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COMPOSITION AND METHOD FOR TREATING CARPETS AND PILE FABRICS

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ABSTRACT OF THE DISCLOSURE

A composition and method for treating carpets and pile fabrics to enhance the abrasion resistance and antistatic properties of such articles are disclosed. The compositions are formulated by adding an aqueous emulsion of oxygen-free polyethylene to a conventional detergent composition adapted for the cleaning of carpets and pile fabrics, advantageously a carpet or upholstery shampoo. In shampooing a carpet or pile fabric with the subject compositions, there is additionally obtained an increase in foaming action of the shampoo as well as a decrease in the force necessary to apply the shampoo.

This invention relates to a composition and method for treating carpets and pile fabrics, and more especially, to the treatment of carpets and pile fabrics to improve their abrasion resistance and to decrease their propensity to generate charges of static electricity.

It is known in the art to treat carpets and pile fabrics by coating or impregnating them with various types of thermoplastic and/or thermosetting synthetic resins (see, for example, U.S. Pat. 3,433,666); however, these previously known methods of treatment are typically not designed for application by the ultimate consumer or user of the carpeting and, therefore, necessitate an extra step in the manufacture of the product, thereby significantly increasing the cost of the product to the consumer. The present invention, on the other hand, relates to a method for treating carpets and pile fabrics which is specifically designed so as to be readily carried out by the consumer in connection with his normal maintenance of the product, namely, the cleaning or shampooing which must periodically be conducted. Moreover, in addition to improving the aforementioned properties of the carpets and pile fabrics, the method of the invention unexpectedly facilitates the normal cleaning or shampooing operation.

SUMMARY OF THE INVENTION

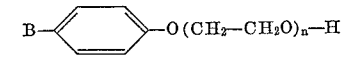
Accordingly, it is an object of this invention to provide a composition and method for treating carpets and pile fabrics to improve their abrasion resistance and antistatic properties.

Another object of the invention resides in the provision of a composition and method for treating carpets and pile fabrics in conjunction with conventional cleaning operations to obtain the foregoing improvements in properties.

It is also an object of the invention to provide a composition and method for the treatment of carpets and pile fabrics which additionally facilitate conventional cleaning techniques for such articles.

Other objects, features and advantages of the invention will become apparent from the description of the invention which follows.

In accomplishing the foregoing objects, there has been provided according to the invention, in any conventional detergent composition adapted for the cleaning of carpets and pile fabrics, the improvement comprising adding to such a composition an aqueous emulsion of polyethylene in an amount sufficient to provide from about 0.1 to about 10.0 percent by weight of emulsified polyethylene particles in the final, diluted detergent composition. The aqueous emulsion of polyethylene employed may be either anionic or non-ionic and is a mechanically stable emulsion of substantially oxygen-free polyethylene particles having an average particle size of from about 0.02 to 0.5 micron and an average molecular weight of from about 7,000 to about 40,000. The polyethylene particles have at least 30 percent of their surface area covered with an emulsifier composition, the most preferred nonionic emulsifiers being those of the formula



wherein R is an alkyl group having 8 to 9 carbon atoms and n is an average number of from 7 to 15, and the most preferred anionic emulsifiers being selected from (1) a salt of a saturated fatty acid having 12 to 18 carbon atoms, (2) a salt of a sulfate of a saturated fatty alcohol having about 12 to 18 carbon atoms, and (3) a salt of a sulfate of an ethoxylated saturated fatty alcohol containing 12 to 18 carbon atoms and average number of ethoxy groups between 1 and 5.

Application of the foregoing detergent compositions proceeds by conventional cleaning methods, namely, contacting the carpet or pile fabric with the detergent composition, causing the detergent composition to foam upon the carpet or pile fabric, and finally, removal of the detergent composition from the surface of the article, as, for example, by vacuuming. In addition to enhancing the abrasion resistance and antistatic properties of the carpet or pile fabric, the topic detergent compositions when employed in accordance with the method of the invention, also result in an increase in the foaming action of the compositions when applied as a foam, and similarly, result in a decrease in the force necessary to apply the shampoo in the carpet or pile fabric.

DETAILED DESCRIPTION OF THE INVENTION

It has been discovered in accordance with the present invention that the addition of an aqueous polyethylene emulsion to a conventional carpet or pile fabric shampoo or the like results in significant advantages insofar as the properties of the article after cleaning and the application of the cleaning composition itself are concerned. The invention is broadly applicable to any type of cleaning composition designed for carpets, pile fabrics and the like so long as an aqueous polyethylene emulsion is miscible therein, e.g., the composition is aqueous based either before or after dilution prior to application. Typically, compositions of this type are of the foaming or lathering variety which, after application, are designed to be self-foaming, e.g., those dispensed from an aerosol can, or to be formed by mechanical manipulation, e.g., an electric rug shampooer. This type of detergent composition is most preferred for use in conjunction with the present invention because it has been found that the addition of

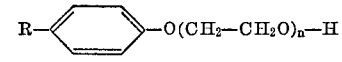
emulsified polyethylene particles thereto results both in an enhancement of the foaming action of the shampoo upon application and also results in a noticeable decrease in the force necessary to apply the shampoo in the case of mechanically foamed compositions. The latter effect is believed to result from a synergistic effect of the polymer and emulsifier on the fabric, thereby minimizing frictional forces. The advantages of such an improvement to the consumer are obvious. Advantageous results according to the invention are, however, not limited to cleaning compositions of the foaming type. While the improvements realized in the application procedure are not as noteworthy in the case of non-foaming compositions, the enhanced properties realized in treated carpets and the like are nonetheless equivalent to those obtainable with compositions of the foaming variety.

Carpets which may be treated with the compositions and method of the invention may be constructed by any known method. Thus, the carpet may be one of the woven types of carpet consisting largely of fibrous material, or it may be a tufted carpet in which the pile fibers are embedded in a non-textile backing, for example, a rubber backing. The fibers of the carpet may be any of those known to be used in the construction of carpets, and include wool, cellulose, particularly a regenerated cellulose such as viscose, synthetic fibers including those comprised of polyamides such as nylon, polyesters such as polyethylene terephthalate, polyolefins such as polyethylene and polypropylene and polymers or co-polymers of acrylonitrile. Blends of fibers may also be used. Pile fabrics which may be treated with the compositions and method of the invention may be comprised of fibers of any of the types mentioned above as being useful for the fabrication of carpets. The advantages conferred in accordance with the invention are particularly evident in the case of carpets and upholstery pile fabrics consisting wholly or substantially of natural fibers or synthetic fibers of nylon or acrylonitrile polymers or copolymers. Articles of the foregoing type typically have very poor abrasion resistance, and carpets, especially, of the aforementioned synthetic polymers are particularly prone to the accumulation and generation of static electricity charges, particularly at low atmospheric humidities. Thus, treatment in accordance with the present invention provides the most notable degree of enhancement in the abrasion resistance and antistatic properties of these particular products.

The aqueous emulsions of polyethylene utilized in the present invention are well known in the art and do not in and of themselves form any part of the present invention. Suitable commercially available emulsions may contain anywhere from about 5 to about 50 solids content by weight, although the more concentrated emulsions must be diluted before application in accordance with the present invention, as described hereinbelow. The polyethylene solids contained in the aqueous emulsions are substantially oxygen-free (less than about 1%), substantially sulfur-free (less than about 0.1%) materials having melting points from about 80° to about 115° C., and average molecular weights of from about 7,000 to about 30,000 or 40,000. Depending upon the specific conditions under which they are prepared, the polymers may have inserent viscosities ranging between about 0.25 and about 1.4. The density of the polyethylene solids is generally between about 0.91 and 0.94 gram per cubic centimeter. Thus, the polyethylene solids are to be carefully distinguished from certain prior art oxygenated polyethylenes which are produced by telomerization of ethylene and subsequent oxidation of the telomer, or by thermodegradation of high molecular weight polyethylenes to low molecular weight products which are then oxidized. Such prior art oxygenated materials rarely exhibit a molecular weight of more than about 3,000, and moreover, are characterized by a yellowish color and disagreeable odor which render them undesirable for use in the present invention.

The latex particles of suitable polyethylene emulsions range in average size between about 0.02 micron and about 0.05 micron. Generally, at least about 30% of the total available surface area of the polyethylene particles is covered with an emulsifying agent, and more typically, the degree of coverage ranges between about 30% and 80%. However, suitable emulsions for the purposes of the present invention may contain polyethylene particles post-stabilized with additional emulsifier to saturate the particles such that they have substantially 100% of their total available surface area covered with one or more emulsifying agents. See U.S. Pat. No. 3,296,162.

Both anionic and non-ionic polyethylene emulsions, as well as emulsions stabilized with anionic/non-ionic emulsifier systems, are suitable for use in the present invention. Non-ionic polyethylene emulsions presently preferred in the invention are those wherein the non-ionic emulsifying agent is an alkylphenoxy polyoxyethylene ethanol emulsifier of the formula.



wherein R is an alkylchain having 8 or 9 carbon atoms, advisably branched such as a polypropylene or polybutylene chain and n represents an average number of 7 to about 15. Typical commercially available emulsifiers of this type include the "Triton" series such as "Triton X–100" (R=C_8; n=9–10); "Triton X–144" (R=C_8; n=7–8); "Triton N–101" (R=C_9; n=9–10); "Triton N–128" (R=C_9; n=12–13); "Tergitol NPX" (R=C_9; n=10); and "Igepal CO–730" (R=C_9; n=13.5).

Aqueous non-ionic emulsions of polyethylene may be obtained by polymerizing ethylene in an aqueous medium at a temperature of from about 60° to 150° C., and preferably at a temperature of from about 70° to 100° C. Pressures employed in the polymerization reaction may range between about 2,000 and 20,000 p.s.i., but preferably are within the range of about 2,500 to 4,500 p.s.i. The aqueous medium may optionally contain an alcohol such as t-butanol in amounts up to about 35% by weight of the medium. An initiator, such as an alkali metal persulfate, e.g. potassium persulfate, may be employed, generally in amounts of from about 0.08% to about 0.5% based on the weight of the aqueous medium. Polymerization proceeds in the presence of from about 1 to 5% of a non-ionic emulsifier, also based on the weight of the aqueous medium. Emulsions produced directly in the polymerization process typically have a minimum of about 14% solids by weight because of practical reasons and may contain up to 30% or even 40% solids while still retaining their stability. Average particle size typically ranges between 0.03 and 0.15 micron, and to assure that no agglomeration of particles occurs, it is preferred that about 80% coverage with emulsifier is achieved. Under certain conditions the emulsions may be post-stabilized to concentrations of about 50% solids by weight. The non-ionic emulsions are characterized by reactor stability, strip stability, shelf stability, chemical stability, pH stability and, with few exceptions, mechanical stability. A description of several preferred nonionic polyethylene emulsions and several methods for producing such emulsions are contained in U.S. Pats. No. 3,226,352; No. 3,296,162; No. 3,536,643. A most preferred non-ionic polyethylene emulsion is available under the trademark "Poly-Em 40" from Cosden Oil & Chemical Company, Big Spring, Tex.

Anionic polyethylene emulsions presently preferred in the invention are those wherein the anionic emulsifying agent is one of three types: (1) the salts of saturated

fatty acids, in particular the sodium salts of fatty acids having 12 to 18 carbon atoms, such as potassium stearate, myristate, and laurate; (2) salts, particularly sodium salts, of sulfates of fatty alcohols having 12 to 18 carbon atoms, or mixtures thereof; and (3) salts, particularly sodium salts, of sulfates of ethoxylated fatty alcohols having about 12 to 18 carbon atoms and an average number of ethoxy groups between 1 and 5. Some of these emulsifiers are commercially available, for example, under the trade names "Duponol C," "Duponol WAQE," "Duponol ME," etc., which contain primarily sodium sulfates of C_{12} alcohols, "Sipex TDS" which is sodium tridecyl alcohol sulfate, and "Sipex ESY" which is the sodium salt of ethoxylated lauryl sulfate having an average of about 1.5 ethoxy groups.

A suitable method for the production of aqueous anionic emulsions of polyethylene involves polymerizing ethylene in an aqueous medium at a temperature of from about 70° to 100° C. and a pressure between about 2,500 and about at least 5,000 p.s.i. The aqueous medium, which may contain up to about 20 to 25 parts by weight of t-butanol, may also contain a pH adjuster such as tripotassium phosphate which maintains the pH of the aqueous medium at a value between about 8.5 and 10.5 in the presence of the emulsifying agent. An alkali metal persulfate initiator, such as potassium persulfate or sodium persulfate, is employed in concentrations of from about 0.06 to 0.5% by weight of the aqueous medium. The emulsifier is employed in amounts of less than about 9% by weight of the aqueous phase used in the emulsion polymerization, and suitably between about 0.9% and about 9% by weight. Typically the emulsifier is present in an amount of about 1.2% to about 3% by weight of the aqueous phase. The emulsifier may be added to the aqueous phase as a salt or in the form of alkali and acidic components in quantities suitable for the in situ formation of the salt. Polymerization is carried out until the reactor latice contain about 20 to 30% by weight of solids, which corresponds to a degree of coverage of the particles' surface area between about 70 and 30%. Average particle sizes are between about 0.02 micron and 0.5 micron. The anionic polyethylene emulsions may also be post-stabilized to concentrations up to about 50% and greater by saturating the polyethylene particles with one or more additional emulsifiers which may be either anionic or non-ionic. The anionic emulsions are characterized by reactor stability, strip stability, shelf stability, chemical stability and, with few exceptions, mechanical stability. Several preferred anionic polyethylene emulsions together with methods for producing the same are contained in U.S. Pats. No. 3,244,652; No. 3,296,162 and No. 3,352,807. The most preferred anionic polyethylene emulsion is available under the trademark "Poly-Em 12" from Cosden Oil & Chemical Company, Big Spring, Tex.

The amount of polyethylene emulsion to be incorporated into a detergent composition in accordance with this invention is not particularly critical. Typically, enough polyethylene emulsion is added to a given carpet or upholstery shampoo such that when the product is diluted in contemplation of ultimate use, usually dilution is with from 5 to 100 volumes of water, it will contain from about 0.1 percent to about 10.0 percent by weight of emulsified polyethylene particles based on the total solids content of the finally diluted composition. It is to be understood, however, that the topic formulations may contain a larger percentage of polyethylene particles, although no particular advantage is obtained thereby. Likewise, it will be appreciated that the lower limit set forth above is merely a practical limitation since even the smallest concentration of emulsified polyethylene particles will impart some degree of enhancement to the properties of the treated article. In a preferred embodiment of the invention, the content of emulsified polyethylene particles ranges from about 0.25 percent to about 5.5 percent.

The following specific embodiments are presented to more fully illustrate the invention, it being understood that the same are merely intended to be illustrative and in no wise limitative.

EXAMPLE 1

A carpet and upholstery shampoo is prepared containing 1 percent emulsified polyethylene solids by weight based upon total solids. The shampoo formulation consists of the following ingredients:

	Parts by weight
Oleic acid	28.0
Coconut oil fatty acids	21.0
Isopropanol (99%)	30.0
Triethanolamine	14.0
Monoethanolamine	6.8
"Tergitol NPX" non-ionic	5.0
Water	15.0

and is diluted with 8 parts by volume of water before application. The polyethylene emulsion is a pH stable, nonionic emulsion available under the trademark "Poly-Em 40" from Cosden Oil & Chemical Company, Big Spring, Texas, and has the following properties:

Total solids	40.6%.
Total emulsifier	5.21%.
pH	7.7.
Brookfield viscosity (25° C.)	50 cps.
Particle size	<1 micron.
Polymer density	0.920 gr. per cc.
Polymer inherent viscosity (0.2% polymer in Tretalin at 135° C.)	0.53.
Polymer apparent average molecular weight	18,000.
Polymer melting point (modified ring and ball method)	109° C.

A section of nylon tufted carpet is shampooed with the above formulation, allowed to dry and then vacuumed to remove the dry shampoo. Two 4-inch diameter circles are cut from the treated carpet and two 4-inch diameter circles are cut from an identical piece of untreated carpeting.

A taber abrader is then utilized to test the carpet samples for abrasion resistance. The machine consists of a revolving circular platform 4 inches in diameter, 2 wheels of given width and coarseness (a CS–10 rubber wheel, and H–18 and H–22 stone wheels, H–22 being coarser than H–18), 2 weights of given mass (½ and 1 kilogram), and a vacuum cleaner suspended ¼ inch above the sample.

The two treated samples and two untreated control sections of carpeting are then weighed to 0.0001 gram, and each is tested by attaching it to the revolving circular platform by adhesive paper and a clamp. The 2 wheels, in this case the H–22 stone wheels, are then lowered onto the sample and weighted with the 1 kilogram mass. The platform is then revolved 1000 revolutions and the vacuum removes any portion of the fabric abraded from the sample by the wheels. After 1000 revolutions, each sample is removed and re-weighed, with the difference in weight representing the degree of abrasion. In this case, an improvement of 86 percent is realized. The data for this experiment are set forth in Table I below.

EXAMPLES 2–7

The procedure of Example 1 is repeated for various other types of carpeting and upholstery pile fabric, also utilizing different abrasion wheels, different loads and varying numbers of cycles. The results for these experiments are set forth in Table I.

TABLE I

Example number	Samples	Wheel	Load, kg.	Cycles	Average wt. loss	Improvement, percent
	Carpet samples (2 samples)					
1	Nylon tufted carpet:					
	Control	H-22	1	1,000	.6415	86
	Treated	H-22	1	1,000	.3337	
2	Acrylic tufted carpet:					
	Control	H-22	1	1,000	1.6372	14
	Treated	H-22	1	1,000	1.4364	
3	100% wool:					
	Control	H-18	[1] 500	300	.3343	9
	Treated	H-18	[1] 500	300	.3064	
	Upholstery samples					
4	Vectra olefin:					
	Control	H-18	[1] 500	300	.3339	47
	Treated	H-18	[1] 500	300	.2274	
5	100% cotton:					
	Control	CS-10	[1] 500	600	.1473	20
	Treated	CS-10	[1] 500	600	.1232	
6	100% Nylon:					28
	Control	H-18	[1] 500	500	.1573	
	Treated	H-18	[1] 500	500	.1213	
7	40% cotton-60% rayon:					
	Control	CS-10	[1] 500	300	.1050	17
	Treated	CS-10	[1] 500	300	.0898	

[1] Grams.

EXAMPLE 8

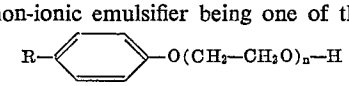
Eight ounces of the polyethylene emulsion specified in Example 1 is added to 15 gallons of commercial shampoo produced by Town and Country. One-half of a room having its floor covered with acrylic tufted carpeting is then shampooed with an electric carpet shampooer following the shampoo manufacturer's instructions. The other half of the room is shampooed in a like manner with the identical commercial shampoo to which no polyethylene emulsion has been added. By comparison, it is observed that the polyethylene-containing shampoo produced a larger amount of foam than did the commercial shampoo by itself. Additionally, it is noted that the drag between the carpet shampooer and the carpeting is virtually eliminated with the polyethylene-containing shampoo, and consequently the effort necessary to effectively shampoo the carpet is noticeably reduced. In a final comparison, persons consciously attempting to accumulate static electric charges via their feet and pass them on in the form of electric shocks were unable to do so on the half of the carpeting treated with the polyethylene-containing formulation, whereas no improvement in the static electricity properties was apparent on the outer half of the carpeting. The foregoing antistatic effect conferred upon the carpet section shampooed with the polyethylene-containing shampoo formulation is noted to remain effective for several weeks after treatment with the shampoo.

Thus, there has been provided according to this invention a composition and method for enhancing the abrasion resistance and antistatic properties of carpets and pile fabrics. At the same time, the invention provides a method whereby the foregoing beneficial effects are achieved in the course of normal maintenance of the carpet or pile fabric involving merely periodic cleaning of the subject materials. Although the beneficial effects are not permanent, they retain their vitality for periods of time corresponding to the normal interval between cleaning, whereupon they will again be automatically restored through use of the compositions according to the invention.

While there have been described and pointed out the fundamental novel features of the invention as applied to the preferred embodiment, those skilled in the art will appreciate that various modifications, changes and omissions in the composition and method for treating carpets and pile fabrics described herein can be made without departing from the spirit of the invention. It is intended, therefore, to be limited only by the scope of the following claims.

What is claimed is:

1. A method for treating a carpet or pile fabric to enhance the abrasion resistant properties thereof and reduce the propensity thereof to generate static electricity charges, which comprises cleaning said carpet or pile fabric with a detergent composition containing therein an aqueous emulsion of polyethylene in an amount sufficient to provide from about 0.1 to about 10.0% by weight of emulsified polyethylene particles, said polyethylene particles containing less than 1% oxygen and having an average particle size of from about 0.02 to 0.5 micron and an average molecular weight of from about 7,000 to about 40,000 and having at least 30% of their surface area covered with a non-ionic emulsifier or an anionic emulsifier, said non-ionic emulsifier being one of the formula:



wherein R is an alkyl group having 8 to 9 carbon atoms and *n* is an average number of from 7 to 15, said anionic emulsifier being one selected from the group consisting of (1) a sodium or potassium salt of a saturated fatty acid having 12 to 18 carbon atoms, (2) a sodium or potassium salt of a sulfate of a saturated fatty alcohol having from 12 to 18 carbon atoms, and (3) a sodium or potassium salt of a sulfate of an ethoxylated saturated fatty alcohol containing 12 to 18 carbon atoms and having an average number of ethoxy groups between 1 and 5.

2. The method as defined by claim **1** wherein said cleaning comprises contacting said carpet or pile fabric with said detergent composition, causing said composition to foam while in contact with said carpet or pile fabric, permitting said composition to dry and thence removing said composition from the carpet or pile fabric.

References Cited

UNITED STATES PATENTS

3,226,352	12/1965	Helin et al.	260—94.9 A
3,296,170	1/1967	Burkhart et al.	260—94.9 A
3,352,807	11/1967	Helin et al.	260—94.9 A
3,536,643	10/1970	Stryker et al.	260—94.9 A
3,401,007	9/1968	Hoffman et al.	8—137

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