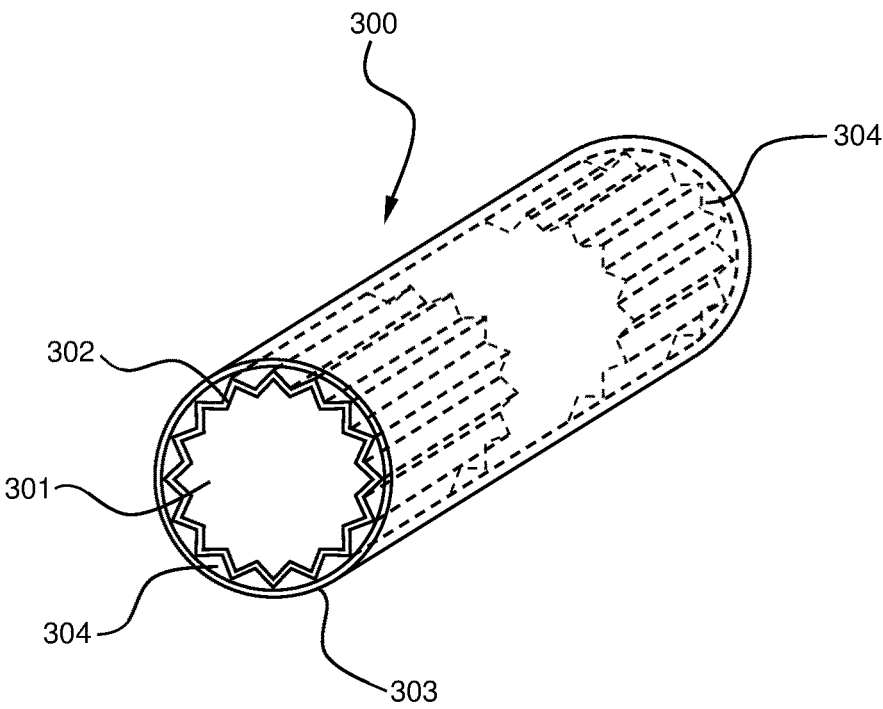


Figure 3

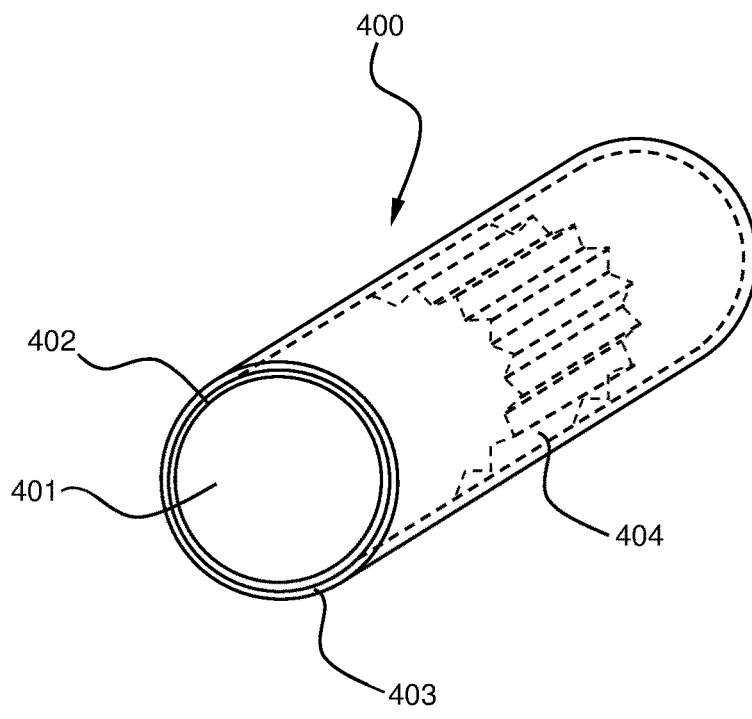


Figure 4

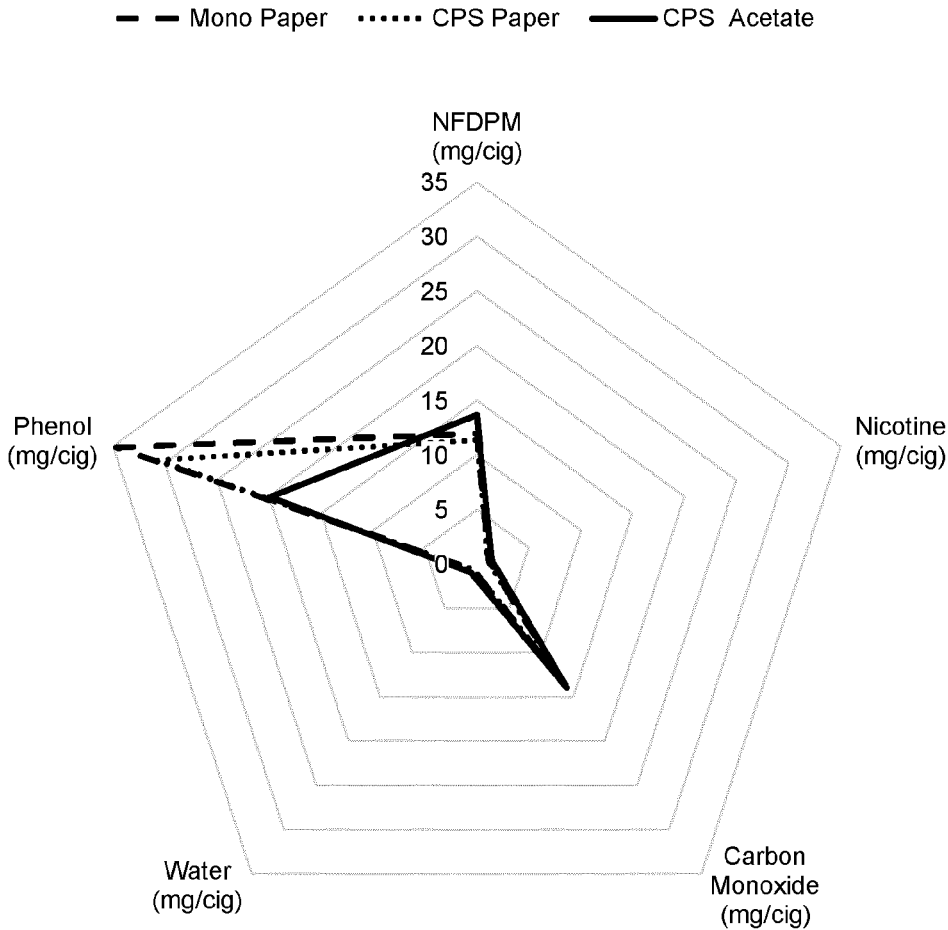


Figure 5

PAPER FILTER

INTRODUCTION

[0001] The present invention provides a mouthpiece, filter or filter element for use with a smoking article such as a cigarette, tobacco heating product or a heat-not-burn product.

BACKGROUND

[0002] Mouthpieces, filters or filter elements for smoking articles such as cigarettes, tobacco heating products or heat-not-burn (HNB) products may be manufactured from a number of different materials. Presently, 98% of commercial cigarette filters comprise an amount of cellulose acetate (source: Euromonitor International). However, cellulose acetate is not biodegradable and, as a result, cigarette filters (and cigarette butts) comprising cellulose acetate may persist in the environment for many years. Due to this, and in consideration of new EU legislation coming into force by 2021 (aimed at reducing the use of single-use plastics such as cellulose acetate filters), there is increasing interest in filter elements (such as mouthpieces) that do not comprise single-use plastics and are biodegradable.

[0003] An alternative filtration material to cellulose acetate is paper. Filters comprising paper as the filtering material are well known in the art. Paper filters offer a number of advantages over cellulose acetate filters in terms of enhanced biodegradability and higher filtration efficiencies at a given pressure drop. However, they also have a number of disadvantages for example they may have a deleterious effect on the taste of the cigarette and a low retention of toxic phenolic compounds. Thus, the experience of smoking cigarettes with conventional paper (i.e., mono-paper) filters is not comparable to that from a conventional cellulose acetate filtered cigarette.

[0004] It is therefore desirable to provide a mouthpiece, filter or filter element for a smoking article (e.g., a cigarette, a tobacco heating product, a heat-not-burn (HNB) product) which provides acceptable filtration and sensory properties while having an improved biodegradability compared to conventional materials such as cellulose acetate.

SUMMARY OF THE INVENTION

[0005] According to the present invention in a first aspect there is provided a mouthpiece, filter or filter element (e.g., for a smoking article such as a cigarette, a tobacco heating product, a HNB product) comprising a longitudinally extending core of paper or other biodegradable (e.g., non-cellulose acetate containing) filtering material, a first wrapper (e.g., plugwrap) engaged around the peripheral surface of the core, and a second wrapper (e.g., plugwrap) engaged around the first wrapper, the first wrapper defining at least with the second wrapper a plurality of channels extending longitudinally from the upstream end of the mouthpiece, filter or filter element and/or a plurality of channels extending longitudinally from the downstream end of the mouthpiece, filter or filter element.

[0006] According to the present invention in an aspect there is provided a mouthpiece, filter or filter element (e.g., for a smoking article such as a cigarette, a tobacco heating product, a HNB product) comprising a longitudinally extending core of paper or other biodegradable (e.g., non-cellulose acetate containing) filtering material, a first wrap-

per (e.g., plugwrap) engaged around the peripheral surface of the core, and a second wrapper (e.g., plugwrap) engaged around the first wrapper, the first wrapper defining at least with the second wrapper a plurality of channels extending longitudinally of the mouthpiece, filter or filter element and which (e.g., extend only part of the core length and) do not extend from either the upstream or downstream ends of the mouthpiece, filter or filter element.

[0007] The paper or other biodegradable (e.g., non-cellulose acetate) filtering material of the longitudinally extending core of the present invention is biodegradable and has an enhanced biodegradability compared to cellulose acetate. Therefore, the present invention provides a mouthpiece, filter or filter element of enhanced biodegradability, and thus is more environmentally friendly and is more in line with EU legislation.

[0008] The term “biodegradable” refers to the paper or other biodegradable filtering material, mouthpiece, filter or filter element being able to exhibit a biodegradation of at least 90% after 6 months under controlled composting conditions (see ISO14855-1 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions—Method by analysis of evolved carbon dioxide).

[0009] Preferably, the paper or other biodegradable filtering material, mouthpiece, filter or filter element is “readily biodegradable”. The phrase “readily biodegradable” refers to the paper or other biodegradable filtering material, mouthpiece, filter or filter element being able to disintegrate rapidly and completely biodegrade when immersed in water. Preferably, the paper or other biodegradable filtering material, mouthpiece, filter or filter element has the ‘Ready Biodegradability’ level of biodegradability as measured according to OECD 301 B ‘Ready Biodegradability’ method (modified Sturm test), which is well known in the art. The phrase “readily biodegradable” will here be understood to mean ‘Ready Biodegradability’ level of biodegradability.

[0010] In some examples, the channels may extend only part of the length of the core. In other examples, the channels may extend the full length of the core.

[0011] It will be appreciated that where the channels may extend only part of the length of the core, the channels will be closed or blocked at the end remote from the end of the mouthpiece, filter or filter element from which the channels extend. It will further be appreciated that where the channels extend for the full length of the core, the channels will be open at both the upstream and downstream end of the mouthpiece, filter or filter element.

[0012] At least one longitudinally extending portion of the mouthpiece, filter or filter element may include no channels within its cross-section. It will be appreciated that the portion(s) may be located at either end or both ends of the mouthpiece, filter or filter element (i.e., the downstream end and/or the upstream end) or the portion may be located in the middle of the mouthpiece, filter or filter element.

[0013] The (or each) portion of the mouthpiece, filter or filter element which does not include channels within its cross-section is herein referred to as a bar or bar portion. The (or each) portion of the mouthpiece, filter or filter element which includes longitudinally extending channels (which extend for either the full length or only part of the length of the core) is herein referred to as a flute or fluted portion.

[0014] In an example, a mouthpiece, filter or filter element according to the invention includes a 9 mm flute section at

one end of the mouthpiece, filter or filter element and an 18 mm bar section for the remaining length of the mouthpiece, filter or filter element (i.e., the other end of the mouthpiece, filter or filter element). In another example, a mouthpiece, filter or filter element according to the invention includes a 7 mm flute section at the downstream end of the mouthpiece, filter or filter element, a 7 mm flute section at the upstream end of the mouthpiece, filter or filter element and a 7 mm bar section in between the fluted portions. In another example, a mouthpiece, filter or filter element according to the invention is fully fluted, and includes a 27 mm flute section for the full length of the mouthpiece, filter or filter element. In a further example, a mouthpiece, filter or filter element according to the invention includes a 7 mm bar section at the downstream end of the mouthpiece, filter or filter element, a 7 mm bar section at the upstream end of the mouthpiece, filter or filter element and a 7 mm flute section in between the bar portions. Thus, the mouthpiece, filter or filter element of the invention may have fluted and/or bar portions.

[0015] The length of the fluted portion(s) may be from 5 to 30 mm, e.g., from 8 to 25 mm, e.g., from 10 to 20 mm, e.g., from 12 to 15 mm. The length of the bar portion(s) may be from 5 to 30 mm, e.g., from 8 to 25 mm, e.g., from 10 to 20 mm, e.g., from 12 to 15 mm.

[0016] The applicants have found that a mouthpiece, filter or filter element comprising flutes or flutes and bars may provide improved filtering performance, particularly in relation to phenols, compared to a conventional paper (e.g., mono-paper) filter. Without wanting to be bound by theory, it is thought that the channels of the fluted portion(s) increases the surface area available for smoke filtration, consequently reducing phenol yield compared to a mono-paper filter. In an example, a mouthpiece, filter or filter element according to the invention may reduce phenol yield by up to 12% compared to a mono-paper filter.

[0017] Further, the applicants have found that, in comparison to other mouthpieces, filters or filter elements comprising flutes or flutes and bars, for example Corinthian™ filter, for example CPST™ filter, which are made from cellulose acetate bonded with plasticizer to create the flutes, the mouthpiece, filter or filter element of the present invention is plastic-free and consequently, biodegradable, whilst still providing acceptable filtration and sensory properties.

[0018] Preferably, the length of the channels is from 5 mm to 30 mm, e.g., from 9 mm to 25 mm. The channels extending longitudinally from one end (upstream or downstream) may be a different length to those extending from the other end, or they may be the same length.

[0019] The channels will be preferably of substantially uniform depth over their longitudinal extent, although there may be variation, for example if a channel extends only part of the length of the core and consequently has a closed end. The depth (e.g., maximum depth) of each channel is from 0.5 mm to 2.6 mm, for example from 0.8 to 2.2 mm, for example from 1.3 to 2.1 mm, preferably from 1.35 to 2 mm, for example from 1.4 to 1.9 mm.

[0020] The width (e.g. maximum width) of each channel is from 1.0 to 3.0 mm, for example from 1.3 to 2.1 mm, preferably from 1.35 to 2 mm, for example from 1.4 to 1.9 mm.

[0021] The mouthpiece, filter or filter element may include from 5 to 25 channels, preferably from 10 to 16 channels, extending longitudinally from the upstream end of the mouthpiece, filter or filter element and/or from 5 to 25

channels, preferably from 10 to 16 channels extending longitudinally from the downstream end of the mouthpiece, filter or filter element.

[0022] The total cross-sectional area of these channels may amount to from 2 to 12%, preferably from 4 to 8%, of the overall cross-sectional area of the mouthpiece, filter or filter element.

[0023] The applicants have found that a mouthpiece, filter or filter element comprising channels of these dimensions may provide improved smoothness compared to standard paper (e.g., mono-paper) and standard cellulose acetate (e.g., mono-acetate) filters. Without wanting to be bound by theory, it is thought that the additional ventilation provided by the channels of these dimensions helps to overcome the “paper taste” typically associated with paper filters and reduces the irritation of the smoke or vapour, consequently improving smoothness.

[0024] The first wrapper may be a paper of basis weight from 60 to 100 gsm, e.g., a paper (e.g., plugwrap) of basis weight from 70 to 90 gsm, e.g., a paper (e.g., plugwrap) of basis weight 80 gsm. Preferably, the first wrapper is air permeable.

[0025] The first wrapper may be coloured. The first wrapper may be a coloured paper (e.g., plugwrap). The colour may be black, red, yellow, orange, green, blue, pink, purple etc. or various tones thereof. Herein “coloured” means a colour (i.e., a hue) that is different to white or off-white (i.e., the colour of paper).

[0026] The applicants have found that the use of a colored paper (e.g., plugwrap) for the first wrapper maintains may provide a unique end appearance that is visually appealing and may help in combating counterfeiting.

[0027] The first wrapper may have longitudinally extending corrugations (e.g., grooves and ridges) which define with the second wrapper the channels extending longitudinally of the mouthpiece, filter or filter element. The first wrapper may be a sheet having a profiled surface, such that it has longitudinally extending corrugations (e.g., grooves and ridges) along regular sections of its length. The first wrapper may be engaged around the peripheral surface of the core with the profiled (e.g., corrugated) surface facing the second wrapper. Each channel may be provided between the corrugations of the first wrapper and the inner surface of the second wrapper. The core of paper or other biodegradable (e.g., non-cellulose acetate containing) filtering material may be conformed to the profiled (e.g., corrugated) surface of the first wrapper.

[0028] The first wrapper may have a corrugated portion (i.e., longitudinally extending corrugations as described above) and a non-profiled (i.e., flat) portion. The first wrapper may be a sheet having an alternating profiled and flat surface, such that it has longitudinally extending corrugations (e.g., grooves and ridges) along regular sections of its length and flat portions along regular sections of its length. As described above, the corrugated portion of the first wrapper may define at least with the second wrapper the channels extending longitudinally of the mouthpiece, filter or filter element (i.e., the fluted portion) while the flat portion of the first wrapper may not define channels [at least with the second wrapper] in the length of the core which the flat portion of the first wrapper engages around (i.e., the bar portion). Thus the corrugated and flat portions of the first wrapper may define at least with the second wrapper the fluted and bar regions, respectively, of the mouthpiece, filter

or filter element. It will be appreciated that the core of paper or other biodegradable (e.g., non-cellulose acetate containing) filtering material may be conformed to the profiled (e.g., corrugated) and/or non-profiled (i.e., flat) surfaces of the first wrapper.

[0029] The applicants have found that the use of a paper wrapper of basis weight 80 gsm having a profiled (e.g., corrugated) surface for the first wrapper maintains the structural integrity and depth of the channels.

[0030] The second wrapper may be a paper of basis weight from 25 to 140 gsm, e.g., a paper (e.g., plugwrap) of basis weight from 60 to 100 gm, e.g., a paper (e.g., plugwrap) of basis weight 80 gsm.

[0031] The second wrapper may be air permeable (e.g., up to 32000 Coresta units). Alternatively, the second wrapper may be air impermeable.

[0032] The mouthpiece or filter or filter element may comprise a plurality of further channels defined by the first wrapper and at least the second wrapper which extend longitudinally of the core and which extend only part of the length of the core but which do not extend from either the upstream or downstream ends of the core. The mouthpiece or filter or filter element may comprise from 5 to 25 further channels, preferably from 10 to 16 further channels which extend longitudinally of the core and which extend only part of the length of the core but which do not extend from either the upstream or downstream ends of the core. In such an example, there is more than one portion of the filter having no channels (i.e., more than one bar section).

[0033] In an example, a mouthpiece, filter or filter element according to the invention includes a 5 mm flute section at one end of the mouthpiece, filter or filter element, a 5 mm bar section adjacent to the flute section, a 5 mm flute section at the other end of the mouthpiece, a 5 mm bar section adjacent to the flute section and a further 5 mm flute section in between the bar portions, such that the channels of this section do not extend from either the upstream or downstream ends of the core.

[0034] The paper filtering material and/or other biodegradable (e.g., non-cellulose acetate containing) filtering material may be paper (in any form) which is conventionally used in filters for smoking articles. The paper filtering material and/or other biodegradable (e.g., non-cellulose acetate containing) filtering material may be standard paper, non-woven paper, airlaid paper, carbon impregnated paper or cellulose/lyocell/viscose based papers.

[0035] The paper filtering material and/or other biodegradable (e.g., non-cellulose acetate containing) filtering material may be a non-plastic plant based fibre (e.g., flax, hemp, jute, sisal, abaca, coconut, bamboo, starch or wood pulp or a blend of these materials).

[0036] The applicants have found that the use of standard paper filtering material may be particularly suitable for the core of the present invention because it has good filtration properties and is flexible, such that it may easily conform to the profiled (e.g., corrugated) and/or non-profiled (i.e., flat) surfaces of the first wrapper, meaning channels are only between the first and second wrapper.

[0037] Preferably the length of the mouthpiece, filter or filter element is from 12 to 30 mm, e.g., from 15 to 28 mm, e.g., from 18 to 26 mm, e.g., from 20 to 24 mm.

[0038] Preferably the circumference of the mouthpiece, filter or filter element is from 14 to 30 mm, e.g., from 16 to 25 mm, e.g., from 24 to 25 mm.

[0039] The mouthpiece or filter element may be biodegradable, with greater than 90% biodegradability as measured according to ISO14855-1 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions—Method by analysis of evolved carbon dioxide.

[0040] Preferably the mouthpiece, filter or filter element has ‘Ready Biodegradability’ level of biodegradability as measured according to OECD 301 B ‘Ready Biodegradability’ method (modified Sturm test).

[0041] The mouthpiece, filter or filter element may comprise a smoke or vapour modifying agent which may modify or enhance the consumer experience. The smoke or vapour modifying agent may impart an additional taste or aroma to the vapour passing through the mouthpiece or filter or may be able to suppress certain flavours or aromas. The smoke or vapour modifying agent may be located in or on the longitudinally extending core of paper or other biodegradable (e.g., non-cellulose acetate containing) filtering material or on the first and/or second wrapper. The smoke or vapour modifying agent may be a particulate additive. The particulate additive may be activated carbon (e.g., activated carbon granules), zeolite, ion exchange resin (e.g., a weakly basic anion exchange resin), sepiolite (e.g., sepiolite granules), silica gel, alumina, molecular sieve, carbonaceous polymer resins and diatomaceous earths. The particulate additive may be a mixture of two or more of these additives. The smoke or vapour modifying agent may be a liquid additive (e.g., a flavour enhancing additive, e.g., an additive for smoke chemistry benefits). The flavour enhancing additive may be any known in the art, for example menthol, peppermint, fruit, berry, vanilla, chocolate, coffee etc. with a suitable carrier e.g., propylene glycol, vegetable glycerine, medium-chain triglyceride (MCT) oil, other oils. The additive for smoke chemistry benefits may be PG, PEG, Triacetin or TEC.

[0042] The mouthpiece, filter or filter element of the invention may be used in a multi-segment filter as a single segment with one or more discrete further segments. The filter construction could be two, three, four or more discrete segments. The discrete segments may be, for example, (e.g., cylindrical) plugs of filtering material (e.g., paper filtering material and/or other biodegradable (e.g., non-cellulose acetate containing) filtering material) that may include capsules, carbon, CPS, tubes, acetate, paper, menthol etc. The multi-segment filter may be attached to a tobacco rod (which can be made from any form of tobacco (including reconstituted)).

[0043] According to the present invention there is provided a smoking article (e.g., a cigarette, e.g., a tobacco heating product, e.g., a HNB product) comprising a mouthpiece, filter, filter element or multi-segment filter as herein described and claimed below joined at one end to a wrapped tobacco rod (e.g., by conventional means, i.e., by a tipping paper).

[0044] In an example, a smoking article according to the invention comprises a filter according to the invention including a 9 mm flute section at one end of the filter and a 18 mm bar section as the remaining length of the filter, joined at the fluted end to a wrapped tobacco rod (i.e., by a tipping paper). In another example, a smoking article according to the invention comprises a filter according to the invention including a 9 mm flute section at one end of the

filter and a 18 mm bar section as the remaining length of the filter, joined at the bar end to a wrapped tobacco rod (i.e., by a tipping paper).

[0045] It will be appreciated that in the above examples, the end appearance of the smoking article will appear differently to the consumer depending on whether the fluted end or the bar end is joined to the wrapped tobacco rod and consequently whether the fluted end or the bar end is at the mouth-end of the smoking article and is therefore, visible. The applicants have found that by arranging a fluted section (as opposed to a bar section) at the mouth-end of a smoking article the consumer may be provided with a unique end appearance that is visually appealing and may help in combating counterfeiting.

[0046] Alternatively, arranging a bar section at the mouth-end of a smoking article may give the impression of a standard single segment (i.e., mono-paper) filter.

[0047] According to the present invention in another aspect there is also provided a method for making a mouthpiece, filter or filter element comprising the steps of:

[0048] providing a longitudinally extending continuous core of paper or other biodegradable (e.g., non cellulose acetate containing) filtering material;

[0049] engaging and securing a first wrapper (e.g., plugwrap) around the peripheral surface of the core;

[0050] engaging and securing a second wrapper around the wrapped core, the first wrapper defining at least with the second wrapper a plurality of channels extending longitudinally of the core;

[0051] cutting the continuous core to form individual mouthpieces or filter elements, arranged so the cut ends form the upstream end of the mouthpiece, filter or filter element and the downstream end of the mouthpiece, filter or filter element.

[0052] The first wrapper may be a sheet, embossed to provide a profiled surface, such that it has longitudinally extending corrugations (e.g., grooves and ridges) along regular sections of its length.

[0053] Preferably, the first wrapper is embossed uniformly so as to provide grooves of uniform depth and width over their longitudinal extent. The depth of the grooves may be from 0.5 mm to 2.6 mm, for example from 0.8 to 2.2 mm, for example from 1.3 to 2.1 mm, preferably from 1.35 to 2 mm, for example from 1.4 to 1.9 mm. The width (e.g. maximum width) of each groove may be from 1.0 to 3.0 mm, for example from 1.3 to 2.1 mm, preferably from 1.35 to 2 mm, for example from 1.4 to 1.9 mm.

[0054] The first wrapper may have an embossed (e.g., corrugated) portion and a non-profiled (i.e., flat) portion. The embossed and flat portions may be alternating and may be of the same or different length.

[0055] It will be appreciated that the corrugated portion of the first wrapper may define at least with the second wrapper the channels extending longitudinally of the core (i.e., the fluted portion) while the flat portion of the first wrapper may not define channels [at least with the second wrapper] in the length of the core which the flat portion of the wrapper engages around (i.e., the bar portion). Thus the corrugated and flat portions of the first wrapper may define at least with the second wrapper, the fluted and bar regions, respectively, of the individual mouthpiece, filter or filter element (i.e., after cutting).

[0056] The continuous core of paper or other biodegradable (e.g., non cellulose acetate containing) filtering material

may be cut axially at any position along the continuous core to form individual mouthpieces or filter elements. It will be appreciated that the cut ends form the upstream end of the mouthpiece, filter or filter element and the downstream end of the mouthpiece, filter or filter element. Thus, depending on whether the continuous core is cut through a fluted or bar portion or between a fluted or bar portion will dictate the length and arrangement of the mouthpiece, filter or filter element (i.e., flute-bar, i.e., flute-bar-flue, i.e., flute, i.e., bar-flute-bar).

[0057] It will be appreciated that the paper or other biodegradable (e.g., non-cellulose acetate containing) filtering material, first wrapper, second wrapper and channel dimensions described above etc. may be used in the method of making a mouthpiece, filter or filter element.

[0058] According to the present invention there is provided a mouthpiece, filter or filter element obtained by the method as herein described and claimed below.

[0059] The present invention will now be described in further detail by reference to the attached Figures in which:

[0060] FIG. 1 shows a perspective view of a mouthpiece, filter or filter element according to an example of the invention;

[0061] FIG. 2 shows a perspective view of a mouthpiece, filter or filter element according to another example of the invention;

[0062] FIG. 3 shows a perspective view of a mouthpiece, filter or filter element according to another example of the invention;

[0063] FIG. 4 shows a perspective view of a mouthpiece, filter or filter element according to another example of the invention;

[0064] FIG. 5 shows a comparison of mainstream smoke deliverables of a filter of the invention with a conventional paper filter and a CPS acetate filter.

[0065] FIG. 1 shows a mouthpiece, filter or filter element **100** which is of length 27 mm and circumference 24 mm. The mouthpiece, filter or filter element **100** comprises a longitudinally extending core **101** of standard paper filtering material of length 27 mm, a first wrapper **102** of paper of 80 gsm engaged around the peripheral surface of the core **101** and a second wrapper **103** of paper of 100 gsm engaged around the first wrapper **102**. The first wrapper **102** defines at least with the second wrapper **103** sixteen channels **104** of depth 1.5 mm, width 1.2 mm and length 9 mm, extending longitudinally from the upstream end of the mouthpiece, filter or filter element **101** (i.e., the fluted portion). The total cross-sectional area of these channels is 6.1% of the overall cross-sectional area of the mouthpiece, filter or filter element. The remaining 18 mm of length of mouthpiece, filter or filter element **100** does not include channels within its cross-section (i.e., the bar portion).

[0066] The mouthpiece, filter or filter element **100** may be made by using techniques known in the art by a method comprising the steps of:

[0067] providing a longitudinally extending continuous core of 36 gsm standard paper filtering material;

[0068] engaging and securing a first wrapper of paper of 80 gsm with alternating embossed (e.g., corrugated) portions and non-profiled (i.e., flat) portions around the peripheral surface of the core;

[0069] engaging and securing a second wrapper of paper of 100 gsm around the wrapped core, the first

wrapper defining at least with the second wrapper a plurality of channels extending longitudinally of the core;

[0070] cutting the continuous core between the embossed portion and non-profiled portion of the first wrapper to form individual mouthpiece, filter or filter element 100, arranged so the cut ends form the fluted upstream end of the mouthpiece, filter or filter element and the bar downstream end of the mouthpiece, filter or filter element.

[0071] FIG. 2 shows mouthpiece, filter or filter element 200 which is of length 27 mm and circumference 24 mm. The mouthpiece, filter or filter element 200 comprises a longitudinally extending core 201 of standard paper filtering material of length 27 mm, a first wrapper 202 of paper of 80 gsm engaged around the peripheral surface of the core 201 and a second wrapper 203 of paper of 100 gsm engaged around the first wrapper 202. The first wrapper 202 defines at least with the second wrapper 203 sixteen channels 204 of depth 1.2 mm, width 1.8 mm and length 27 mm, extending longitudinally along the full length of the core 201. The total cross-sectional area of these channels is 4.5% of the overall cross-sectional area of the mouthpiece, filter or filter element.

[0072] It will be appreciated that the method for making mouthpiece, filter or filter element 100 described above may be used to make mouthpiece, filter or filter element 200. However, in the method for making mouthpiece, filter or filter element 200 the first wrapper is only embossed, such that it has longitudinally extending corrugations (e.g., grooves and ridges) along regular sections of its length, and does not include a non-profiled (i.e., flat) portion.

[0073] FIG. 3 shows mouthpiece, filter or filter element 300 which is of length 27 mm and circumference 24 mm. The mouthpiece, filter or filter element 300 comprises a longitudinally extending core 301 of standard paper filtering material of length 27 mm, a first wrapper 302 of paper of 80 gsm engaged around the peripheral surface of the core 301 and a second wrapper 303 of paper of 100 gsm engaged around the first wrapper 302. The first wrapper 302 defines at least with the second wrapper 303 sixteen channels 304 of depth 1.35 mm, width 1.35 mm and length 9 mm, extending longitudinally from the upstream end of the mouthpiece, filter or filter element 300 and 12 channels 304 of depth 1.35 mm, width 1.35 mm and length 9 mm, extending longitudinally from the downstream end of the mouthpiece, filter or filter element 300. The total cross-sectional area of these channels is 4.8% of the overall cross-sectional area of the mouthpiece, filter or filter element. The remaining 9 mm of length of mouthpiece, filter or filter element 300 does not include channels within its cross-section (i.e., the bar portion).

[0074] It will be appreciated that the method for making mouthpiece, filter or filter element 100 described above may be used to make mouthpiece, filter or filter element 300. However, in the method for making mouthpiece, filter or filter element 300 the continuous core is cut through the embossed portion of the first wrapper, so the cut ends form the fluted upstream and downstream ends of the mouthpiece, filter or filter element 300.

[0075] FIG. 4 shows mouthpiece, filter or filter element 400 which is of length 27 mm and circumference 24 mm. The mouthpiece, filter or filter element 400 comprises a longitudinally extending core 401 of standard paper filtering

material of length 27 mm, a first wrapper 402 of paper of 80 gsm engaged around the peripheral surface of the core 401 and a second wrapper 403 of paper of 100 gsm engaged around the first wrapper 402. The first wrapper 402 defines at least with the second wrapper 403 sixteen channels 404 of depth 1.35 mm, width 1.35 mm and length 7 mm which do not extend from either the upstream or downstream ends of the mouthpiece, filter or filter element 400. The total cross-sectional area of these channels is 4.8% of the overall cross-sectional area of the mouthpiece, filter or filter element. The two remaining 7 mm lengths of mouthpiece, filter or filter element 400 on either side of the 7 mm fluted portion do not include channels within their cross-section (i.e., the bar portions).

[0076] It will be appreciated that the method for making mouthpiece, filter or filter element 100 described above may be used to make mouthpiece, filter or filter element 400. However, in the method for making mouthpiece, filter or filter element 400 the continuous core is cut through the non-profiled (i.e., flat) portion of the first wrapper, so the cut ends form the bar upstream and downstream ends of the mouthpiece, filter or filter element 400.

[0077] It will be appreciated that the mouthpieces, filters or filter elements 100, 200, 300 and 400 may be used in a multi-segment filter as a single segment with one or more discrete further segments. Further, it will be appreciated that the mouthpieces, filters or filter elements 100, 200, 300 and 400 or multi-segment filter comprising 100, 200, 300 or 400 may be joined at one end to a wrapped tobacco rod for use as a smoking article (e.g., a cigarette, e.g., a tobacco heating product, e.g., a HNB product).

Smoke and Sensory Experiment 1

[0078] Filter A of the invention (as shown in FIG. 1) was made by the method described above. The filter was tested against a conventional paper filter (i.e., mono-paper) and a conventional cellulose acetate filter (i.e., mono-acetate).

[0079] Filter A, a mono-paper filter and a mono-acetate filter were assembled for smoke testing by joining each filter at one end to a wrapped tobacco rod to form a cigarette. The mouth-end of each cigarette was then inserted into a smoking machine, configured to smoke the cigarettes. The experiment was performed at standard room temperature and humidity.

[0080] The amount of phenol in the smoke of the cigarette comprising Filter A is lower (30.8 mg/cigarette) than the amount of phenol in the smoke of the cigarette comprising a mono-paper filter (34.7 mg/cigarette). Thus, filters of the invention are able to reduce the amount of phenol by up to 12% compared to a mono-paper filter.

[0081] Filter A, the mono-paper filter and the mono-acetate filter were assembled for sensory testing by joining each filter at one end to a wrapped tobacco rod to form a cigarette. The preliminary smoke panel results suggest that mouthpieces, filters or filter elements of the invention may improve smoothness compared to mono-paper and mono-acetate filters.

Smoke and Sensory Experiment 2

[0082] Filter A of the invention (as shown in FIG. 1) was made by the method described above. The filter was tested against a cellulose acetate filter of the same construction (i.e., Combined Performance Superior™ (CPS™) filter

available from Essentra plc.) comprising high-quality crimped cellulose acetate fibres, bonded together by plasticiser. This filter is referred to as CPS acetate.

[0083] Filter A and the CPS acetate filter were assembled for smoke testing by joining each filter at one end to a wrapped tobacco rod to form a cigarette. The mouth-end of each cigarette was then inserted into a smoking machine, configured to smoke the cigarettes. The experiment was performed at standard room temperature and humidity.

[0084] FIG. 5 shows the amount of phenol, nicotine-free dry particulate matter (NFDPM), nicotine, carbon monoxide and water in the smoke of each filtered cigarette. The results for the mono-paper filtered cigarette from Smoke and Sensory Experiment 1 have been included in FIG. 5 for comparison.

[0085] Filter A has a lower nicotine-free dry particulate matter (NFDPM) yield (11.4 mg/cigarette) than the CPS acetate filter (13.69 mg/cigarette). Thus, filters of the invention are able to reduce the amount of NFDPM compared to a CPS acetate filter. Filter A also has a comparable nicotine, carbon monoxide and water yield to the CPS filter indicating that mouthpieces, filters or filter elements of the invention are comparable to cellulose acetate filters of the same construction. The mouthpieces, filters or filter elements of the invention may therefore provide a biodegradable alternative to CPS acetate filters, with comparable filtration properties.

[0086] Filter A and the CPS acetate filter were assembled for sensory testing by joining each filter at one end to a wrapped tobacco rod to form a cigarette. The smoke panel results suggest that mouthpieces, filters or filter elements of the invention improve smoothness compared to mono-paper and CPS acetate filters. In the experiment, Filter A provided a smoother smoke than the mono-paper filter and both provided a smoother smoke than CPS acetate.

Biodegradability Experiment

[0087] The biodegradability of the paper filtering material and/or other biodegradable (e.g., non-cellulose acetate containing) filtering material used in mouthpieces, filter or filter elements of the present invention was compared with the biodegradability of known cellulose acetate filters and filters containing cellulose acetate.

[0088] The biodegradability was measured according to ISO14855-1 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions—Method by analysis of evolved carbon dioxide. The test provides a measure of the biodegradability of a material (expressed as a percentage) over a 180 day period under optimal oxygen, temperature and moisture conditions.

[0089] Table 1 shows the biodegradability results for a mono-acetate filter, an airlaid paper filter (Genia), a wood pulp paper filter and a hemp paper filter compared to a conventional cellulose acetate (CA) filter rod when tested according to the method of ISO14855-1. Filters were purchased or made according to methods known in the art.

TABLE 1

Filter	Mono-Acetate	Wood Pulp Paper (100%)	Hemp Paper (100%)	Genia (Airlaid)
Length (mm)	108	108	108	108
Circumference (mm)	24.2	24.2	24.2	24.2
Plug wrap (gsm)	27	27	27	27
Hardness (%)	90	88	89	88.5
Plasticizer (%)	6.3	—	—	—

TABLE 1-continued

Filter	Mono-Acetate	Wood Pulp Paper (100%)	Hemp Paper (100%)	Genia (Airlaid)
Biodegradation % compared to CA reference after 180 days	87.2	99.5	95.6	94.1

[0090] Table 1 shows that wood pulp paper and hemp paper have the highest biodegradability of all the filtering materials. Further, the airlaid paper (Genia) also demonstrates good biodegradability compared to CA.

[0091] Thus, the paper filtering material and/or other biodegradable filtering material used in mouthpieces or filter elements of the present invention degrade faster and more extensively than cellulose acetate.

1. A mouthpiece, filter or filter element comprising a longitudinally extending core of paper or other biodegradable (e.g., non-cellulose acetate containing) filtering material, a first wrapper engaged around the peripheral surface of the core, and a second wrapper engaged around the first wrapper, the first wrapper defining at least with the second wrapper a plurality of channels extending longitudinally from the upstream end of the mouthpiece, filter or filter element and/or a plurality of channels extending longitudinally from the downstream end of the mouthpiece, filter or filter element.

2. A mouthpiece, filter or filter element comprising a longitudinally extending core of paper or other biodegradable (e.g., non-cellulose acetate containing) filtering material, a first wrapper engaged around the peripheral surface of the core, and a second wrapper engaged around the first wrapper, the first wrapper defining at least with the second wrapper a plurality of channels extending longitudinally from the mouthpiece, filter or filter element and which (e.g., extend only part of the core length and) do not extend from either the upstream or downstream ends of the mouthpiece, filter or filter element.

3. The mouthpiece, filter or filter element according to claim 1 wherein the channels extend only part of the length of the core.

4. The mouthpiece, filter or filter element according to claim 1 wherein at least one longitudinally extending portion of the mouthpiece, filter or filter element includes no channels within its cross-section.

5. The mouthpiece, filter or filter element according to claim 1 wherein the channels extend the full length of the core.

6. The mouthpiece, filter or filter element according to claim 1 wherein the length the channels is from 5 mm to 30 mm, e.g., from 9 mm to 25 mm.

7. The mouthpiece, filter or filter element according to claim 1 wherein the depth of each channel is from 0.5 mm to 2.6 mm for example from 0.8 to 2.2 mm, for example from 1.3 to 2.1 mm, preferably from 1.35 to 2 mm, for example from 1.4 to 1.9 mm.

8. The mouthpiece, filter or filter element according to claim 1 wherein the width (e.g. maximum width) of each channel is from 1.0 to 3.0 mm, for example from 1.3 to 2.1 mm, preferably from 1.35 to 2 mm, for example from 1.4 to 1.9 mm.

9. The mouthpiece, filter or filter element according to claim 1 including from 5 to 25 channels, preferably from 10 to 16 channels, extending longitudinally from the upstream end of the mouthpiece, filter or filter element and/or from 5 to 25 channels, preferably from 10 to 16 channels, extending longitudinally from the downstream end of the mouthpiece, filter or filter element.

10. The mouthpiece, filter or filter element according to claim 1 wherein the total cross-sectional area of the channels extending longitudinally from the upstream end and/or downstream end of the mouthpiece, filter or filter element amounts to from 2 to 12%, preferably from 4 to 8%, of the overall cross-sectional area of the mouthpiece, filter or filter element.

11. The mouthpiece, filter or filter element according to claim 1 wherein the first wrapper is a paper (e.g., plugwrap) of basis weight from 60 to 100 gsm, e.g., a paper (e.g., plugwrap) of basis weight from 70 to 90 gm, e.g., a paper (e.g., plugwrap) of basis weight 80 gsm.

12. The mouthpiece, filter or filter element according to claim 1 wherein the first wrapper is air permeable.

13. The mouthpiece, filter or filter element according to claim 1 wherein the first wrapper has longitudinally extending corrugations (e.g., grooves and ridges) which define with the second wrapper the channels extending longitudinally of the filter.

14. The mouthpiece, filter or filter element according to claim 1 wherein the second wrapper is a paper (e.g., plugwrap) of basis weight from 25 to 140 gsm, e.g., a paper (e.g., plugwrap) of basis weight from 70 to 90 gm, e.g., a paper (e.g., plugwrap) of basis weight 80 gsm.

15. The mouthpiece or filter or filter element according to claim 1 comprising plurality of further channels defined by the first wrapper and at least the second wrapper which extends longitudinally of the core and which extends only part of the length of the core but which does not extend from either the upstream or downstream ends of the core.

16. The mouthpiece, filter or filter element according to claim 1 wherein the paper filtering material and/or other biodegradable (e.g., non-cellulose acetate containing) filtering material is standard paper, non-woven paper, airlaid paper, carbon impregnated paper or cellulose/lyocell/viscose based papers.

17. The mouthpiece, filter or filter element according to claim 1 wherein the paper filtering material and/or other biodegradable (e.g., non-cellulose acetate containing) filtering material is a non-plastic plant based fibre (e.g., flax, hemp, jute, sisal, abaca, coconut, bamboo, starch or wood pulp or a blend of these materials).

18. The mouthpiece, filter or filter element according to claim 1 wherein the length of the mouthpiece, filter or filter element is from 12 to 30 mm, e.g., from 15 to 28 mm, e.g., from 18 to 26 mm, e.g., from 20 to 24 mm.

19. The mouthpiece or filter element according to claim 1 wherein the mouthpiece or filter element has greater than 90% biodegradability as measured according to ISO14855-1 Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions—Method by analysis of evolved carbon dioxide.

20. The mouthpiece, filter or filter element according to claim 1 wherein the mouthpiece, filter or filter element has ‘Ready Biodegradability’ level of biodegradability as measured according to OECD 301 B ‘Ready Biodegradability’ method (modified Sturm test).

21. A multi-segment filter comprising a mouthpiece, filter or filter element according to claim 1 and one or more discrete further segments.

22. A smoking article (e.g., a cigarette, e.g., a tobacco heating product, e.g., a HNB product) comprising a mouthpiece, filter, filter element or multi-segment filter according to claim 1 joined at one end to a wrapped tobacco rod (e.g., by conventional means, i.e., by a tipping paper).

23. A method for making a mouthpiece, filter or filter element comprising the steps of:

providing a longitudinally extending continuous core of paper or other biodegradable (e.g., non cellulose acetate containing) filtering material;

engaging and securing a first wrapper (e.g., plugwrap) around the peripheral surface of the core;

engaging and securing a second wrapper around the wrapped core, the first wrapper defining at least with the second wrapper a plurality of channels extending longitudinally of the core;

cutting the continuous core to form individual mouthpieces or filter elements, arranged so the cut ends form the upstream end of the mouthpiece, filter or filter element and the downstream end of the mouthpiece, filter or filter element.

24. The method of making a mouthpiece, filter or filter element according to claim 23 wherein the first wrapper is embossed to provide a profiled (e.g., corrugated) surface, such that it has longitudinally extending corrugations along regular sections of its length.

25. A mouthpiece, filter or filter element obtained by the method of claim 23.

* * * * *