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DEGRADABLE CIGARETTE FILTERS

BACKGROUND OF THE INVENTION

The present invention relates to degradable cigarette filters, and more particularly to
5 shaped fibers made from degradable materials and the use of such shaped fibers in cigarette filters.

Conventional cigarette filter plugs are made of cellulose acetate fibers bonded to each other by triacetin. After smoking, the spent filters are sometimes discarded in the environment. The cellulose acetate filaments therein tend to degrade slower than tobacco and/or the paper
10 parts of the cigarettes, often contributing to the litter in the environment. To reduce such litter, there is a need to replace cellulose acetate filaments in cigarette filters with materials that degrade faster than cellulose acetate in the environment. At the same time, there is also a need to retain the filtration chemistry, smoke characteristics and consumer acceptability from the cellulose acetate triacetin systems.

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SUMMARY OF THE INVENTION

Among the objects of the present invention is a cigarette filter produced from biodegradable materials formed into fibers with designed cross sectional shapes.

Another object of the present invention is a cigarette filter of biodegradable shaped fibers
20 with increased surface area and reduced overall material per filter.

Still another object of the present invention is a cigarette filter of biodegradable shaped fibers having micro cavities therein for retaining flavorants and adsorbents for favor delivery and selective filtration.

In accordance with the present invention, a biodegradable cigarette filter comprises
25 shaped fibers of PHBV. The fibers may have designed shapes in cross section that include Y, V, C, Triad, 4-DG and JC shapes. Moreover, the shaped fiber may include micro cavities with adsorbents and/or flavorants in the cavities.

BRIEF DESCRIPTION OF THE DRAWINGS

30 Novel features and advantages of the present invention in addition to those mentioned above will become readily apparent to persons of ordinary skill in the art from a reading of the following detailed description in conjunction with the accompanying drawings wherein similar parts are identified by similar reference characters and in which:

Figure 1 is a cross sectional view of a shaped biodegradable fiber having a Y shape;

35 Figure 2 is a cross sectional view of a shaped biodegradable fiber having a V shape ;

Figure 3 is a cross sectional view of a shaped biodegradable fiber having a C shape;

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Figure 4 is a cross sectional view of a shaped biodegradable fiber having a Triad shape;
Figure 5 is a cross sectional view of a shaped biodegradable fiber having a 4-DG shape;
and

Figure 6 is a cross sectional view of a shaped biodegradable fiber having a JC shape.

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DETAILED DESCRIPTION OF THE INVENTION

The cigarette filters of the present invention may be made of sheets, films, fiber bands, yarns, or non-wovens from biodegradable materials such as paper (wood pulps), wool, cellulose acetate with lower acetylating levels, starch, and starch based polymer composites, cotton,
10 polyactic acid, polyvinyl alcohol, polyhydroxyalkanoates, polyesters, polyesteramides, polycaprolactones, un-stabilized polypropylene, micro-glass materials, and their combinations. The biodegradable materials can be spun into fibers by melt spinning, dry spinning, wet spinning, electro spinning or any other known process into fibers.

For example, PHBV (Polyhydroxybutyrate-co-hydroxyvalerate) and its blends with
15 aliphatic aromatic polyester such as Ecoflex, PBS (poly butylenes succinate), d-, 1-, and dl- PLA (polyactic acid) and starch composites have been successfully spun into round cross section fibers by melt spinning process. However, in order to increase the surface area and reduce material use per filter, the filter fibers herein have improved cross sectional shapes. These shaped fibers are formed into filters and used in reduced litter cigarettes.

20 The cross section of the fibers may be controlled by the shapes of the die used in the spinning processes. As shown in Figures 1-6, the cross section of the fibers may be modified to Y, V, C, Triad, 4-DG, or JC by using appropriate dies in the melt spinning process. Other fiber cross sections that have been reported in the literature such as those in U.S. Patent 6,907,895 are included herein by reference.

25 To process these shaped fibers into cigarette filters, single or multi-strands of these shaped fibers from single or multiple components may be drawn and crimped into tow bands, or the strands of these shaped fibers made of faster degradable materials can be combined with cellulose acetate fibers to form a joint tow bands during the cigarette filter making process. Alternatively, nonwovens from the above fibers can be produced from melt-blown, spun bonded,
30 needle punched/felt, wet-laid, air-laid and other processes and then processed into cigarette filters by processes of rolling, folding or shredding. Appropriate amounts of a bonding/hardening agent may be applied onto the fibers in the filters as needed for firmness and smoke subjective adjustment. Adsorbents such as carbon granules and flavorants such as menthol can be impregnated into the micro cavities of the shaped fibers as well.

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CLAIMS:

1. A biodegradable cigarette filter comprising shaped fibers of PHBV.
- 5 2. A biodegradable cigarette filter according to claim 1 wherein the fibers have a Y shape in cross section.
3. A biodegradable cigarette filter according to claim 1 wherein the fibers have a V shape in cross section.
- 10 4. A biodegradable cigarette filter according to claim 1 wherein the fibers have a C shape in cross section.
5. A biodegradable cigarette filter according to claim 1 wherein the fibers have a Triad shape in cross section.
- 15 6. A biodegradable cigarette filter according to claim 1 wherein the fibers have a 4-DG shape in cross section.
7. A biodegradable cigarette filter according to claim 1 wherein the fibers have a JC shape in cross section.
- 20 8. A biodegradable cigarette filter according to claim 1 wherein the fibers include micro cavities.
- 25 9. A biodegradable cigarette filter according to claim 8 including adsorbents in the micro cavities.
10. A biodegradable cigarette filter according to claim 9 wherein the adsorbents include carbon.
- 30 11. A biodegradable cigarette filter according to claim 8 including flavorants in the micro cavities.
- 35 12. A biodegradable cigarette filter according to claim 11 wherein the flavorants include menthol.