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REPROCESSING OF TEXTILE MATERIAL

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ABSTRACT OF THE DISCLOSURE

A process for removing a vinyl polymer from textile material which comprises subpecting the textile material to irradiation and subjecting the irradiated material to an alkaline solution.

In the processing of textile material, it is customary to apply various chemicals and other compounds to achieve particular properties or characteristics in the resulting product. Materials which are commonly applied to textile material include vinyl and acrylic polymers. Acrylic polymers such as various homopolymers or copolymers of an acrylic acid or an acrylate ester are employed to improve the hand and drapeability of textile materials and also certain acid-containing acrylic polymers are employed to provide soil release characteristics (see U.S. Pat. No. 3,377,249).

In the processing of such textiles, occasionally it is desirable to remove the acrylic polymer after it has been applied, for example, due to errors in the processing conditions, changes in market requirements, etc. Heretofore, it has been difficult to remove the vinyl polymer without causing degradation or deterioration of the textile itself.

The present invention provides a process for easily and conveniently removing degradable polymers from a textile. Also, the process of the invention permits the removal of the polymers without significantly degrading the textile.

In accordance with the invention, textile material is reprocessed by a process which comprises subjecting to irradiation, textile material which has been previously treated with a degradable vinyl polymer, and subjecting said irradiated textile material to an alkaline solution.

The textile material undergoing reprocessing in accordance with the invention may be any of a wide variety of materials including natural or synthetic fibers or blends of such fibers. Examples of natural fibers include cotton, linen, flax, etc. Suitable synthetic fibers are regenerated cellulose fibers such as viscose rayon, and also synthetic polymeric fibers, for example, polyamides, acrylics and particularly polyesters and blends thereof. Durable press garments and other articles generally are made from blends of polyester fibers and cellulosic fibers such as cotton and rayon fibers. The textile material undergoing reprocessing preferably is in the form of a fabric, although the process of the invention may be used on fibers, yarns, threads and the like.

The textile material is processed in accordance with the invention to remove the degradable vinyl polymer which previously has been applied thereto. The degradable vinyl polymer advantageously includes a degradable acrylic group, e.g., a methacrylic group. For example, the polymer may be a homopolymer of methacrylic acid, a methacrylic ester or a derivative thereof. Also, the polymer may be a copolymer where at least one

constituent is a methacrylic group. Examples of other degradable vinyl polymers include poly(vinylidene chloride), poly(methacrylamide), poly(tetrafluoroethylene) and the like. Degradable vinyl polymers generally are formed from monomer units which include a carbon atom with four groups attached thereto. This is in contrast to cross linkable polymers formed from units with hydrogen substituted carbon atoms.

Textile materials treated with the following copolymers may be reprocessed successfully in accordance with the present invention:

ethyl acrylate:methacrylic acid
ethyl acrylate:methacrylic acid:acrylamide
butyl acrylate:methacrylic acid
ethyl acrylate:itaconic acid
methyl methacrylate:acrylic acid
2-ethyl hexyl acrylate:methacrylic acid
acrylamide:methacrylic acid
butyl methacrylate:acrylic acid:acrylamide
ethyl acrylate:methacrylic acid:N-methylol acrylamide
ethyl acrylate:methacrylic acid:styrene
ethyl acrylate:acrylic acid:hydroxypropyl methacrylate
ethyl acrylate:methacrylic acid:divinyl benzene
ethylacrylate:methacrylic acid:allyl acrylamide
ethyl acrylate:methacrylic acid:glycidyl acrylate
ethyl methacrylate:sodium styrene sulfonate
styrene:methacrylic acid
ethyl acrylate:acrylic acid:hydroxyethyl methacrylate
hydroxyethyl methacrylate:acrylic acid:acrylamide
butyl methacrylate:ethyl methacrylate:acrylic acid

and the like.

The textile material to be reprocessed in accordance with the invention, as pointed out above, is subjected to irradiation. The term "irradiation" as used herein is meant to include that energy which is propagated through space, the possibility of propagation being unconditioned by the presence of matter, as distinguished from mere mechanical agitation in material such as is characteristic of the energy produced by sonic or ultrasonic trasducers, although the speed, direction and amount of energy transferred may be less effective as a result of the presence of matter. The level of irradiation to be used in accordance with this invention is that having sufficient energy to remove an electron from a gas atom forming an ion pair. The required energy is about 32 electron volts for each ion pair formed. Thus, irradiation of at least about 32 electron volts is effective for the process of this invention. Useful in the process are high energy particle irradiation such as electrons, protons, neutrons, α-particles and the like; ionizing electromagnetic irradiation such as γ-rays, X-rays, vacuum ultraviolet rays and the like, and combinations of such irradiations, e.g., corona discharge and the like.

Dosages within the range of about 0.001 megarad to 100 megarads may be utilized, a rad being the amount of high energy irradiation which leads to an energy absorption of one hundred ergs per gram of the absorbing material. The preferred range is between about 0.1 megarad and 10 megarads and preferably between about one and four megarads.

Subsequent to the irradiation step, the textile material is subjected to an alkaline solution. Advantageously, the alkaline solution is an aqueous solution including an alkali metal hydroxide such as sodium, potassium or lithium hydroxide. Also, ammonium hydroxide may be employed. Advantageously, an inorganic salt is present

in the alkaline solution. Preferably, the salt is an alkali metal salt, for example, a halide, sulfate, phosphate, nitrate, etc.

The proportion of the compound providing basicity in the alkaline solution is generally between about 0.5% and 10% by weight and preferably between about 1% and 4%. The inorganic salt advantageously comprises between about 1% and 16% by weight and particularly between about 3% and 8%. Especially useful are alkaline solutions in which the cation in the compound providing basicity is the same as the cation of the inorganic salt.

The textile material advantageously is immersed in the alkaline solution, although the alkaline solution may be applied in other ways such as spraying, padding, etc., provided sufficient exposure is achieved to substantially saturate the textile material. Exposure of the textile material to the irradiation and to the alkaline solution results in the stripping of the degradable vinyl polymer therefrom. The textile material then may be washed and dried and processed as desired.

The process of the invention is particularly useful in the reprocessing of textile material which has been treated to provide durable press characteristics in addition to treatment with a degradable vinyl polymer. Such treatment generally includes the use of a textile resin such as an epoxy, acetal or aminoplast resin. The term "textile resin" includes both monomers and polymers which after application to a textile material are polymerized and/or condensed and transformed to a thermoset state. In addition, the process of the invention is useful in the reprocessing of textile material where the durable press characteristics have been achieved through the use of a crosslinkable vinyl monomer with dual functionality, e.g., N-methylol acrylamide. Other suitable textile resins and crosslinkable vinyl monomers with dual functionality are set forth in U.S. Pat. 3,377,249.

The textile resin or crosslinkable vinyl monomer present on the textile material does not appear to be adversely affected during the subsequent irradiation and treatment with the alkaline solution. Thus, the process of the present invention is particularly useful in the stripping of polymers from textile material which has been treated to provide durable press characteristics. Furthermore, the invention is especially useful in the reprocessing of textile material which has durable press and soil release characteristics since degradable acrylic soil release polymers can be stripped using the procedure of the present invention.

The following examples illustrate preferred embodiments of the present invention but are not intended to restrict the scope thereof. In the examples, parts and percentages are by weight.

EXAMPLE I

A polyester/cotton fabric made from a 65%/35% blend which has been treated with a dihydroxy dimethylol ethylene urea textile resin and a soil release polymer comprising 70% methacrylic acid and 30% ethyl acrylate to provide 3.5% polymer on the fabric, is irradiated with a 2-megarad dose by passing the fabric through irradiation equipment having an insulated core transformer manufactured by High Voltage Engineering Corporation of Burlington, Mass. The irradiated fabric next is immersed in a 1% aqueous sodium hydroxide solution containing about 5% sodium chloride maintained at a temperature of about 85° F. After one minute, the fabric is removed from this bath and immersed for about one minute in a water bath at about the same temperature. The fabric is removed from the water bath, squeezed to remove excess liquid and then dried in an oven at about 225° F. Analysis of the resulting fabric shows that the proportion of polymer on the fabric is reduced to less than about 1%. In subsequent processing, the fabric performs the same as new fabric which has not been treated with the acrylic polymer and reprocessed according to the above procedure.

EXAMPLE II

The procedure of this example is the same as that of Example I except that the fabric being processed contains about 5% of a copolymer comprising 30% methacrylic acid and 70% ethyl acrylate. The results achieved are the same as those of Example I.

EXAMPLE III

The procedure of this example is the same as that of Example I except that the irradiation dose is increased to four megarads and the sodium chloride is omitted. The results are the same as those of Example I.

EXAMPLE IV

The procedure of this example is the same as that of Example I except that the sodium chloride is replaced with about 7% sodium sulfate. The results are the same as those of Example I.

EXAMPLE V

The procedure of this example is the same as that of Example I except that the sodium chloride is replaced with about 16% sodium phosphate. The results are the same as those of Example I.

EXAMPLE VI

The procedures of Examples I–V are repeated except that the sodium hydroxide is replaced with potassium hydroxide. The results are the same as those of the preceding examples.

The above description and examples show that the present invention provides a novel process for removing degradable vinyl polymers from textile material. Moreover, the process permits the removal of such polymers without harming the textile. In addition, the process of the invention is suitable for the removal of degradable vinyl polymers from textiles having durable press characteristics.

It will be apparent from the above that various modifications in the formulations and procedures described in detail may be made within the scope of the invention. Therefore, it is intended that the invention be limited only by the following claims.

That which is claimed is:

1. A process for removing degradable vinyl polymers from textile material which comprises subjecting textile material having thereon degradable vinyl polymers formed from monomer units which include a carbon atom with 4 groups attached thereto, to an irradiation dose between about 0.1 and 10 megarads and subjecting said irradiated textile material to an alkaline solution comprising between about 0.5 and 10% an alkali metal hydroxide or ammonium hydroxide to remove said degradable vinyl polymers from said textile material.

2. A process according to claim **1** wherein the degradable vinyl polymer is an acrylic polymer.

3. A process according to claim **1** wehrein the degradable vinyl polymer includes a methacrylic constituent.

4. A process according to claim **1** wherein the degradable vinyl polymer includes methacrylic acid.

5. A process according to claim **1** wherein the degradable vinyl polymer includes a methacrylate ester.

6. A process according to claim **1** wherein an alkali metal salt is included in the alkaline solution.

7. A process according to claim **6** wherein the alkali metal salt is a chloride, sulfate or phosphate.

8. A process according to claim **6** wherein the proportion of the alkali metal salt is between about 1% and 16% by weight of the solution.

9. A process according to claim **6** wherein the alkaline solution is an aqueous solution of an alkali metal hydroxide and an alkali metal salt.

10. A process according to claim **9** wherein the alkali metal cation of the compound providing basicity to the alkaline solution is the same as the cation of the alkali metal salt.

11. A process according to claim 9 wherein the proportion of the alkali metal hydroxide is between about 1% and 4% by weight and the proportion of the alkali metal salt is between 3% and 8% by weight.

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