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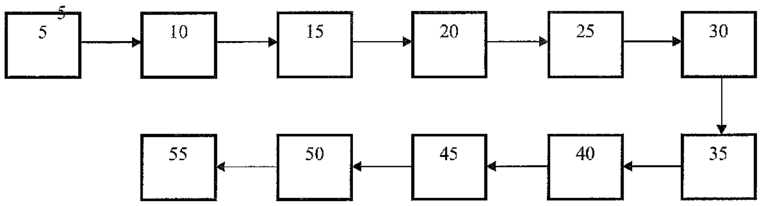
(54) **Title**: AQUEOUS DISPERSION OF DYE, STAIN-BLOCKER, AND FLUOROCHEMICAL AND ITS USE IN THE MANUFACTURE OF CARPET

FIGURE 1



(57) **Abstract**: Disclosed is composition comprising an aqueous dispersion containing a dye, a stain blocker component, and an anti-soil component. The composition provides uniform dyeing, and superior stain blocking and anti-soil characteristics to fibers, carpets, and fabrics by adjusting the conductivity and pH of the dispersion. Alternatively, the composition can comprise an aqueous dispersion containing a dye, a stain blocker component, and a retarder for slowing down the rate of dye reaction. Also disclosed is a method of applying the compositions and dispersions to fibers, carpets, and fabrics.

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AQUEOUS DISPERSION OF DYE, STAIN-BLOCKER, AND FLUOROCHEMICAL AND ITS USE IN THE MANUFACTURE OF CARPET

FIELD OF THE INVENTION

This disclosure relates to the carpet industry in general and to the application of carpet dyeing and finishing chemistry in particular. The disclosed aqueous dispersion of dye, stain-blocker, and fluorochemical and application thereof relates especially to the treatment of carpet fiber to maintain carpet appearance after extended use. The aqueous dispersion and processes disclosed herein provide superior appearance retention via stain and soil protection while using far less water and energy than processes of the prior art. The aqueous dispersion and processes are applicable to various fibers, including nylon 6,6 and copolymers and blends thereof.

BACKGROUND OF THE TECHNOLOGY

The carpet industry today uses large quantities of fresh water in the course of dyeing and treating carpets. However, fresh water is becoming increasingly valuable for other uses, and that the continued growth of such water usage is unacceptable. Means of reducing water consumption are now being sought actively as part of a sustainably "green" philosophy, so that the carpet industry may continue to thrive.

While various processes are in use in the carpet industry for the dyeing and finishing of carpets, some large scale and some small, most of the residential broad loom carpet made today is dyed and finished on a continuous dye range. The is done mainly in one of two ways: (1) a two stage process, where the carpet is steamed and dyed first, steamed, rinsed, and excess water extracted, then stain-blocker (SB) is applied, the carpet is again steamed and washed, and then fluorochemical (FC) is applied in the form of a foam or liquid spray and the carpet is finally dried. (See e.g. U.S. Patent Nos. 5,853,814; 5,948,480 and WO2000/000691). (2) A co-application process, where the carpet is steamed and dyed first, steam again, rinsed, and extracted, and then a blend of SB and FC is applied together at high wet pick-up (e.g. 300 – 400%), after which the carpet and chemicals are exposed once again to steam to fix the treatment, followed by drying. (See e.g. U.S. Patent Nos. 6,197,378 and 5,520,962). Both of the continuous range-dye processes in use today have been found to be quite efficient compared to prior technologies, delivering excellent product quality at lower cost and with far less water pollution per unit of production.

SUMMARY OF THE INVENTION

Unfortunately, large volumes of water and steam are still being employed in the continuous range-dye processes currently used to finish carpets. In either case, carpet finishing treatment processes of the prior art have required multiple steps because of reagent incompatibility, especially with respect to pH limitations. Specifically, dyes react too quickly and therefore react with poor uniformity at low pH, while stain and soil resist chemistry require low pH to be effectively applied. (See U.S. Patent No. 5,948,480 for an explanation of the difficulties of combining stain blocker and fluorochemicals).

Therefore, there is still a need for an aqueous stain-blocker / fluorochemical solution and application process that consumes less water than traditional two-stage and co-application processes. There is also a need for an efficient process of dyeing and finishing carpets to further reduce the consumption of water.

The invention disclosed herein provides a stable aqueous dispersion of dye, stain-blocker, and fluorochemical that can be applied as a composition to fibers for carpets and fabrics. Such solution overcomes the problem of dyes reacting too quickly at low pH, by adjusting the conductivity of the solution to a level where the dyes can react at a pace that provides uniform color throughout. Further, the composition pH can remain relatively low for stain and soil resist chemistry to be effectively applied. Also disclosed are processes for applying the aqueous dispersion and carpets and fabrics made with the fibers treated with the composition and aqueous dispersion.

In one aspect, a composition comprising an aqueous dispersion of a dye, an anti-soil component, and a stain blocker component is disclosed. The aqueous dispersion has a conductivity between about 2000 to about 9000 micromhos, and a pH between about 1.5 to about 5. The anti-stain component can comprise a fluorochemical. Further, the aqueous dispersion can comprise a metal salt and / or a retarder.

In another aspect, a method of applying the composition to a fiber is disclosed. Such method comprises: (a) providing an aqueous dispersion comprising a dye, an anti-soil component, and a stain blocker, wherein said aqueous dispersion has a conductivity between about 2000 to about 9000 micromhos and a pH between about 1.5 to about 5; (b) contacting said fiber with said aqueous dispersion at temperature between about 20°C to about 40°C; (c) steaming said fiber for at least 60 seconds; (d) rinsing said fiber with water; and (e) drying said fiber. Optionally, water can be removed from the fiber prior to drying. The fiber can be manufactured into a carpet or fabric. Alternatively, a pre-treated fiber can be manufactured into a carpet or fabric, and then the carpet or fabric treated with the composition as disclosed above. The fiber can be any type, including natural staple, synthetic staple, or synthetic continuous filament. The contacting can be done using known processes, such as bathing, exhaustion, foaming, spraying, and nip-rolling, and can also be implemented as part of various dyeing processes such as skein dyeing, beck dyeing, piece dyeing, and space dyeing.

In a further aspect, a composition comprising an aqueous dispersion of a dye, stain blocker, and a retarder is disclosed. The retarder reacts with dye sites and competes for the fiber surface along with the dye, thus reducing the rate of dyeing and creating more level dyeing. The composition can further comprise an anti-soil component to make a four-part composition.

In yet another aspect, a method of applying a composition to a fiber is disclosed. Such method comprises: (a) providing an aqueous dispersion comprising a dye and a stain blocker, wherein said aqueous dispersion has a conductivity between about 2000 to about 9000 micromhos and a pH between about 1.5 to about 5; (b) contacting said fiber with said aqueous dispersion at temperature between about 20°C to about 40°C; (c) steaming said fiber for at least 60 seconds; (d) rinsing said fiber with water; and (e) drying said fiber. Optionally, the water can be removed from the fiber prior to drying. This method can be used with fibers that are already treated with an anti-soil component, that have inherent anti-soil properties, or will be post-treated with an anti-soil component after contacting with the aqueous dispersion.

In yet a further aspect, a carpet fiber comprising a dye, an anti-soil component, and a stain block is disclosed. The stain block penetrates farther into said fiber than the stain block applied separately from a dyeing step.

BRIEF DESCRIPTION OF THE FIGURES

Figure 1 depicts a known process of applying a dye, stain blocker, and anti-soil component in three separate steps.

Figure 2 depicts on aspect of the disclosed method of applying a composition comprising dye, stain blocker, and anti-soil components.

DEFINITIONS

While mostly familiar to those versed in the art, the following definitions are provided in the interest of clarity.

OWF (On weight of fiber): The amount of chemistry that was applied as a % of weight of fiber.

WPU (Wet pick-up): The amount of water and solvent that was applied on carpet before drying off the carpet, expressed as a % of weight of fiber.

DETAILED DESCRIPTION OF THE INVENTION

A composition comprising an aqueous dispersion of a dye, an anti-stain component, and a stain blocker is disclosed. The aqueous dispersion is buffered to a pH of between about 1.5 to about 5, including about 2 to about 4, and about 3 to about 5. The conductivity of the aqueous dispersion is also adjusted from about 2000 to about 9000 micromhos, including from about 4000 to about 9000 micromhos, from about 2000 to about 7000 micromhos, and from about 4000 to about 7000 micromhos.

The disclosed composition can use a variety of stain blockers, such as syntans, sulfonated novolacs, or sulfonated aromatic aldehyde condensation products (SACs). Stain blockers are usually made by reacting formaldehyde, phenol, polymethacrylic acid, maleic anyhydride, and sulfonic acid depending on specific chemistry. Similarly, a variety of anti-soil components can be used in the composition, including fluorochemical and non-fluorochemical based. The fluorochemicals can be anionic or cationic or contain extenders (See e.g. U.S. Patent No. 5,756,407 herein incorporated by reference in its entirety).

Examples of stain blockers include: formaldehyde polymers or copolymers, such as CEASESTAIN and STAINAWAY (from American Emulsions Company, Inc., Dalton, Ga); MESITOL (from Bayer Corporation, Rock Hill, N.C.); ERIONAL (from Ciba Corporation, Greensboro, N.C.); STAINKLEER (from Dyetech, Inc., Dalton, Ga.); LANOSTAIN (from Lenmar Chemical Corporation, Dalton, Ga.); and SR-300; SR-400; and SR-500 (from DuPont, Wilmington Del.); polymers of methacrylic acid such as the SCOTCHGUARD FX series (from 3M Company, St. Paul Minn.); and sulfonated fatty acids from Rockland React-Rite, Inc.; stain resist chemistries from ArrowStar LLC, Dalton, Ga.; and Tri-Tex, from Canada.

Examples of fluorochemical anti-soil components include: fluorochemical emulsions, such as AMGUARD (from American Emulsions Company); SOFTECH (from Dyetech); LANAPOL (from Lenmar Chemical Corporation); SOCTCHGUARD FC (from 3M); NK GUARD (from Nicca USA, Inc., Fountain Head, N.C.); UNIDYNE (from Diakin America, Inc., Decatur Ala.); and ZONYL 555, N-130, N-119, and CAPSTONE RCP (Dupont). Formulated chemistries from Daikin, Solvay, ArrowStar, and Omnova can also be used. Further, fluorochemical compositions based on C-8, C-6, C-4, and C-3 fluorocarbon chains can be used.

The aqueous dispersion or composition can optionally contain a metal salt in a range from about 1 gram of metal / Liter to about 16 gram of metal / Liter of aqueous solution, including from about 1 gram of metal / Liter to about 6 gram of metal / Liter of said aqueous solution. Examples of metal salts include: sodium sulfate, magnesium sulfate, potassium sulfate, calcium sulfate, manganese sulfate, iron sulfate, copper sulfate, zinc sulfate, aluminum sulfate, sodium nitrate, magnesium nitrate, potassium nitrate, calcium nitrate, manganese nitrate, iron nitrate, copper nitrate, zinc nitrate, aluminum nitrate, sodium chloride, potassium chloride, calcium chloride, magnesium chloride, manganese chloride, copper chloride, iron chloride, sodium phosphate, potassium phosphate, calcium phosphate, manganese phosphate, iron phosphate, copper phosphate, zinc phosphate, aluminum phosphate, sodium bicarbonate, sodium carbonate, calcium bicarbonate, calcium carbonate, potassium bicarbonate, and potassium carbonate.

Further, a retarder can be used in the aqueous dispersion or composition in a range from about 0.25% to about 4% by weight aqueous solution, including 0.5% to about 2% by weight of aqueous solution. An example retarder is DOWFAX 2A4 or DOWFAX 2A1. The retarder competes for the fiber surface along with the dye, thus reducing the rate of dyeing and creating more level dyeing. Alternatively, an aqueous dispersion comprising a dye, stain blocker, and retarder is disclosed. Such compositions can be used with fibers that are already treated with an anti-soil component, that have inherent anti-soil properties, or will be post-treated with an anti-soil component after contacting with the aqueous dispersion. The retarder can adjust the conductivity of the aqueous dispersion from about 2000 to about 9000 micromhos, including from about 4000 to about 9000 micromhos, from about 2000 to about 7000 micromhos, and from about 4000 to about 7000 micromhos.

The disclosed compositions can also contain additives to aid in dye penetration, anti-soil penetration, stain blocker penetration, as well as additives to protect the carpet from long term exposure to the elements and additives to keep the three components in suspension. Such additives include: dye auxiliaries, sequestrants, pH control agents, surfactants, fluoro-surfactants, nano materials, odor control agents, antimicrobial agents, fragrance agents, bleach resist agents, softeners, and UV stabilizers.

By adjusting the conductivity of the aqueous dispersion, the rate of dye reaction is retarded so that uniformity can be obtained. In a typical 2 step process dye application is at 5-6 pH, and the conductivity is not high (i.e. 265 micromhos). When fiber is exposed to dye and stain blocker components that are mixed together at lower pH dispersion, per this disclosure, they would normally be expected to create an environment wherein dye will strike very fast and result in non level dyeing. Surprisingly this was not found to be the case. The higher conductivity however, enables stain protection via stain blocker penetration of the fiber adequately. Further, the higher conductivity of the disclosed compositions allows for a relatively higher pH solution than would typically be used for the individual components. The higher pH also slows down the rate of dyeing, while the higher conductivity at the higher pH facilitates the effective application of anti-soil and stain blocker. Thus, it has been found that the pH and conductivity can be adjusted to achieve an optimum balance between dye, stain blocker, and anti-soil application.

Also disclosed is a method of applying the disclosed compositions comprising the aqueous dispersion of the dye, anti-soil component, and stain blocker to a fiber. The process comprises contacting the fiber with the aqueous dispersion at a temperature between about 20°C to about 40°C, including between about 24°C to about 28°C. After contacting, the fiber is steamed for at least 60 seconds, including from about 2 to about 3 minutes, followed by rinsing and drying the fiber. Water can be removed from the fiber prior to drying using conventional methods, such as suction, nip-rolling, centrifuge, and convection. The steaming cycle to fix dye and stain blocker will be at a steam temperature close to 100°C and the drying can be performed at a temperature between about 130-135°C. It should be noted that the temperatures will be dependent on the line speed, and specific type of equipment used. Optionally, the fiber can be pre-heated or steamed prior to contacting the fiber with the aqueous solution.

The fiber can be any type, including natural staple, synthetic staple, or synthetic filament. Natural staple fibers include wool. Synthetic fibers include polyamide, polyester, and polyolefin. Examples of polyamides include: nylon 6,6, nylon 6, nylon 4,6, nylon 6,10, nylon 10,10, nylon 12, its copolymers, and blends thereof. Polyamide copolymers can also include 5-sulfosiophthalic acid, methylpentamethylenediamine, and isophthalic acid moieties.

The fiber can be manufactured into various articles, including carpets and fabrics either before or after contacting said fiber with the aqueous solution. In other words, the disclosed processes can be applied to the fiber prior to forming the article or after forming the article. The process can further comprise, prior to contacting the fiber with the aqueous dispersion, steam heat setting the fiber at a temperature between about 118°C to 145°C or optionally a dry heat set at a temperature between about 145°C to 205°C. The optional dry heat set provides additional stain resistance.

The stain blockers have a range of molecular size and it is theorized that the stain blocker during the steam fixation step migrates to the interior. The extent of migration depends on the steaming conditions and the molecular size of the stain blocker. The durability of stain resistance to detergent washing, for example, will depend on how much of the stain blocker is left on the surface verses how much has penetrated the surface. The steam fixing step after dyeing is usually longer and using this step for steam fixing will more effectively drive the stain blocker into the fiber and provide more durability compared to traditional steam fixing post-stain blocker application. By suitable design of molecular sizes, one can ensure more of the stain blocker stays on the surface and less penetrates the surface. Such modification of molecular sizes and types of stain blockers to further enhance the tri-application process is contemplated by this disclosure. For example, one of skill in the art can design a mixture of molecular sizes for the stain blocker, that will ensure some larger molecules stay on the surface and smaller molecules penetrate, thereby offering not only improved initial stain resistance but also durability of stain resistance. Additionally, the longer steam fixing step provides for more durability of anti-soil chemistries, since anti-soil components are typically non-water soluable.

Further disclosed is a method of applying a composition to a fiber, where the composition comprises an aqueous dispersion comprising a dye and a stain blocker.

The aqueous dispersion is kept at a conductivity between about 2000 to about 9000 micromhos, including from about 4000 to about 9000 micromhos, and about 4000 to about 7000 micromhos; and a pH from about 1.5 to about 5, including about 2 to about 4 and about 3 to about 5. As with the previously disclosed method, the fiber is contacted with the aqueous solution, followed by steaming, rinsing, drying, and optionally removing the water prior to drying. Further, an anti-soil component, as discussed above, can be applied after contacting the fiber with the aqueous solution. The anti-soil component can be applied using numerous methods, such as spraying or foaming. Also, as discussed above, the fiber can be manufactured into an article before or after contacting the fiber with the aqueous solution.

This method is especially applicable to those fibers that have inherent anti-soil characteristics or in processes where the specific anti-soil is most effectively applied by foaming of spraying. Further, in some applications, the application of an anti-soil component, such as a fluorochemical, may not be necessary or desired. Such applications include non-allergen fabrics and certain eco-friendly fabrics.

The disclosed processes effectively eliminates several steps from the known fiber, carpet, and fabric treatment processes, including multiple rinsing, washing, and steaming steps. The process is surprisingly effective in that intermediately low pH levels have been found effective for application of certain stain resist chemistries when applied in the presence of acid dyes, while certain combinations of stain and soil resist chemistry were found to be surprisingly effective in moderating acid dye rate, so that dyed fabrics were surprisingly uniform.

Figure 1 depicts a known process of applying a dye, stain blocker, and anti-soil component in three separate steps to a carpet. The carpet is fed to pre-steamer 5, where it is pre-steamed prior to entering the dyer 10. After dyeing, the carpet is fed to main steamer 15, rinsed 20, and water is extracted in the extractor 25. Stain-block is applied in a flex-nip applicator 30, followed by post-steaming 35. The carpet is then washed 40 and the water extracted 45. Finally, anti-soil is applied via a spray applicator 50 and the carpet dried 55.

Figure 2 depicts one aspect of the disclosed process as applied to a carpet. The carpet is fed to a pre-steamer 105, where it is pre-steamed prior to applying the disclosed composition 110. After applying the dye, anti-soil, and stain blocker, the carpet is fed to a main steamer 115, rinsed 120, and the water is extracted in the extractor 125. Finally, the carpet is dried 130. Because the anti-soil component and stain blocker go through a much longer steam fixing cycle than known processes, the surface texture of the carpet fiber will differ and the stain blocker penetrates deeper into the carpet fiber.

The disclosed compositions and methods are beneficial to almost any fabric treatment process where dyes, stain blockers, and anti-soil components are employed, especially where dye and stain resist can be placed in competition with one another for amine ends (i.e. acid dye sites) in the dye bath. Articles to which the disclosed compositions and methods are applicable include: textile fabrics, rugs, carpets, furniture coverings, automotive upholstery, draperies, and various other soft surfaces to which dyes and stain blocking chemistries are both applied.

EXAMPLES

The following are examples of nylon carpets treated with various aspects of the disclosed compositions compared to standard treatments with separate components. Selection of alternative anti-soil components, dyes, stain blockers, fibers, and textiles having different surface chemistries will necessitate minor adjustments to the variables herein described.

Test Methods

Stain Rating Method using AATCC 175 referenced and described in U.S. Patent Nos. 5,853,814 and 5,948,480. Stain Rating is on a scale of 1 to 10, with 1 being the lowest stain resistance and 10 being the highest.

Shampoo test (wash durability) using WAQE test method referenced and described in U.S. Patent Nos. 5,853,814 and 5,948,480.

Conductivity measurement: Conductivity measurements were taken with a Myron L Co. Ultrameter II model 6Psi. Samples including two Myron L KCl conductivity standards (700 and 7000micromhos) were heated to approximately 25°C in a laboratory oven. The conductivity instrument cell was rinsed 3 times with sample solution before taking sample measurements. Three replications of each sample was measured and recorded when the temperature range was at 24.9 – 25.2°C.

Example 1

A control carpet sample was prepared as follows: Two 995 denier nylon 6,6 yarns (Fiber 995-476AS, a mild dull, medium acid dyeable, fiber with wavy trilobal cross section available from INVISTA) were twisted to 6 twists-per-inch and heat set via a Superba heat set process at a temperature of 265°F with residence time of 28 seconds and tufted into 1/8" gage, 9/16" pile height carpet with a weight of 45-46 ounces / square yard. The carpet was then dyed using the dye mixture below to a wool beige color. Stain blocker and anti-soil were not added. The control carpet had an initial stain rating of 1, a stain rating of 1 after 1 WAQE wash and a stain rating of 1 after 3 WAQE washes.

Sample carpets were prepared similar to above, except that a Suessen heat set at 195°C, instead of Superba heat set, was performed on the yarn for 60 seconds residence time.

A tri-component composition was prepared as follows: A mixture of dyes (Yellow 3G, Red 2B, and Blue 4R to obtain a wool beige color), stain blocker (s-801 from INVISTA) at 4%, and anti-soil (Capstone RCP fluorochemical) at a concentration that imparts a final fluorine OWF between 150-250 ppm was prepared at room temperature. Also added to the mixture was a 40% wt/wt aqueous magnesium salt mixture (10 grams of metal / liter) to adjust the pH to about 2.1.

Table 1 below shows the results of applying dye, stain blocker (SB), and anti-soil using the traditional method (Sample 1), and two aspects of the disclosed process using the tri-component composition described above. (Samples 2 and 3). The composition was applied at 80°F.

Table 1

Sample	Description	SB and level	Anti-soil	Initial Stain Rating	1 WAQE	3 WAQE
1	Dye, SB, and anti-soil applied separately	S-801 at 4%, 2.1 pH	Capstone RCP at 150 ppm OWF	10	10	10
2	Dye and SB applied together, anti-soil applied in subsequent step	S-801 at 4%, pH 2.1	Capstone RCP at 150 ppm OWF	10	10	9.5
3	Tri-component application as described above.	S-801 at 4%, pH 2.1	Capstone RCP at 150 ppm OWF	10	10	10

As shown above, the aspects of the disclosed process yield excellent stain test results. It should also be noted that similar tests without the magnesium sulfate and at pH of 3.5 yielded similar results. Further, the dye uniformity and dye depth was good, which is counter-intuitive, since the dyes should react quickly with the acid dye sites at the 2.1pH resulting in non-uniform color.

Example 2

Sample carpets were prepared as discussed above, except that the yarn was heat set in a Superba heat setting machine at 265°F , with a residence time of 28 seconds. The carpet was treated on a range continuous dyer as described in Table 2 below. The dye was the wool beige color described above. The carpets were tested for stain resistance. The tri-component composition was prepared as above without the salt, with the variations disclosed in Table 2. The stain blocker in all cases was S-801 at 4.0% and 2.1pH, unless otherwise stated. Samples 8 and 9 used $MgSO_4$ in the concentrations disclosed above.

Table 2

Sample	Description	Anti-soil	Initial Stain Rating	1 WAQE	3 WAQE	Conductivity (micromhos)
1	Standard separate process	Capstone RCP at 250 ppm OWF	10	9	7.5	265
2	Dye + SB applied together	Capstone RCP at 250 ppm OWF	9.5	7.5	7	4806
3	Dye + SB applied together with DOWFAX 2A1 at 0.5%	Capstone RCP at 250 ppm OWF	9	7	5.5	4721
4	Dye + SB applied together with DOWFAX 2A1 at 1%	Capstone RCP at 250 ppm OWF	9	7.5	6	4903
5	Dye + SB applied together with DOWFAX 2A1 at 1% applied at 4 pH	Capstone RCP at 250 ppm OWF	7	5	4	3302
6	Tri-component with DOWFAX 2A1 at 1.0% at 4 pH	Capstone RCP at 250 ppm OWF	4	3	2	2740

Sample	Description	Anti-soil	Initial Stain Rating	1 WAQE	3 WAQE	Conductivity (micromhos)
7	Tri-component with DOWFAX 2A1 at 1.0% at 4 pH and $MgSO_4$.	Capstone RCP at 250 ppm OWF	8	7	7	4556
8	Tri-component with DOWFAX 2A1 at 1.0% at 2 pH and $MgSO_4$.	Capstone RCP at 250 ppm OWF	8	7	6	6560

As shown above in Samples 2-6, lower conductivities (i.e. below 4000) affect the stain rating when applying the dye and stain blocker separate from the anti-soil component. However, a conductivity value around 2000 could be used with darker colors, since they are not as sensitive to staining as the lighter colors. With the tri-component application, the higher conductivity sample (Sample 8) performed equally well to the medium conductivity sample (Sample 7). With darker colors, a conductivity level of 2000 would be acceptable for the reasons stated above.

The invention has been described above with reference to the various aspects of the disclosed composition, treated fibers, carpets, fabrics, and methods of making the same. Obvious modifications and alterations will occur to others upon reading and understanding the proceeding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the claims.

CLAIMS

What is claimed is:

1. A composition comprising an aqueous dispersion of a dye, an anti-soil component, and a stain blocker, wherein said aqueous dispersion has a conductivity between about 2000 to about 9000 micromhos and a pH between about 1.5 to about 5.

2. The composition of claim 1, wherein said anti-soil component comprises a fluorochemical.

3. The composition of claim 2, wherein said fluorochemical has less than or equal to six fluorinated carbons.

4. The composition of one of claims claim 1 – 3, further comprising a metal salt.

5. The composition of one of claims 1 – 4, further comprising a retarder.

6. The composition of claim 4, wherein said metal salt is selected from the group consisting of: sodium sulfate, magnesium sulfate, potassium sulfate, calcium sulfate, manganese sulfate, iron sulfate, copper sulfate, zinc sulfate, aluminum sulfate, sodium nitrate, magnesium nitrate, potassium nitrate, calcium nitrate, manganese nitrate, iron nitrate, copper nitrate, zinc nitrate, aluminum nitrate, sodium chloride, potassium chloride, calcium chloride, magnesium chloride, manganese chloride, copper chloride, iron chloride, sodium phosphate, potassium phosphate, calcium phosphate, manganese phosphate, iron phosphate, copper phosphate, zinc phosphate, aluminum phosphate, sodium bicarbonate, sodium carbonate, calcium bicarbonate, calcium carbonate, potassium bicarbonate, and potassium carbonate.

7. The composition of claim 6, wherein said metal salt is magnesium sulfate.

8. The composition of one of claims 4, 6, or 7, wherein said metal salt is present between about 1 gram of metal / Liter to about 16 gram of metal / Liter of said aqueous solution.

9. The composition of claim 1, wherein said conductivity is between about 4000 to about 7000 micromhos.

10. The composition of claim 1, wherein said pH is between about 1.5 to about 4.

11. The composition of claim 8, wherein said metal salt is present between about 1 gram of metal / L to about 6 gram of metal / L of said aqueous solution.

12. The composition of one of claims 9-11, further comprising a retarder.

13. The composition of one of claims 1-5 or 9-10, further comprising an additive that performs a function selected from the group consisting of: aid in dye penetration, aid in anti-soil penetration, aid in stain blocker penetration, protect the carpet from long term exposure to the elements, and keep the dye, stain blocker, and anti-soil components in suspension.

14. The composition of claim 13, wherein said additive is selected from the group consisting of: dye auxiliaries, sequestrants, pH control agents, surfactants, fluoro-surfactants, nano materials, odor control agents, antimicrobial agents, fragrance agents, bleach resist agents, softeners, and UV stabilizers.

15. A method of applying a composition to a fiber comprising: (a) providing an aqueous dispersion comprising a dye, an anti-soil component, and a stain blocker, wherein said aqueous dispersion has a conductivity between about 2000 to about 9000 micromhos and a pH between about 1.5 to about 5; (b) contacting said fiber with said aqueous dispersion at temperature between about 20°C to about 40°C; (c) steaming said fiber for at least 60 seconds; (d) rinsing said fiber with water; and (e) drying said fiber.

16. The method of claim 15, wherein said anti-soil component comprises a fluorochemical.

17. The method of claim 15 or 16, wherein said aqueous dispersion further comprises a metal salt.

18. The method of one of claims 15-17, wherein said aqueous dispersion further comprises a retarder.

19. The method of claim 17, wherein said metal salt is selected from the group consisting of: sodium sulfate, magnesium sulfate, potassium sulfate, calcium sulfate, manganese sulfate, iron sulfate, copper sulfate, zinc sulfate, aluminum sulfate, sodium nitrate, magnesium nitrate, potassium nitrate, calcium nitrate, manganese nitrate, iron nitrate, copper nitrate, zinc nitrate, aluminum nitrate, sodium chloride, potassium chloride, calcium chloride, magnesium chloride, manganese chloride, copper chloride, iron chloride, sodium phosphate, potassium phosphate, calcium phosphate, manganese phosphate, iron phosphate, copper phosphate, zinc phosphate, aluminum phosphate, sodium bicarbonate, sodium carbonate, calcium bicarbonate, calcium carbonate, potassium bicarbonate, and potassium carbonate.

20. The method of claim 19, wherein said metal salt is magnesium sulfate.

21. The method of claim 17, 19, or 20, wherein said metal salt is present between about 2 gram / Liter to about 16 gram / Liter of said aqueous solution.

22. The method claim 21, wherein said metal salt is present between about 2 gram / Liter to about 6 gram / Liter of said aqueous solution.

23. The method of claim 15, wherein said aqueous dispersion has a conductivity between about 4000 to about 7000 micromhos.

24. The method of claim 15, wherein said aqueous dispersion has a pH between about 1.5 to about 4.

25. The method of one of claims 15-24, wherein said aqueous dispersion further comprises an additive selected from the group consisting of: dye auxiliaries, surfactants, fluoro-surfactants, nano materials, odor control agents, antimicrobial agents, frangrance agents, bleach resist agents, softeners, and UV stabilizers.

26. The method of claim 15, wherein said aqueous dispersion temperature is between about 24°C to about 28°C.

27. The method of claim 15, wherein said steaming said fiber is between about 2 minutes to about 3 minutes.

28. The method of claim 15, further comprising pre-steaming said fiber prior to contacting said fiber with said aqueous solution.

29. The method of claim 15, wherein said steaming is performed at a temperature of about 100°C.

30. The method of claim 15, wherein said drying is performed at a temperature between about 130°C to about 135°C.

31. The method of claim 15, wherein said at least one fiber is a polyamide fiber.

32. The method of claim 31, wherein said polyamide fiber is selected from the group consisting of: nylon 6,6, nylon 6, nylon 4,6, nylon 6,10, nylon 10,10, nylon 12, its copolymers, and blends thereof.

33. The method of one of claims 15 - 32, wherein said fiber is formed into a carpet or fabric either before or after contacting said fiber with said aqueous dispersion.

34. The method of claim 15, further comprising steam heat setting said fiber at a temperature of about 100°C prior to contacting said fiber with said aqueous dispersion.

35. The method of claim 15, further comprising dry heat setting said fiber at a temperature between about 130°C – 135°C prior to contacting said fiber with said aqueous dispersion.

36. The method of claim 15, wherein said contacting is done by a process selected from the group consisting of: bathing, exhaustion, foaming, spraying, and nip-rolling., skein dyeing, beck dyeing, space dyeing

37. The method of claim 15, further comprising removing water from the fiber prior to drying said fiber.

38. A method of applying a composition to a fiber comprising: (a) providing an aqueous dispersion comprising a dye and a stain blocker, wherein said aqueous dispersion has a conductivity between about 2000 to about 9000 micromhos and a pH between about 1.5 to about 5; (b) contacting said fiber with said aqueous dispersion at temperature between about 20°C to about 40°C; (c) steaming said fiber for at least 60 seconds; (d) rinsing said fiber with water; and (f) drying said fiber.

39. The method of claim 37, wherein said method further comprises applying an anti-soil component after contacting said fiber with said aqueous solution.

40. The method of claim 38, wherein said anti-soil component comprises a fluorochemical.

41. The method of claim 40, wherein said anti-soil is applied by a method selected from the group consisting of: spraying or foaming.

42. The method of claim 38, further comprising removing water from the fiber prior to drying said fiber.

43. The method of claim 38, further comprising steam heat setting said fiber at a temperature of about 100°C prior to contacting said fiber with said aqueous dispersion.

44. The method of claim 38, further comprising dry heat setting said fiber at a temperature between about 130°C to about 135°C prior to contacting said fiber with said aqueous dispersion.

45. The method of claim 38, wherein said at least one fiber is a polyamide fiber.

46. The method of claim 45, wherein said polyamide fiber is selected from the group consisting of: nylon 6,6, nylon 6, nylon 4,6, nylon 6,10, nylon 10,10, nylon 12, its copolymers, and blends thereof.

47. The method of one of claims 38 - 46, wherein said fiber is formed into a carpet or fabric either before or after contacting said fiber with said aqueous dispersion.

48. A composition comprising an aqueous dispersion of a dye, a stain blocker, and a retarder, where the retarder reduces the rate of dyeing.

49. The composition of claim 48, further comprising an anti-soil component.

50. The composition of claim 48, where the retarder adjusts the conductivity of the aqueous dispersion from about 2000 to about 9000 micromhos.

51. A carpet fiber comprising a dye, an anti-soil component, and a stain block, wherein said stain block penetrates farther into said fiber than said stain block applied separately from a dyeing step.

FIGURE 1

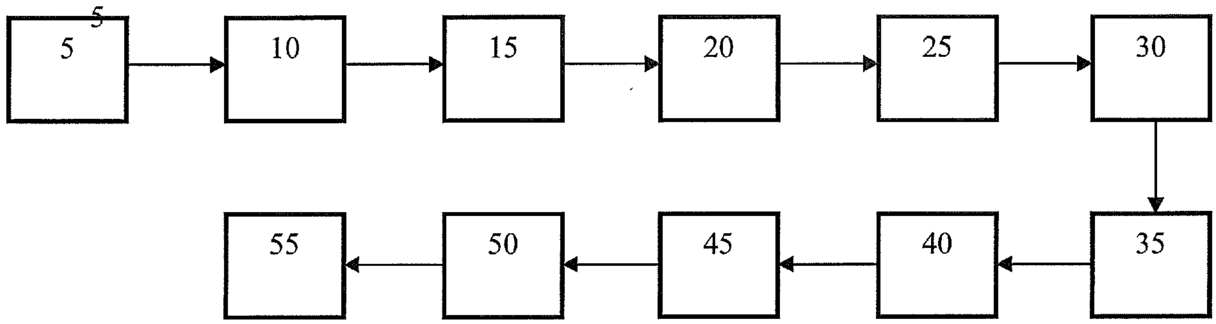

FIGURE 2