

[54] **COMPOSITION FOR IMPARTING  
NON-PERMANENT SOIL-RELEASE  
CHARACTERISTICS COMPRISING AN  
AQUEOUS SOLUTION OF  
POLYCARBOXYLATE COPOLYMER AND  
WATER-SOLUBLE AMINE**

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[58] Field of Search ..... **260/29.6 N; 117/138.5**

[56] **References Cited**

**UNITED STATES PATENTS**

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[57] **ABSTRACT**

A composition for applying non-permanent soil-release finish to fabrics from dilute solution comprising a polycarboxylate polymer having an acid equivalent weight of from about 110 to 175, and a water-soluble amine. A preferred polycarboxylate polymer is a copolymer of  $\frac{2}{3}$  methacrylic acid/ $\frac{1}{3}$  ethylacrylate. The composition is particularly useful for applying a soil-release finish in the rinse cycle of a home laundry process.

**8 Claims, No Drawings**

**COMPOSITION FOR IMPARTING  
NON-PERMANENT SOIL-RELEASE  
CHARACTERISTICS COMPRISING AN AQUEOUS  
SOLUTION OF POLYCARBOXYLATE  
COPOLYMER AND WATER-SOLUBLE AMINE**

**BACKGROUND OF THE INVENTION**

This invention relates to a process for treating a textile substrate to impart a soil-release characteristic thereto which can conveniently be used in the rinse cycle of a home laundry procedure.

The genesis of synthetically produced textile fibers has brought about a tremendous effort in the textile industry along numerous avenues. There has been much research effort directed to the improvement of these synthetic fibers per se, and improved blends of synthetically produced fibers with natural fibers, i.e., cellulosic fibers or keratinous fibers. Results of this research have been successful and the direction of research has been diverted from the synthetic polymer per se and/or blends of said polymers with other naturally occurring fibers. Recently, fiber research has been directed towards improving physical characteristics of fabric produced from synthetic fibers and/or blends of these synthetic fibers with naturally occurring fibers, specifically, to the physical characteristics and/or endurance properties of garments produced from synthetic fabrics and/or fabric produced from blends of synthetic fibers and naturally occurring fibers.

Much research has been directed to the attainment of a garment having improved soil-release properties. Many of the synthetically produced fibers that are presently being incorporated in blends with naturally occurring fibers have a propensity to accept and retain oily grime and dirt. Accordingly, when the garment is being worn the soil and/or oily materials accumulate on the garment and settle in the fabric. Once the garment becomes soiled, it is then subjected to a cleaning process for removal of the dirt and/or oily deposits, and only a dry cleaning process will successfully clean the garment.

The cleaning process normally employed, however, is washing in a conventional home washing machine by the housewife. During a wash cycle, it is virtually impossible to remove the soil and/or oily stains from the garment, and secondly, assuming that the undesirable materials are removed from the garment or a fairly clean garment is being washed, soil remaining in the wash water is redeposited onto the garment prior to the end of the wash cycle. Hence, when the garment is removed from the washing machine and subsequently dried, it has not been properly cleaned. Such a condition, heretofore unavoidable, is quite disadvantageous in that the garment after being worn never again assumes a truly clean appearance, but instead tends to gray and/or yellow due to the soil and/or oily materials deposited and remaining thereon. Further use and washing of the garment increases the intensity of the graying to the point that ultimately the garment is unacceptable for further wear due to its discoloration. The process of the present invention solves the soiling problem as hereinafter described.

The problem heretofore confronted with fabrics having synthetic fibers incorporated therein, or made entirely of synthetic fibers, has been that the synthetic fibers as well as being hydrophobic, are oleophilic.

Therefore, while the oleophilic characteristics of the fiber permit oil and grime to be readily embedded therein, the hydrophobic properties of the fiber prevent water from entering the fiber to remove contaminants therefrom.

Attempts have been made to reduce the oleophilic characteristics of these synthetic fibers by coating the fibers with a coating that is oleophobic, i.e., will hinder the attachment of soil or oily materials to the fibers.

Many polymer systems have been proposed which are capable of forming a film around the fibers that constitute the textile material, particularly acid emulsion polymers prepared from organic acids having reactive points of unsaturation. These treating polymers are known as soil-release agents.

The term "soil-release" in accordance with the present invention refers to the ability of the fabric to be washed or otherwise treated to remove soil and/or oily materials that have come into contact with the fabric.

The present invention does not wholly prevent the attachment of soil or oily materials to the fabric, but hinders such attachment and renders the heretofore uncleanable fabric now susceptible to a successful cleaning operation. While the theory of operation is still somewhat of a mystery, soiled, treated fabric when immersed in detergent-containing wash water experiences an agglomeration of oil at the surface. This water is basic in nature, and it has been determined that soil-release is best realized in wash water that is basic in nature. These globules of oil are then removed from the fabric and rise to the surface of the wash water. This phenomenon takes place in the home washer during continue agitation, but the same effect has been observed even under static conditions. In other words, a strip of polyester/cotton fabric treated according to the process of the present invention and soiled with crude oil, when simply immersed in a detergent solution will lose the oil even without agitation.

Concentrated solutions of soil-release polymers have been padded onto fabrics by textile manufacturers to impart a permanent soil-release finish to the fabric. As the amount of soil-release polymer on the fabric is increased, the ability to release soil is increased. However, fabrics with this permanent soil-release finish possess many disadvantages. As the amount of soil-release polymer on the fabric is increased, the fabric has a tendency to become stiffer and lose the desirable hand characteristic of the fabric. Thus, the upper limit on the amount of soil-release polymer is determined by economics and the resulting adverse effect on the fabric. Fabrics with a relatively heavy application of soil-release polymer do not have the same desirable appearance and hand as the same fabrics without the soil-release polymer. Furthermore, practically speaking, there is a set range of soil-release agent that can be applied, dictated by commercial success.

Soil-release polymers are effective fabric treating agents even at very low levels on the fabric, at which levels the appearance and hand of the fabric are not adversely affected. Thus, an ideal method of treating a synthetic fiber-containing fabric would be to reapply a very small amount of soil-release polymer each time the fabric is washed, such as in the rinse cycle of the home laundry procedure.

Certain polycarboxylate polymers are very effective soil-release agents at low levels on the fabric. However, these polymers cannot be applied to fabrics from dilute

aqueous solutions because the polymers are so soluble in water that they will not deposit onto the fabric from dilute solution.

#### SUMMARY OF THE INVENTION

It has now been discovered that a very effective non-permanent soil-release finish can be applied to fabrics using a dilute aqueous solution of about 0.005 to 1.0 percent preferably .01 to 0.05 percent polycarboxylate polymer in the presence of a water-soluble amine. The amine serves to decrease the solubility of the polymer sufficiently to cause the polymer to be deposited onto the fabric from dilute aqueous solution. A preferred range of amine concentration is from 0.05 to 1.5 percent in aqueous.

Polycarboxylate polymers found to be effective soil-release agents when applied from dilute solution in the presence of a water-soluble amine are those polycarboxylate polymers having an acid equivalent weight (i.e., gram per mole of carboxylate) in the range of from about 110 to 175. The preferred acid equivalent weight for these polymers for use in this invention is about 125.

The most effective polymers for use as soil-release agents applied from dilute solutions in the presence of water-soluble amines are copolymers of methacrylic acid with ethylacrylate wherein the methacrylic acid comprises about  $\frac{2}{3}$  of the copolymer and the ethylacrylate comprises about  $\frac{1}{3}$  of the copolymer. The methacrylic acid/ethylacrylate copolymers that are effective have molecular weights ranging from about two thousand to about five million, although copolymers having a molecular weight of about one million are preferred. The copolymers form a hydrophilic film on the treated fibers upon drying, and afford soil releasability at that point. Each subsequent treatment with the polymer serves to enhance the soil-release characteristics of the substrate.

Water-soluble diamines have been found to be particularly effective in the compositions of this invention; specific examples of these diamines include tetramethylene diamine and N,N-dimethyl, N',N'-diethanoethylene-diamine. Water-soluble monoamines which are effective in the compositions of the present invention include N-methylethanolamine and N-phenyl diisopropylamine. Water-soluble tetramines which can be used in compositions of the present invention include N,N'-bis (3-aminopropyl)-1, 3-propane diamine and tris (2-aminoethyl) amine.

The proportion of water-soluble amines to the polycarboxylate polymers in compositions of the present invention ranges from about 1:5 to 40:1 with the preferred range being from about 1:1 to about 30:1.

The soil-release properties of pure cellulosic fiber fabrics are much better than those of synthetic fiber containing fabrics, e.g., polyester fibers, in that the synthetic polyester fibers are hydrophobic and thus prevent the ingress of water that is necessary for cleaning the fabric, and also possess an electrical charge that attracts soil particles. The present invention is therefore most primarily directed to fabrics containing a substantial portion of synthetic polyester fibers.

The present invention may be used to treat a wide variety of textile materials made exclusively from synthetic polymer fibers, as well as blends of natural and synthetic fibers. Examples of synthetic fibers which may be successfully employed in the practice of the

present invention include those made with polyamide, acrylic, and polyester fibers. Blends of natural and synthetic fibers which may be successfully treated according to the present invention include fabrics comprising 50% polyester/50% cotton, 65% polyester/35% cotton, etc. Cellulose fibers, for example, cotton, viscose, regenerated cellulose, etc., also may be combined with the synthetic fibers.

#### DESCRIPTION OF THE PREFERRED EMBODIMENTS

Treating compositions were made up of a copolymer of  $\frac{2}{3}$  methacrylic acid/ $\frac{1}{3}$  ethylacrylate of a molecular weight of about one million, with the percentage of a water-soluble amine as shown in Table I.

Table I

| Composition | Amine Used                                         |
|-------------|----------------------------------------------------|
| A           | 0.18% N,N dimethyl N',N' diethanoethylene diamine  |
| B           | 0.88% N,N dimethyl, N',N' diethanoethylene diamine |
| C           | 0.24% tetramethylethylene diamine                  |
| D           | 1.1% tetramethylethylene diamine                   |
| E           | 0.4% N-methyl ethanolamine                         |
| F           | 0.05% tris (2-aminoethyl) amine                    |

The treating compositions were dissolved in water to make solutions 0.05 percent in copolymers and the amine concentration listed. Identical polyester/cotton swatches were soaked in 250 mls. of the treating solutions for 10 minutes. The pH of the treating solutions was between 6 and 7.

The treated swatches were soiled by applying to each swatch three drops of a 1:1 mixture of dirty motor oil/mineral oil. The oil was allowed to spread and set for three hours. The swatches were then washed in 650 mls. of a solution containing one gram of a 10-2-2 (anionic-nonionic-soap) commercially available laundry detergent, at 80°-90°F for 10 minutes, rinsed for 5 minutes, and dried.

Table II

| Swatch  | Reflectance, Rd Units |
|---------|-----------------------|
| A       | 73.9                  |
| B       | 73.7                  |
| C       | 71.9                  |
| D       | 73.5                  |
| E       | 71.2                  |
| F       | 65.4                  |
| control | 48.7                  |

It can be seen from the foregoing examples that this copolymer of methacrylic acid/ethylacrylate is effective as a soil-release agent when deposited from dilute solution in the presence of a water-soluble amine. The composition of the invention is particularly well adapted to be used in the rinse cycle of a home laundry system, as the copolymer in the presence of the water-soluble amine will deposit the soil-release finish onto fabrics from dilute solution. The composition can be added directly to the rinse water without adjusting the pH or the temperature of the water.

None of the swatches treated in the foregoing example had chunks of polymer visible on the surface of the swatches, and the original hand of the fabrics was not adversely affected by the treatment with the soil-release polymer of the invention. The treated swatches appeared to have more body than before treatment.

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In addition, a slight amount of foam was generated during the treatment process only by the solution containing tris (2-aminoethyl) amine; the remaining solutions were clear.

An added feature of the present invention is the prevention of soil redeposition from the wash water by virtue of the soil-release coatings on the synthetic fibers. One of the greatest disadvantages inherent in the synthetic polymers is the feature that even after removing the soil by washing, there is the continued danger that the soil will be redeposited onto the fibers from the wash water before the garment is removed therefrom.

What is claimed is:

1. A composition for imparting non-permanent soil-release characteristics to textile fabrics comprising a copolymer of  $\frac{2}{3}$  methacrylic acid and  $\frac{1}{3}$  ethyl acrylate having an acid equivalent weight of from about 110 to 175 and a molecular weight of about 2000 to about 5,000,000 and a water-soluble amine selected from the group consisting of tetramethylene diamine; N-methylethanolamine; N,N dimethyl, N'N'-di-

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thanoethylene-diamine; N,N' bis(3-aminopropyl)-1,3-propane diamine; tris (2-aminoethyl) amine; and N-phenyl diisopropylamine, said copolymer and said water soluble amine being present in a ratio ranging from about 1:5 to 40:1.

2. The composition of claim 1 wherein the copolymer has an acid equivalent weight of 125.

3. The composition of claim 1 wherein the copolymer consists of about  $\frac{2}{3}$  methacrylic acid and about  $\frac{1}{3}$  ethylacrylate.

4. The composition of claim 1 wherein the ratio of amine to polymer is from 1:1 to 30:1.

5. The composition of claim 1 wherein the amine is tetramethylene diamine.

6. The composition of claim 1 wherein the amine is tris (2-aminoethyl) amine.

7. The composition of claim 1 wherein the amine is N,N-dimethyl, N',N'-diethanoethylene-diamine.

8. The composition of claim 1 wherein the molecular weight of the copolymer is about one million.

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