

IMPROVEMENTS RELATING TO THE MANUFACTURE OF TOBACCO
SMOKE FILTERS

The invention the subject of the present application relates to the manufacture of tobacco smoke filter elements.

The most widely established method of manufacture of cigarette filter elements comprises the continuous feeding of plasticiser treated cellulose acetate tow and a web of wrapper paper to a garniture unit of a rod making machine. A driven endless band extends through the garniture unit and serves to convey the tow and wrapper paper web through the unit, wherein the wrapper paper is wrapped about the tow and lap seamed, there thereby being continuously produced a rod of circular cross-section. Downstream of the garniture unit the rod is cut into lengths a multiple, commonly six, of a unit element. Subsequent cutting of the rod lengths during the making of filter tipped cigarettes provides discrete filter elements. A similar method is used, although to a lesser extent, for the manufacture of paper filter elements, a web of crimped filter paper rather than cellulose acetate tow being fed to the garniture unit.

There have also been proposed methods of making filter rod by the extrusion of foamed thermoplastics materials. Such proposals have been disclosed in United Kingdom Patent Specification No. 451,683 (Sharman), United Kingdom Patent Specifications Nos. 1,271,274; 1,341,400; 1,442,631; 1,456,908 and 1,482,216 (Monsanto Chemicals Limited or Monsanto Limited) and in United States Patent Specification No. 4,180,536 (Celanese Corporation).

Mention is made in United Kingdom Patent Specification No. 694,436 (Mayer-Neville) of a cigarette filter element formed by rolling into cylindrical form a strip of porous latex foam. Similar filter elements are disclosed in United Kingdom Patent Specification No. 799,781 (Cogepa).

United Kingdom Patent Specifications Nos. 1,122,661 and 1,279,803 (Monsanto Chemicals Limited) relate to cigarette filter elements made from an extruded, foamed thermoplastic material which has been drawn, to impart unidirectional orientation to the material, and then worked in order to break down the foam structure and to produce a three dimensional structure of interconnected fibre elements.

United Kingdom Patent Specification No. 993,602 (Du Pont) teaches a method of making cigarette filter rod wherein a polyoxymethylene is extruded as a foamed structure ribbon, the ribbon is shredded under the action of a wire brush and the shreds are wrapped in a paper web. United Kingdom Patent Specification No. 1,183,498, in the name of the present applicants, teaches the comminution of synthetic foam materials, as for example in a hammer mill, and the wrapping of the resultant particulate material in paper to provide filter rod. A class of foam materials disclosed in United Kingdom Patent Specification No. 1,205,766 (National Patent Development Corporation) is said to provide a suitable tobacco smoke filter medium, especially when the materials are in particulate form. According to United Kingdom Patent Specification No. 1,194,492 (Strickman Foundation), a tobacco

smoke filtration material is provided by granulating a rigid polyurethane foam.

It is proposed in United States Patent Specification No. 3,800,808 (Brown & Williamson Tobacco Corporation) to make cigarette filter material by encasing a starch with a cellulose ester, cellulose acetate for example, swelling the starch and then removing the starch by enzymation and/or chemical hydrolysis or by solubilising the starch. The resultant foamed product is cut into shreds, which shreds are used as filter material for filter rod.

Although numerous proposals have been made in the patents literature for the use of foamed materials in or as cigarette filters, these proposals have failed to find practical application in the tobacco industry.

It is an object of the present invention to provide a method of making commercially acceptable filter rod, which method is practical and simple. It is another object of the present invention to provide a method in which readily available and inexpensive materials can be used to make commercially acceptable filter rod.

The subject invention provides a method of making a tobacco smoke filter element comprising foamed filtration material, wherein a particulate plastics material comprising one or more of the group of polypropylene, cellulose acetate, polyethylene, polyester, viscose and nylon, a polysaccharide comprising one or more of the group of starch, modified starch, cellulose and modified cellulose, and, optionally, a

binder, and water are fed to an extruder, the inclusion levels on a dry weight basis of the materials fed to the extruder being 5% to 95% for the plastics material, 95% to 5% for the polysaccharide and 0% to 5% for the binder, the polysaccharide, plastics material and binder either being blended together before being fed to the extruder or being fed directly to the extruder, and the extruder being operated under such heat and pressure conditions that immediately upon emergence of the extrudate from the extruder die, water, or at least a portion thereof, flashes into steam, thereby creating cells within the extrudate and a consequent swelling whereby the extrudate assumes a cross-section greater than that of the exit orifice of said extruder die, said extrudate being further processed into smoking article filter rod lengths by being fed continuously to the garniture of a filter making machine, or by being shredded and the thus produced particulate material being fed to a cigarette making machine.

If cellulose acetate is used as the plastics material, it may be derived from waste cigarette filters. Two or more plastics materials may be fed together to the extruder.

The polysaccharide used as an expansion agent may be a natural starch such, for example, as corn starch, or a modified starch. As an alternative the polysaccharide may be a cellulose, which term includes food grade cellulose, or a modified cellulose, methyl cellulose for example.

Other materials, chalk for example, may be fed to the extruder with the plastics material and the starch.

The materials fed to the extruder may include a binder, the inclusion level of which typically does not exceed 5%. Cellulosic binders, hydroxypropyl cellulose, carboxymethyl cellulose or sodium carboxymethyl cellulose for example, are especially useful. Alternatively, or in addition, a natural, or modified natural, binder may be used, examples being pectin, or pectin salts, and guar.

The materials fed to the extruder may include one or more of a nucleating agent, such, for example, as calcium carbonate or calcium acetate, a humectant such, for example, as glycerol, propylene glycol or sorbitol, and a lubricant such, for example, as pharmaceutical grade mineral oil.

The purpose of introducing water to the extruder is to produce the foamed structure of the extrudate. In the extruder the materials fed thereto are subjected to conditions of heat, 100°C to 250°C for example, and pressure such that immediately upon emergence from the exit die of the extruder, the water, or at least a portion thereof, flashes into steam, thereby creating cells within the extrudate and a consequent swelling of the extrudate. The water may be injected into the extruder through ports in the extruder barrel and/or be fed to the extruder via the feed hopper thereof.

Advantageously, the plastics material and the polysaccharide, plus other materials if utilised, are blended before being fed to the extruder.

The water may account, on a weight basis, for 1% to 20%

of the materials plus water fed to the extruder.

The density of the extrudate may be in a range of 20 mg/cc to 500 mg/cc.

The extruder used in carrying out the inventive process is suitably a twin-shaft cooker extruder.

Advantageously, the die of the extruder comprises a slit-form exit orifice, whereby the extrudate takes the form of a flat web or ribbon. Alternatively, the exit orifice of the die is such that the extrudate upon first issuing from the die is of tubular or near-tubular cross-section, the extrudate being then opened to provide a flat web or ribbon. The die may according to further alternatives be configured for the extrusion of a strand or for the coextrusion of a plurality of strands.

Advantageously, the extrudate when in web or ribbon form is subjected to a draw down step, so effecting an increase in the machine direction dimension of the extrudate and a decrease in the thickness thereof.

When the extrudate takes the form, for example, of a web or ribbon or a plurality of strands, it may be fed continuously to the garniture of a filter making machine, wherein it is gathered into rod form and wrapped in a plugwrap, the process being similar to that commonly adopted in the making of paper filters for cigarettes. Alternatively, a web, ribbon or strand(s) may be shredded to provide pieces approximating in size to cut cigarette filler, the so provided particulate material being then fed to a cigarette making

machine, wherein it is wrapped in plugwrap thus to provide filter rod rather than cigarette rod. Advantageously, before the extrudate passes to either of these rod forming stages it is subjected to the cooling action of cooling means.

The material fed to the filter or cigarette making machine may be treated with a bonding agent. Thus, for example, if the plastics material fed to the extruder comprises cellulose acetate, a triacetin bonding agent may be used. Again, for example, if the plastics material comprises polypropylene, the bonding agent may be a copolymer of ethylene and vinyl acetate.

If the extrudate is of an open cellular interior structure, the extrudate may take the form of a continuous rod of the required filter rod circumference. In such case the extrudate may be passed through sizing means, tubular sizing means for example, in order to ensure a consistent and accurate rod circumference. After formation to size the rod is cut into, for example, lengths six times unit filter element length.

Examples of the subject invention are as follows:

EXAMPLE I

A 50%:50% dry blend of polypropylene granules and Pfizer (Trade Mark) dietary fibre was fed to a Baker Perkins (Trade Mark) twin-shaft cooker extruder at a feed rate of 9.5 Kg/hr. The extruder was operated at a shaft speed of 110 r.p.m. and with an outlet die temperature of 126°C. Water was fed to the barrel of the extruder at a feed rate of one litre per

hour.

The resultant extrudate was a white, fluffy, soft but self-sustaining rod of a density of 0.032 g/cc.

EXAMPLE II

A 50%:50% dry blend of polypropylene granules and methyl cellulose granules manufactured by Celanese Corporation under designation M450 was fed to the extruder used in Example I at a feed rate of 16.0 Kg/hr. The operating conditions were: shaft speed - 130 r.p.m.; outlet die temperature - 140°C; and water feed rate - two litres per hour.

The resultant extrudate was a white, bubbly, firm, self-sustaining rod of a density of 0.053 g/cc.

The rods extruded in Examples I and II were suitable for being shredded to provide pieces of cigarette filler size for feeding to a cigarette making machine for the manufacture of wrapped filter rod.



CLAIMS

1. A method of making a tobacco smoke filter element comprising foamed filtration material, wherein a particulate plastics material comprising one or more of the group of polypropylene, cellulose acetate, polyethylene, polyester, viscose and nylon, a polysaccharide comprising one or more of the group of starch, modified starch, cellulose and modified cellulose, and, optionally, a binder, and water are fed to an extruder, the inclusion levels on a dry weight basis of the materials fed to the extruder being 5% to 95% for the plastics material, 95% to 5% for the polysaccharide and 0% to 5% for the binder, the polysaccharide, plastics material and binder either being blended together before being fed to the extruder or being fed directly to the extruder, and the extruder being operated under such heat and pressure conditions that immediately upon emergence of the extrudate from the extruder die, water, or at least a portion thereof, flashes into steam, thereby creating cells within the extrudate and a consequent swelling whereby the extrudate assumes a cross-section greater than that of the exit orifice of said extruder die, said extrudate being further processed into smoking article filter rod lengths by being fed continuously to the garniture of a filter making machine, or by being shredded and the thus produced particulate material being fed to a cigarette making machine.

2. A method according to Claim 1, wherein there is additionally fed to said extruder one or more of a nucleating agent, a humectant and a lubricant.
3. A method according to Claim 1 or 2, wherein said extrudate is subjected to a draw down step to effect an increase in the machine direction dimension of the extrudate and a decrease in the thickness thereof.
4. A method according to Claim 1, wherein said extrudate is processed to produce particulate material, said particulate material is treated with a bonding agent.
5. A method according to any one of Claims 1 to 3, wherein when said extrudate is fed to said filter making machine, said extrudate takes the form of a continuous rod of open cellular structure.
6. A cigarette comprising a rod of tobacco material wrapped in a wrapper and a tobacco smoke filter element produced according to the method of any one of Claims 1 to 5, the rod of tobacco material and the tobacco smoke filter element being interconnected by a tipping wrapper.

