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ANTISTATIC POLYETHYLENE COMPOSITIONS CONTAINING WATER-INSOLUBLE ALIPHATIC ALCOHOLS OR ETHYLENE-OXIDE CONDENSATION PRODUCTS

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This invention relates to improvements in polythene compositions and articles such as film, sheeting, filaments, coatings and the like prepared from polythene compositions. Polythene consists of polymers of ethylene corresponding substantially to the formula $(CH_2)_x$ and may be solid, semi-solid or grease-like at ordinary temperatures. The present invention is concerned only with those forms of polythene which are solid at ordinary temperatures.

In the manufacture and use of film, sheeting, filaments, coatings and the like comprising polythene there is a tendency for the material to accumulate electrostatic charges. Such accumulated charges are troublesome in that not only do they render the articles difficult to manipulate during manufacture, but they greatly increase the tendency for the articles to accumulate dust on their surfaces, which is a serious disadvantage when the articles are used for decorative purposes or as furnishing materials, particularly when they have an irregular or roughened surface.

It is an object of this invention to provide a process for reducing the tendency of polythene compositions and articles prepared therefrom to accumulate electrostatic charges. A further object is to provide an effective, inexpensive anti-static agent for polythene compositions and articles prepared therefrom which does not react chemically with polythene compositions or detract from the transparency or colour of articles prepared therefrom.

According to the present invention these objects are accomplished by a process which comprises treating polythene compositions or articles prepared from polythene compositions with either a condensation product obtained by the interaction of ethylene oxide with either a water insoluble fatty alcohol or a water-insoluble fatty acid, e. g. by the interaction of from 1 to 20 mols of ethylene oxide with 1 mol of said fatty alcohol or fatty acid; or with a saturated aliphatic alcohol containing more than 12 but not more than 32 carbon atoms.

Saturated aliphatic alcohols which are particularly suitable for use in the process of this invention are myristic, cetyl and stearyl. It is preferred, however, that one of the higher unsaturated alcohols, particularly oleyl alcohol, be added to the saturated alcohol, since some saturated alcohols, if used alone tend to "bloom" on the surface of the finished articles on storage. This addition of the oleyl alcohol does not appreciably affect the anti-static properties of the saturated aliphatic alcohol. As far as the action of the oleyl alcohol is at present understood it appears to hold the saturated alcohol in a single phase film on the surface of the polythene composition, preventing the saturated alcohol appearing on the surface as solid particles, and so preventing "blooming." The saturated aliphatic alcohols having radicals containing 14, 16 or 18 carbon atoms are preferred for use in the process of this invention because they are readily available.

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The preparation of the condensation products which may be used in the process of this invention may be carried out by the method described in British specification No. 380,431. The preferred condensation products are those obtained by the interaction of from 2 to 5 mols of ethylene oxide with 1 mol of the water insoluble fatty alcohol or fatty acid, since products containing higher molecular proportions of ethylene oxide, e. g. proportions as high as 17 mols of ethylene oxide, while being initially effective as anti-static agents, have a less permanent effect than the products within the preferred range. Suitable water insoluble fatty acids for use in forming these condensation products include, for example, capric, lauric, myristic, palmitic, stearic, montanic and naphthenic acids, while examples of suitable water insoluble fatty alcohols are hexyl, decyl, lauryl, myristic, cetyl, stearyl, and eicosyl alcohols. Mixtures of such acids or alcohols, e. g. the acids obtained from coconut oil or the mixture of alcohols obtained from sperm oil may also be used. Such mixtures are in fact preferred as they are available commercially at a more reasonable price than the purified alcohols or acids. Sperm oil alcohols are a mixture containing about 44% cetyl alcohol with smaller amounts of myristic, stearyl and eicosyl alcohols. The acids derived from coconut oil contain about 45% by weight lauric acid and smaller quantities of capric, myristic, palmitic and stearic acid together with a small amount about 5% of the unsaturated acids oleic and linoleic.

The process of this invention is preferably operated by incorporating from 0.1% to 5%, preferably from 0.5% to 1.5% by weight, of the anti-static agent with the polythene composition before the composition is used in the fabrication of articles. The anti-static agent may be incorporated with the polythene composition by fluxing in a suitable mixer, such as a Banbury mixer. Articles prepared from polythene compositions which do not contain these anti-static agents may, however, be treated by coating with the anti-static agent preferably by applying a solution or dispersion of the agent in water or an organic liquid, and thereafter removing the solvent or dispersion medium by evaporation.

Our invention is illustrated but in no way limited by the following examples, in which all parts given are by weight.

Example 1

400 parts of solid polythene, 6 parts of a commercial mixture of cetyl and oleyl alcohols containing 50% cetyl alcohol and 50% oleyl alcohol, 2 parts of oleyl alcohol, 0.4 part of diorthocresylolpropane as a stabilizer, and 4 parts of Blue Lake 24480 (I. C. I.) were incorporated by fluxing in a Banbury mixer. The mixture was then transferred from the Banbury mixer to a pair of malaxating rollers, which were steam-heated sufficiently to prevent the mixture from solidifying and worked into a sheet which was removed from the rollers by means of a doctor knife and allowed to cool.

The sheet obtained was suitable for use in the fabrication of articles such as handbags, or for cutting into chips for use in the production of moulded or extruded articles. Articles formed from the material showed a markedly reduced tendency to collect dust on their surfaces.

Example 2

As Example 1 except the mixture used consisted of 300 parts of solid polythene, 0.3 part diortho-cresylolpropane as a stabilizer, and 6 parts of myristic alcohol. The sheet obtained showed little tendency to collect dust on its surface.

Example 3

A sheet of material was made as in Example 1 from a mixture consisting of 300 parts solid polythene, 0.6 part of Red Seal zinc oxide, 3 parts stearyl alcohol and 0.3 part Cadmium Scarlet 10106 (Blyth Colour Works). The sheet formed though showing little tendency to collect dust on its surface, suffered from the defect of marked "blooming" on the surface of the sheet.

Example 4

As Example 1, except that the mixture used consisted of 400 parts of solid polythene, 4 parts of the product obtained by the condensation of sperm oil alcohols with 2.5 molecular proportions of ethylene oxide, 0.4 part of zinc oxide (Red Seal) and 0.08 part of Cadmium Tangerine 10105 (Blyth Colour Works). The sheet obtained did not collect dust and was free from blooming.

Example 5

4 parts of the condensation product obtained by the condensation of 1 molecule of N dodecyl alcohol with 3 molecules of ethylene oxide were mixed into 400 parts of solid polythene with the addition of 0.04 part of Monastral Fast Green G. S. (I. C. I.) and a sheet material produced from this mix by the method of Example 1. The resultant product showed little tendency to collect dust on its surface.

Example 6

A sheet of material was prepared by the method described in Example 1 from a mixture consisting of 500 parts solid polythene and 5 parts of the condensation product obtained by the condensation of the acids obtained from coconut oil and ethylene oxide. The mixture of acids contained 5% of capric acid, 45% of lauric acid, 18% myristic acid, 9% palmitic acid and 2% stearic acid together with 5% oleic and 2% linoleic acid. Condensation products containing the acid and ethylene oxide in the ratios 1:2 and 1:3 were used with success as anti-static agents.

The anti-static agents of this invention as well as reducing the tendency of dust to collect on the surfaces of sheet materials or moulded articles composed of polythene have the added advantage that they do not affect the mechanical strength of the sheets or moulded articles, they are not toxic in the quantities used, they do not impart unpleasant odours to the polythene and they do not discolour the articles in which they are incorporated.

We claim:

1. An anti-static plastic composition essentially comprising solid polythene and from 0.1% to 5% by weight of said composition of a material selected from the group consisting of: (1) a condensation product resulting from the condensation of 2 to 5 mols ethylene oxide and one mol of a compound selected from the group consisting of water insoluble fatty alcohols, said alcohols having from 6 to 20 carbon atoms and water insoluble fatty acids, said acids having from 10–28 carbon atoms; (2) a saturated aliphatic alcohol containing more than 12 but not more than 32 carbon atoms; (3) a mixture of a saturated aliphatic alcohol containing more than 12 but not more than 32 carbon atoms and oleyl alcohol.

2. An anti-static plastic composition essentially comprising solid polythene and from 0.5% to 1.5% by weight of said composition of a material selected from the group consisting of: (1) a condensation product resulting from the condensation of 2 to 5 mols ethylene oxide and one mol of a compound selected from the group consisting of water insoluble fatty alcohols, said alcohols having from 6 to 20 carbon atoms and water insoluble fatty acids, said acids having from 10–28 carbon atoms; (2) a saturated aliphatic alcohol containing more than 12 but not more than 32 carbon atoms; (3) a mixture of a saturated aliphatic alcohol containing more than 12 but not more than 32 carbon atoms and oleyl alcohol.

3. An anti-static plastic composition essentially comprising solid polythene and from 0.5% to 1.5% by weight of said composition a condensation product resulting from the condensation of 2 to 5 mols of ethylene oxide and one mol of a compound selected from the group consisting of water insoluble fatty alcohols, said alcohols having from 6 to 20 carbon atoms and water insoluble fatty acids, said acids having from 10–28 carbon atoms.

4. An anti-static plastic composition essentially comprising solid polythene and from 0.5% to 1.5% by weight of said composition of a condensation product resulting from the condensation reaction of 2 to 5 mols ethylene oxide and 1 mol of water insoluble sperm oil alcohols.

5. An anti-static plastic composition essentially comprising solid polythene and from 0.5% to 1.5% by weight of said composition a condensation product resulting from the condensation of 2 to 5 mols of ethylene oxide and one mol of a mixture of water insoluble fatty alcohols said mixture containing at least 44% cetyl alcohol and said alcohols having from 6 to 20 carbon atoms.

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