SMOKING ARTICLE FILTER INCLUDING POLYMERIC INSERT

The present invention relates to a polymeric insert formed of a dissolvable polymeric material and to a filter and smoking article incorporating such a polymeric insert.

Filter cigarettes typically comprise a wrapped rod of tobacco cut filler and a cylindrical filter aligned in end-to-end relationship with the wrapped tobacco rod, with the filter attached to the tobacco rod by tipping paper. In conventional filter cigarettes, the filter may consist of a plug of cellulose acetate tow wrapped in porous plug wrap. Filters incorporating one or more structural inserts are also known. For example, it is known to provide filters including one or more flow restriction elements for increasing the resistance to draw (RTD) of the smoking article.

It has been previously proposed to produce filters for cigarettes using biodegradable materials so that the cigarette butt that remains after smoking can be more readily degraded after its disposal. For example, it has been proposed to form fibrous filter segments with fibres of a biodegradable thermoplastic material, either alone or in combination with conventional cellulose acetate fibres.

It would be desirable to provide an insert for the filter of a smoking article that can be readily broken down or degraded in order to facilitate the disintegration and degradation of the filter as a whole after the disposal of the filter. In particular, it would be desirable to provide such an insert that can be readily and quickly broken down in the presence of liquid water at a wide variety of temperatures. It would be desirable if such an insert could be readily manufactured and incorporated into smoking article filters using existing apparatus and methods.

Herein disclosed is~~According to a first aspect of the invention there is provided~~ a smoking article comprising a polymeric insert having a compressibility of less than about 100 N *per* 1.5 mm and formed of a dissolvable polymeric material comprising one or more water soluble polymers. Preferably, the compressibility is less than about 70 Newtons *per* 1.5 mm and more preferably less than about 40 Newtons *per* 1.5 mm. Preferably the compressibility is no less than about 5 N *per* 1.5 mm. In preferred embodiments of the invention, the polymeric insert is a structural element of the smoking article, such as a structural element of the filter portion of a smoking article having a filter at one end.

According to a first aspect of the invention, there is provided a polymeric insert for a smoking article, the polymeric insert having walls and being formed of a dissolvable polymeric material compressibility of less than 100 N *per* 1.5 mm comprising one or more water soluble polymers, wherein the thickness of the walls of the polymeric insert is between 0.2 mm and 2.0 mm.

The compressibility of the polymeric insert can be measured in a compression test in which the polymeric insert is placed on a substantially flat support surface and a force is applied in a downwards direction on one side of the insert using a head having a flat, 12 mm round surface moving at a speed of 100 mm *per* minute. Suitable apparatus for conducting such a test is the FMT-310 Force Tester of Alluris GmbH. The polymeric insert is conditioned for 24 hours at a temperature of 22 °C and a relative humidity of 55% before the compression test

is carried out. The test is continued until the insert has been compressed 1.5 mm. The force (Newtons) at this point is the compressibility. If the test is unable to continue to 1.5 mm compression, the force can be normalized to 1.5 mm. In other words, if the maximum compressive force is 28 Newtons and the compression at this maximum compression is 1.4 mm, the reported value for compressibility will be 30 Newtons *per* 1.5 mm (28 Newtons divided by 1.4 multiplied by 1.5).

~~According to a second aspect of the invention t~~There is provided a filter for a smoking article, the filter including a polymeric insert having a compressibility of less than about 100 N *per* 1.5 mm and formed of a dissolvable polymeric material comprising one or more water soluble polymers. Preferably the compressibility is no less than about 5 N *per* 1.5 mm. The polymeric insert is shaped and configured such that the structure of the insert is no longer visible when the insert is placed in a closed container with water at 22 °C for 24 hours without agitation, the amount of water present in the container being about eight times the weight of the polymeric insert. In preferred embodiments of the invention, the polymeric insert is a structural element of the filter.

~~According to a third aspect of the invention t~~There is also provided a filter for a smoking article, the filter comprising a polymeric insert having a compressibility of less than about 100 N *per* 1.5 mm and formed of a dissolvable polymeric material comprising one or more water soluble polymers and a filter wrapper circumscribing the filter. Preferably the compressibility is no less than about 5 N *per* 1.5 mm. The filter wrapper is welded to the outer surface of the polymeric insert by means of the polymeric material forming the polymeric insert. The filter wrapper may be a plug wrap. In preferred embodiments of the invention, the polymeric insert is a structural element of the filter.

~~According to a fourth aspect of the invention~~Further, there is provided a polymeric insert for a smoking article, the polymeric insert having a compressibility of less than about 100 N *per* 1.5 mm and formed of a dissolvable polymeric material comprising one or more water soluble polymers. Preferably the compressibility is no less than about 5 N *per* 1.5 mm. The polymeric insert is shaped and configured such that the structure of the insert is no longer visible when the insert is placed in a closed container with water at 22 °C for 24 hours without agitation, the amount of water present in the container being about eight times the weight of the polymeric insert. The polymeric insert is useful as a structural element of a smoking article, such as a structural element of the filter portion of a smoking article having a filter at one end.

According to a second aspect of the invention, there is provided a filter for a smoking article, the filter comprising a polymeric insert according to the first aspect.

According to a third aspect of the invention, there is provided a method for forming a filter for a smoking article, the method comprising the steps of: providing a polymeric insert compressibility of less than 100 N *per* 1.5 mm formed of a dissolvable polymeric material

comprising one or more water soluble polymers and the thickness of the walls of the polymeric insert being between 0.2 mm and 2.0 mm; providing a filter wrapper; wetting at least one of the polymeric insert and the filter wrapper through the application of water; and wrapping the filter wrapper around the filter and into contact with the polymeric insert wherein the applied water at least partially dissolves the polymeric material at the outer surface of the polymeric insert and wherein the dissolved polymeric material adheres the filter wrapper to the outer surface of the polymeric insert.

~~Also according to the invention t~~There is also provided a method for forming a filter for a smoking article, the method comprising the steps of providing a polymeric insert formed of a dissolvable polymeric material having a compressibility of less than about 100 N *per* 1.5 mm and comprising one or more water soluble polymers, providing a filter wrapper, wetting at least one of the polymeric insert and the filter wrapper through the application of water; and wrapping

Preferably, the walls of the polymeric insert have a thickness of up to about 2.0 mm, more preferably up to about 0.7 mm. As mentioned in the first and third aspects of the invention~~In some embodiments~~, the wall thickness is ~~preferably~~ between about 0.2 mm and about 2.0 mm~~, more preferably~~. The wall thickness may be between about 0.5 mm and about 0.7 mm. The thickness of the walls forming the inserts, including any transverse barriers or other structures of the inserts, may be measured in a longitudinal cross section of the insert.

It has been advantageously found that the rate of the dissolution of the polymeric material forming the polymeric insert and the break down of the structure of the polymer insert can be reduced through the reduction of the thickness of the walls of the polymeric insert.

Preferably, the polymeric insert is between about 10 mm and 20 mm in length, more preferably between about 12 mm and 14 mm in length. Where the polymeric insert includes one or more tubular portions, the length of each portion is preferably at least 3 mm, more preferably at least 4 mm. Preferably, the external diameter of the polymeric insert is between about 6 mm and 9 mm, more preferably between about 7 mm and 8.5 mm, most preferably between about 7.2 mm and 7.9 mm for a standard sized cigarette or between about 6.6 mm and about 7.6 mm for a reduced diameter cigarette.

The dissolvable polymeric material forming the polymeric insert of the present invention includes one or more water soluble polymers. Preferably, the water soluble polymers are water soluble thermoplastics which can be readily processed to form the polymeric inserts and also provide a sufficient rigidity on hardening. Preferred water soluble thermoplastic polymers include starch and polyvinyl alcohol (PVA) which may be used individually to form the polymeric insert, or in a blend containing both polymers or one or more other dissolvable polymers known in the art.

Preferably, the dissolvable polymeric material includes one or more biodegradable polymers. Preferred polymers are fully biodegradable as defined in the Aqueous Aerobic Biodegradation Test (Sturm test) outlined in the European standard EN13432. After the polymeric material within the polymeric insert has dissolved, the biodegradable polymers can then advantageously be decomposed by natural, biological processes. The dissolution of the polymeric material advantageously disperses the biodegradable polymers so that the polymers can be more readily biodegraded within a shorter period of time. The preferred water soluble polymers, starch and polyvinyl alcohol, are both fully biodegradable.

The dissolvable polymeric material may be combined with one or more additional, inert components for forming the polymeric insert. Preferably, the polymeric material is combined with an organic or inorganic filler material. Suitable inorganic filler materials include calcium carbonate or titanium dioxide. Alternatively or in addition, the polymeric material may be combined with tobacco material. Other additional components may include, for example, pigments, whiteners, colourants or flavourants. As discussed above, the additional components may be water soluble or water insoluble. Where the additional components are water insoluble,

Preferably, filters according to the present invention have an overall RTD of between about 250 mm WG (water gauge) and about 500 mm WG, more preferably between about 275 mm WG and about 400 mm WG, most preferably between about 300 mm WG and about 400 mm WG, wherein the RTD is measured with all ventilation blocked. Preferably, smoking articles according to the invention have an overall RTD of at least about 30 mm WG, more preferably at least about 40 mm WG, wherein the RTD is measured prior to smoking with all ventilation blocked.

The RTD of a filter or smoking article is expressed herein with the units of pressure 'mm WG' or 'mm of water gauge' and is measured in accordance with ISO 6565:2002.

Preferably, the overall length of smoking articles according to the present invention is between about 70 mm and about 128 mm, more preferably about 84 mm.

Preferably, the external diameter of filters and smoking articles according to the present invention is between about 5 mm and 8.5 mm, more preferably about 7.9 mm.

Preferably, the overall length of filters according to the present invention is between about 18 mm and about 36 mm, more preferably about 27 mm.

Polymeric inserts as described above may advantageously be incorporated into a wide variety of different types of smoking article. For example, the polymeric inserts may be incorporated into combustible smoking articles, such as filter cigarettes, having a rod of tobacco cut filler or other smokable material, which is combusted during smoking.

Alternatively, the polymeric inserts may be incorporated into heated smoking articles of the type described above in which material is heated to form an aerosol, rather than combusted. For example, polymeric inserts according to the present invention may be incorporated into a heated smoking article comprising a combustible heat source, such as that disclosed in WO-A-2009/022232, which comprises a combustible heat source and an aerosol-generating substrate downstream of the combustible heat source. Polymeric inserts according to the present invention may also be incorporated into heated smoking articles comprising non-combustible heat sources, for example, chemical heat sources or electrical heat sources such as electrical resistive heating elements.

Alternatively, polymeric inserts as described above may be incorporated into smoking articles in which a nicotine-containing aerosol is formed from a tobacco material or other nicotine source without combustion and without heating, such as those described in WO-A-2008/121610 and WO-A-2010/107613.

Smoking articles according to the present invention may be packaged in containers, for example in soft packs or hinge-lid packs, with an inner liner coated with one or more flavourants.

~~According to the invention t~~There is further provided a method for forming a filter according to the invention, as described above. The method comprises the steps of: providing