The present invention pertains to fluorine-free compositions rendering textile articles, such as carpets and other textile floor coverings made from synthetic fibres or natural fibres which are water repellent, soil resistant and stain resistant. The invention pertains additionally to a method for treating textile articles and treated textile articles especially carpets are water repellent, soil resistant and stain resistant.
WATER REPELLENT, SOIL RESISTANT, 
FLUORINE-FREE COMPOSITIONS

[0001] The present invention pertains to fluorine-free compositions rendering textile articles, such as carpets and other textile floor coverings made from synthetic fibres or natural fibres water repellent, soil resistant and stain resistant. The invention pertains additionally to a method for treating textile articles and for treating textile articles being water repellent, soil resistant and stain resistant, especially carpets.

[0002] Generally, it was known to use fluorine containing chemicals and compositions to impart a variety of valuable properties to textile fibres of synthetic or natural origin, especially to protect carpets and other textile floor coverings from wetting and soiling.

RELATED ART

[0003] U.S. Pat. No. 6,824,854 discloses a carpet treated with a soil resistant agent comprising a dispersion of polyfluoro organic compounds having at least one urea, urethane or ester linkage in combination with an anionic surfactant. The ratio of polyfluoro compound to surfactant is thereby from about 0.075:1.0 to about 5:1.

[0004] U.S. Pat. No. 4,264,484 relates to a carpet which is soil resistant and stain resistant and which has been treated with a composition comprising a liquid containing a water-insoluble polymer derived from ethylenically unsaturated monomer free of nonvinyllic fluorine having one major transition temperature higher than about 25°C. and a water insoluble fluorourilaphatic radical- and aliphatic chloride-containing ester having a major transition temperature higher than about 25°C.


[0006] EP-A 2 222 734 describes a copolymer and a method for treatment of fibrous substrates with such copolymer to render them soil resistant and to impart minimal water repellency. The copolymer is prepared by polymerization of methacrylic acid with certain fluorinated alkylated benzyl isocyanates having straight chain branched perfluoroalkyl groups.

[0007] It has also been known, to impart fluorine-free water repellency to textiles and fabrics.

[0008] EP-A 3 368 525 describes a composition and its use for treating textiles, fibres and fabric substrates, whereby desirable properties like water repellency and durability are enhanced. Said composition is a quite complex mixture of various components such as a compound having an epoxy functionality, a compound having an alkox functionality, a crosslinking component selected from specific compounds and a catalyst comprising metal salts of mineral acids, e.g. zinc chloride, magnesium chloride, metal soaps and anhydrides. A condensation product is formed that is suitable to impart the desired properties to textiles when the compounds having the particular functionalities and the crosslinking component is reacted with the catalyst and cured.

[0009] WO 2013 059387 A1, WO 2013 059395 A1, WO 2013 059400 A1, and WO 2013 059416 A1 describe non-fluorinated soil resist compositions featuring various combinations of surfactant, stain resistant, and optional inorganic oxide species. The preferred soil resistant species are given as including polymethyl methacrylate, methyl methacrylate/ethyl methacrylate copolymer, an alkali metal salt of a hydrolysed styrene/maleic anhydride copolymer or of a hydrolyzed styrene/maleic anhydride/cumene terpolymer, an ammonium salt of a styrene/maleic anhydride copolymer or of a hydrolyzed styrene/maleic anhydride/cumene terpolymer, amorphous silicon dioxide, colloidal silica, and amorphous silicas.

[0010] However, the related art fails to disclose a carpet or a textile floor covering treated with fluorine-free chemical compositions providing durable soil resistance and water repellency, and a carpet or textile floor covering free of fluorine and having these high quality properties.

[0011] Moreover, there is an increasing interest in the carpet and textile floor covering industry to replace the presently used C₄₂-fluorochemicals with fluorine-free soil resistant and water repellent products. Eco labels such as “Blue Angel,” which is awarded by RAL gGmbH, St. Augustin, Germany and others are continuously reinforcing this trend.

Object of the Invention

[0012] Thus, it was an object of the present disclosure to provide fluorine-free compositions that reliably impart durable surface protection to textile flooring substrates against the detrimental influences of water and soil. Such compositions should be easy to manufacture and easy to apply to textiles of synthetic or natural origin, while at the same time imparting a comparable protection as with fluorine containing chemicals as they are currently available on the market. In addition, reliable water repellency should be provided to carpets and textile floor coverings by treatment with such new compositions.

BRIEF DESCRIPTION OF THE INVENTION

[0013] The present invention, therefore, pertains to a fluorine-free fiber protectant Composition X1 comprising:

[0014] A) A nanoparticulate silicate clay (also referred to as a clay nanoparticle);

[0015] B) An anionic acrylic-based copolymer binding agent;

[0016] C) water

whereby the ratio of is from 0.8 to 24 volume parts for A, from 1.3 to 23.8 volume parts for B, and the balance is C. Composition X1 is useful for applications such as natural or synthetic fiber protection. Furthermore, following evaporation of water, the fibers treated with composition X1 display improved water and soil repellency characteristics useful as substitutes for, and replacements of, the fluorinated fiber protectant compositions currently applied.

[0017] Another object of the invention is a fluorine-free fiber protectant Composition X2 comprising components A, B, C and:

[0018] D) A textile softening agent;

whereby the ratio of is from 0.9 to 22.5 volume parts for A, from 1.3 to 19 volume parts for B, from 0.7 to 11 volume parts D, and the balance is C. Composition X2 is also useful for applications such as natural or synthetic fiber protection.

[0019] Additionally, other compositions effective under this disclosure are effective and include only B, C and D to yield a third composition, Composition X3. And some
compositions include only A and D, to yield a fourth composition, Composition X4.

Another object of the invention is an article of manufacture, especially a carpet or a textile floor covering, which is treated with the composition as defined hereinbefore by e.g. spray application or foam application, whereby the article is rendered water repellent and soil resistant.

Another object of the invention is a method for the fluorine-free treatment of textiles or fibres of synthetic or natural origin with a composition as defined herein in an effective amount to render the textiles or fibres water repellent, soil resistant, and soft.

Another object of the invention is a kit providing one or more of Compositions X1, X2, X3 or X4 in separate containers, that are then be mixed and/or used at a place of carpet manufacture.

DETAILED DESCRIPTION OF THE INVENTION

Fluorochemicals are used as topical protectant ingredients in many industrial applications, including carpets and textiles industries. As topical protectants, certain fluorochemicals impart desirable water repellency, oil repellency and soil repellency attributes to substrates as surface coatings. However, certain fluorochemicals, such as long chain polymeric perfluorocarbon species, have been shown to be precursors to undesirably bio-persistent species, such as perfluoroalkyl carboxylic acids (PFCAs) and perfluoroalkane sulfonic acids (PFASs). Examples of long chain polymeric perfluorocarbon species are those having C8, C10 or C10 perfluorinated side chains. There is a desire to reduce the overall usage of fluorochemicals in the carpets and textiles industries, for environmental and also for cost reasons. Thus, it can be understood that durable water- and soil-repellent fibers that contain a reduced amount of fluorochemicals are in demand. Recent trends in this field have been towards the adoption of emulsified, shorter chain perfluorinated polymer ingredients to apply onto fibers, carpets, fabrics and the like. Examples of shorter chain perfluorinated polymers are those having C4 and/or C6 side-chains. A salient review on this topic is provided by Wang, Cousins, Scheringer and Hungerbuehler in Environmental International. "[Fluorinated alternatives to long-chain perfluoralkyl carboxylic acids (PFCAs), perfluoroalkane sulfonic acids (PFSAHs) and their potential precursors,]" Environmental International, 60, 242-248 (2013)] However, a more impactful solution to the problem is to eliminate fluorocarbon-containing treatments, and instead use non-fluorinated compositions that impart the desired water- and soil-repellent performance attributes. E.g. labels such as "Blue Angel," which is awarded by RAL gGmbH, St. Augustin, Germany and others are continuously reinforcing this trend.

There is a need in the carpets and textiles industries for solutions to provide durable water repellency and soil repellency attributes to fibrous substrates without the use of long chain polymeric perfluorocarbon species. Water repellency refers to the degree to which a substrate repels water and water/isopropanol mixtures and is determined using a similar method to that for oil repellency.

Unlike currently applied soil resistant or water repellent chemicals, the compositions in this disclosure are free of fluorine-containing ingredients. The compositions X1, X2 and X3 comprise two or more of components A, B, C and D, and the application rates of one or more of X1, X2 or X3 onto the carpet or textile floor covering may be adjusted to achieve maximum water and soil repellency benefit. Such performance benefits are, at the same time, economically advantageous.

Typical nanoparticulate silicate clays useful in the composition as component A include those described in U.S. Patent Application Publication No. 2011/0311757 to Iverson et al., which is incorporated herein by reference. These nanoparticulate silicate clays can be selected from the group consisting of smectites, kaolins, illites, clorites, attapulgites, and combinations thereof. More specific examples include montmorillonite, bentonite, pyrophyllite, hectorite, saponite, saucnite, nontronite, talc, heidellite, volkenskite, vermiculite, kaolinite, dickite, antigorite, anauxite, indellite, chrysotile, bravisite, muscovite, paragonite, biotite, corrensite, penninite, doubsasite, sudosite, penmine, sepiolite, polygorskite, and combinations thereof.

The nanoparticulate silicate component, A, may be natural or synthetic. In one aspect the nanoparticulate silicate component includes synthetic hectorite. Regardless of whether the clay nanoparticle is natural or synthetic, the clay nanoparticle component may be present in an amount from about 0.9 to about 24 volume parts of the combined composition X1. Typically, the clay nanoparticle is present in an amount of about 7 to about 14 parts by volume of the composition X1. Examples of suitable nanoparticulate silicates are those commercially available from DYK Additives GmbH under the brand name Laponite®. These include Laponite® RID, Laponite® RDS, Laponite® JS, Laponite® SL25, and Laponite® S482. Laponite® SL-25 is a basic (pH 8-10), 21.5-25 wt % solids aqueous dispersion. The nanoparticulate silicate found in Laponite® SL-25 has an average particle size of from about 20 nm to about 90 nm, and a surface area of from about 120 m²/g to about 500 m²/g.

Typical acrylic polymer components for use in the present disclosure as component B include those anionic or non-ionic, fluorine-free, water-dispersed acrylics that are known to act as binding agents, wherein the mixture including the acrylic copolymer binding agent ("binder") forms a transparent or largely transparent coating. In some instances, the acrylic copolymer binder is self-crosslinking. When used according to the present disclosure, the water-based non-fluorinated acrylic copolymer provides a certain degree of durable water repellency to the treated carpets and fibers.

Binding agents useful according to this disclosure include any non-fluorinated emulsifiable acrylic polymer or copolymer suitable for use as a coating ingredient for soft surfaces, such as textiles, yarn, fabric, carpets, rugs, mats, or hard surfaces, such as vinyl tile, stone masonry, ceramic tile, and hardwood flooring. Many examples of such acrylic co-polymers can be utilized as component B in the compositions described by this disclosure. Acrylic-based copolymers having at least one of acrylic, methyl acrylate, ethyl acrylate, propyl acrylate, butyl acrylate, methacrylate, methyl methacrylate, ethyl methacrylate, propyl methacrylate, butyl methacrylate, ethacrylate, methyl ethacrylate, ethyl ethacrylate, propyl ethacrylate, butyl ethacrylate, acrylic acid, and ethylene monomers, and combinations and blends thereof, are suitable candidates for use according to this disclosure. The acrylic-based copolymers can be non-ionic, or anionic, but the preferred acrylic-based copolymers in this disclosure have a net anionic charge association. Further, preferred components are those anionic acrylic-
based copolymers that are self-crosslinking, and can thus crosslink by application of thermal and/or photoinitiated stimuli. Numerous non-fluorinated, emulsified acrylic copolymers suitable as component B are commercially available, such as the self-crosslinking families of RHOPLEX™ and PRIMAL™ emulsions, manufactured by Rohm and Haas Company. One preferred binding agent is PRIMAL™ ECO-36 (Rohm and Haas), which is an anionic, self-crosslinking acrylic based copolymer that can be applied on a substrate as a 46.5-47.5 wt % solids aqueous emulsion. Depending on process requirements, PRIMAL™ ECO-16 (self-crosslinking, non-ionic, methyl methacrylate—ethyl acrylate copolymer) and PRIMAL™ ECO-8 (self-crosslinking, nonionic) may also be used. As MMA/EA copolymers, corresponding polymer products from other manufacturers may also be used.

[0030] Another possible water-based acrylic copolymer may be ethylene acrylic acid copolymer (EAA). These dispersion polymers are also known under various trade names. For example TECEAL E-799/45 (Trub Emulsions Chemie), an ethylene-acrylic acid dispersion (solids content 45%, Tg 4°C), may be used. Still another possible water-based acrylic copolymer class may be styrene-acrylic copolymers.

[0031] It must be understood that the invention is not limited to the use of substances identified by certain trade names, but other substances with similar properties for the purpose and effects of the invention may be used.

[0032] Acrylic copolymers of different types with differing mechanical properties may be blended with each other to achieve the desired final properties of the treated fiber. The advantages of the acrylic copolymers can be summarized as:

- [0033] transparency,
- [0034] heat-curability,
- [0035] adhesivity or durability, and
- [0036] water repellency on fiber or carpet.

[0037] Typical textile softening agents for use in the present disclosure as component D, include those that are known to act as textile softening agents, wherein the mixture including the textile softening agent provides a smoother handle to the textile. Textile softening agents can act to improve the shelf life of clothes or the softness or more pleasing tactile sensation of carpets and knitted fabrics. Textile softening agents can act to enhance lubricity when used to treat yarns, fabrics, textiles, carpets, and the like. Suitable examples of such agents are described by Rudat in U.S. Patent Appl. No. 2008 0287020 as being amino siloxanes or aminosiloxanes, oils of various types, polyalkylene glycols, polyalkylene waxes, partially oxidized polyalkylene waxes, lanolin and lanolin derivatives, fatty acids, fatty acid esters, oxidized or functionalized polyolefins, and sterates. Rudat describes the use of aminosiloxanes as efficacious when combined with fluorochemicals and silsesquioxane-containing sols. U.S. Patent Appl. No. 2008 0287020 is incorporated herein by reference. Polysiloxane compounds, such as amino functional polydimethylsiloxanes; fatty acid condensation products, such as condensation products of hydrated tallow with 2-[2-aminoethyl]amino] ethanol; and acetate salt (CAS No. 68425-52-5) or acryl compounds such as bis [acryloyloxyethyl]-hydroxyethylammonium methyl sulfate (CAS No. 93334-15-7) are suitable in principle as softeners. A softener from the above mentioned compounds or a mixture of them can be included in the composition according to the invention. Suitable softeners have been described previously by Baumann in EP 1,746,199 B1. Such textile and carpeting softeners are commercially available, and examples of suitable softeners are Finistro® AFN (fatty acid condensation product) of Thor, Speyer, Germany; Megatext® JET-LF of Huntsman Textile Effects, Langweid am Lech, Germany; Perrutox® CCA 500 (fatty acid condensation product) of Rudolf GmbH & Co. KG, Geretsried, Germany; Raninois® TS 20 (fatty acid condensation product) of Ranie Chemie, Weilh, Germany; Softycon N (fatty acid condensation product) Textilecolor AG, Sevelen, Switzerland; Tubingal® OH5 of CHT R. Beilich GmbH, Tubingen, Germany; and Cefasoft NI (fatty acid condensation product) of Zschimmer & Schwarz Mohsdorf GmbH & Co. KG, Mohsdorf, Germany. EP 1,746,199 is incorporated herein by reference.

[0038] In general, the fiber treatment compositions disclosed herein are improvements over PFCA and PFSA fiber treatment technology. The aqueous compositions can be utilized directly, only with the addition of water of dilution. Further, the application process is environmentally friendly, resulting only in release of water vapor and negligible amounts of nonhazardous cosolvent vapors (dispersion aids) when the substrate is dried.

[0039] Nanoparticles, as a general class of chemical molecules, are known to extend the soil protection properties provided by fluorine containing chemicals. As disclosed in U.S. patent application No. 2011/0311757 A1, herein incorporated by reference, nanoparticle treatments have been used previously as a fluorine extender for anti-soiling purposes. WO2013/116486, herein incorporated by reference, teaches nanoparticles shown to have anti-soiling properties when used in conjunction with non-fluorinated chemicals having water repellent properties. The nanoparticles disclosed in WO2013/116486 demonstrate efficacy of non-fluorochimical treatments to produce a softer hand fiber, while retaining desirable soil-resistant attributes.

[0040] A soil repellent fiber is disclosed comprising a fluorine-free surface treatment comprising at least one clay nanoparticle component and at least one acrylic copolymer component. The clay nanoparticle can refer to particles substantially comprising minerals of the following geological classes: smectites, kaolins, chlorites, and attapulgites. These classes include specific clays such as montmorillonite, bentonite, pyrophyllite, hectorite, saponite, saucnite, nontronite, talc, beidellite, volchonskite, vermiculite, kao- linite, dickite, antigorite, anauxite, indellite, chrysotile, bravaiste, suscovite, paragonite, bitore, corrensite, pennisite, donbasite, sudsolite, pennine, sepiolite, and polygorskite. The clay nanoparticles can be either synthetic or natural, including synthetic hectorite, and Laponite® from BYK Additive GmbH, Moosburg/Germany. The Laponite® clay nanoparticles can be Laponite® RD, Laponite® RDS, Laponite® JS, Laponite® S482 and Laponite® SL25.

[0041] The concentrates according to the disclosure typically contain stabilizing additives. Preferred concentrates according to the disclosure can contain surfactant or emulsifier species. Examples of surfactants suitable for the present disclosure are any of the anionic or non-ionic surfactants commonly used in formulating chemicals, such as triethanolamine, water-soluble salts of alkylbenzene sulfonates such as the isopropylamine salt of a C12-alkybenzene sulfonic acid, and/or a C12 fatty alcohol sulfate, alkyl sulfates, alkyl polyethoxy ether sulfates, paraffin sulfonates, alpha-olefin sulfonates and sulfosuccinates, alpha-sulfocar-
boxylates and their esters, alkyl glyceryl ether sulfonates, 
fatty acid monoglyceride sulfates and sulfonates, alkyl pheno
tol polyethoxy ether sulfates, the water-soluble salts or 
esters of alpha-sulfonated fatty acids containing from about 
6 to about 20 carbon atoms in the fatty acid group and from 
about 1 to about 10 carbon atoms in the ester group, and the 
like. Examples of preferred non-surfactant emulsifier spe-
cies are diethylene glycol monobutyl ether (butyl diglycol) 
and ethylene glycol monohexyl ether (hexyl glycol). Glycols 
and glycol ethers are particularly preferred emulsifiers. The 
preferred emulsifiers ensure the textile softening constitu-
ents are kept as a finely divided emulsion in water. The 
choice of non-ionic emulsifiers is advantageous as they act 
to inhibit unwanted foaming during application, and they 
contribute to uniform treatment on the substrate surface. 
Should foaming be desired for application, a foaming agent 
can be provided. Other stabilizing additives include peptiz-
ing agents. Peptizing agents improve dispersability of nano-
particulates in a dispersion medium such as water. Examples 
of peptizing agents suitable for this disclosure are disodium 
etrideconate, sodium carbonates, sodium metaphosphates, 
sodium polyacrylates, and sodium hydroxide. Disodium 
etrideconate is especially preferred peptizing agent.

[0042] However, the prior art fails to disclose the combi-
nations of one or more of Compositions X1, X2, X3 or X4 
as fiber, yarn, fabric, textile and carpet treatments for durable 
water repellency and soil resistance. The applicant has 
surprisingly found that topical application of composition 
X1 in an amount from about 500 ppm to about 5,000 ppm 
nanoparticulate silicate can result in the desired end use 
performance of durable water repellency and soil resistance. 
In another aspect of the present disclosure, Compositions X3 
and X4 can be applied simultaneously and can also result in 
the desired end use performance of durable water repellency 
and soil resistance. This is a significant discovery because it 
eliminates the need for additional economic costs, process-
ing steps and equipment and environmental concerns 
involved with the use of fluorocarbons or other water 
repellant technologies, such as microcrystalline waxes.

[0043] Topical compositions X1, X2, X3 and X4 can be 
applied by many different methods, such as gravure coating, 
silk screen printing, roll coating, spray coating, spray 
bar application, rotary spray applicator, bath application, or 
foam wet processing methods. In one nonlimiting embod-
iment, the compositions can be diluted prior to application. 
Suitable diluents include those known in the art. In one 
nonlimiting embodiment, the diluent is water. In another 
nonlimiting embodiment, the acidity of the formulation may 
be adjusted. In one nonlimiting embodiment, the pH may be 
adjusted to be between 5 and 10. In another nonlimiting 
embodiment, the pH may be adjusted to be between 5.5 and 
6.5. Upon drying the treated substrate and evaporation of the 
water, the topical compositions X1, X2, X3, and X4 that on 
drying and evaporation of the water, form a coating on the 
substrate. Suitable substrates may be textile, yarn, fiber, 
fabric or carpeting. Examples of preferred methods of appli-
cation in this disclosure are spray bar application and rotary 
spray applicator. Rotary applicator systems such the 
WEKO-FLOW with WEKO-SIGMA liquid application sys-
tem, manufactured by Weitmann & Konrad GmbH & Co. 
KG of Leinfelden-Echterdingen, Germany are suitable.

Similarly, rotary applicator systems such as The Wave and 
The IQ Spray Application Systems, manufactured by Con-
ultex Systems of Spartanburg, S.C., USA are suitable for 
application of compositions of this disclosure. Spray bar 
applicator systems, or spray manifold systems, are well 
known in the trade, and any such system is suitable for 
applying the compositions described herein.

Definitions

[0044] While mostly familiar to those versed in the art, the 
following definitions are provided in the interest of clarity.

- approx. wt. % active solids: the approximate amount, in 
terms of weight percent, of the active component in the 
formulated material.

Formulated: For the purpose of this disclosure, by “formu-
lated” it is meant that, for example, one or more of the active 
components A, B, or C, are provided as complex water-
borne mixtures, in combination with such chemical adjuncts 
as surfactants, co-solvents, emulsifying agents, peptizing 
agents, or dispersing agents, for example. The anionic 
acrylic-based copolymer, B, can therefore be provided as a 
water-borne formulation having certain adjuncts present 
and, separately, the textile softening agent, C, can be 
provided as a water-borne product having certain adjuncts 
present, and in this form B and C can, for example, be 
combined and mixed with A and D.

Nanoparticulate: A multidimensional particle in which one 
of its dimensions is less than 100 nm in length.

owf: “on weight of fiber.” The amount of solids of fiber 
protectant applied after evaporation of solvent. The value of 
solids applied owf is typically expressed as a percentage of 
the mass of fiber present in the article.

fluid ppv: parts per volume of a formulated (fluid-based) 
composition component.

Soil repellency and dry soil resistance: Terms used herein 
interchangeably to describe the ability to prevent dry soils 
from sticking to a fiber. For example, the dry soil may be dirt 
tracked in by foot traffic.

tpi: twists per inch.

WPU (Wet Pick-up): The amount of solution weight that 
was applied to the fiber before drying off the solvent.

[0045] The invention will be described in more detail with 
the help of following examples that do not restrict the scope 
of the invention. Further, it should be understood that the 
recipes in this disclosure reflect specific use rates for com-
ponents added as part of a discrete example recipe, but these 
recipes should not be construed to be limited for the purpose 
of this disclosure as not encompassing a range of similarly 
effective use rates for the indicated recipe components. For 
example, if component B is listed as being used in a 
composition at 10.0 ppv, it should be understood that B can 
also be used in the composition at 5, 7, 9, 11, 13, and 15 ppv.

[0046] The following are examples of mixtures of com-
positions X1, X2, X3 and X4 which are suitable for the 
present invention:
Composition X1:

TABLE 1

<table>
<thead>
<tr>
<th>Component</th>
<th>Identifier</th>
<th>Approx. wt. %</th>
<th>Active ingredient</th>
<th>Fluid ppv</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Laponite® SL25</td>
<td>21.5-25%</td>
<td>4.96%</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Primal™ ECO-36</td>
<td>46.5-47.5%</td>
<td>3-50%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Water, any</td>
<td>Balance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total 100

An example recipe for Composition X1.

Composition X2:

TABLE 2

<table>
<thead>
<tr>
<th>Component</th>
<th>Identifier</th>
<th>Approx. wt. %</th>
<th>Active ingredient</th>
<th>Fluid ppv</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Laponite® SL25</td>
<td>21.5-25%</td>
<td>5</td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>Primal™ ECO-36</td>
<td>46.5-47.5%</td>
<td>10</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Water, any</td>
<td>Balance</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total 100

An example recipe for Composition X2.

Composition X3:

TABLE 3

<table>
<thead>
<tr>
<th>Component</th>
<th>Identifier</th>
<th>Approx. wt. %</th>
<th>Active ingredient</th>
<th>Fluid ppv</th>
</tr>
</thead>
<tbody>
<tr>
<td>B</td>
<td>Primal™ ECO-36</td>
<td>62.5%</td>
<td></td>
<td>5-80</td>
</tr>
<tr>
<td>D</td>
<td>Tubingal OHS</td>
<td>37%</td>
<td>5-40%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Water, any</td>
<td>Balance</td>
<td></td>
<td>balance</td>
</tr>
</tbody>
</table>

Total 100

An example recipe for Composition X3.

Composition X4:

TABLE 4

<table>
<thead>
<tr>
<th>Component</th>
<th>Identifier</th>
<th>Approx. wt. %</th>
<th>Active ingredient</th>
<th>Fluid ppv</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Laponite® SL-25</td>
<td>21.5-25%</td>
<td>40-100%</td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>Water, any</td>
<td>Balance</td>
<td></td>
<td>balance</td>
</tr>
</tbody>
</table>

Total 100

An example recipe for Composition X4.

[0051] Soil repellency refers to the ability of a fibrous substrate to resist the adhesion of dry soils. The tests performed to evaluate soil repellence levels generally involve applying standardized, non-liquid-containing dry soil compositions to a fibrous substrate, and further subjecting the substrate to a moving load to simulate wear or traffic. The soil composition is subsequently subjected to a controlled soil removal process, such as by vacuum cleaner. These tests may also involve water extraction. The substrate is then compared to a control sample, or a standard of established value.

[0052] Composition X1 is the combination of A, B, and C at a range of incorporation indicated in Table 1. A suitable range of application of X1 onto an area of carpet fiber substrate is 0.1%-8% owf. Application of X1 at less than 0.1% owf is ineffective for durable soil and water repellency,
and application of X1 at greater than 8% o/w is understood to understood to not be economical under current market conditions, or practical as would be considered using the preferred methods of application in industry. A more preferable range of application of X1 on a fiber substrate such as carpet is 0.3%-2.5% o/w.

Composition X2 is the combination of all four of A, B, C, and D, at a range of incorporation indicated in Table 2. A suitable range of application of X2 onto an area of carpet fiber substrate is 0.1%-8% o/w. A more preferable range of application of X2 on a fiber substrate such as carpet is 0.4%-2.5% o/w.

Composition X3 is the combination of B, C, and D at a range of incorporation indicated in Table 3. A suitable range of application of X3 onto an area of carpet fiber substrate is 0.1%-6% o/w. Application of X3 at less than 0.1% o/w is ineffective for softness improvement, and application of X3 at greater than 6% o/w is understood to have a detrimental effect on the soil resistance of the substrate. A more preferable range of application of X3 on a fiber substrate such as carpet is 0.3%-2.0% o/w.

Composition X4 is the combination of A, C and D at a range of incorporation indicated in Table 4. A suitable range of application of X4 onto an area of carpet fiber substrate is 0.1%-8% o/w. Application of X4 at less than 0.3% o/w is ineffective for soil resistance, while application of X4 at greater than 8% o/w is understood to be not economical under current market conditions, or practical as would be considered using the preferred methods of application in industry. A more preferable range of application of X4 on a fiber substrate such as carpet is 0.5%-4.0% o/w.

In one aspect, Compositions X1, X2, X3, or X4 are prepared by one or more of mixing, agitating, sonicating, or physically blending the individual chemistries A, B, D, in their requisite proportions, in diluent C.

In another aspect, Compositions X1, X2, X3, or X4 are prepared by taking each of A, B, D, and dispersing, emulsifying, sonicating, dispersing, or agitating each in diluent C, prior to combining the components by one or more of: mixing, agitating, sonicating, or physically blending the individual chemistries A, B, D, in their requisite proportions, in diluent C.

In yet another aspect, a Composition X1 is applied to yarns, fibers, textiles, fabrics or carpets. The disclosed nanoparticles clays, A, acrylic-based copolymers, B, and aqueous diluent, C, are combined, in one pot, to yield a composition, X1, that is a surprisingly stable complex liquid mixture and is effective for durable water and soil repellency for fibers. Composition X1 is thereafter suitable for transport to a manufacturing facility, where it can optionally be diluted with water, then applied onto yarns, fibers, textiles, fabrics or carpets.

In another aspect, a Composition X2 is applied to yarns, fibers, textiles, fabrics or carpets. The disclosed nanoparticles clays, A, acrylic-based copolymers, B, aqueous diluent, C, and textile softening agents, D, are combined, in one pot, to yield a composition, X2, that is a surprisingly stable complex liquid mixture and is effective for durable water and soil repellency for fibers, with additional softness benefit. Composition X2 is thereafter suitable for transport to a manufacturing facility, where it can optionally be diluted with water, then applied onto yarns, fibers, textiles, fabrics or carpets.

In yet another aspect, one or more of Compositions X1, X2, X3 and X4 are sequentially applied to yarns, fibers, textiles, fabrics or carpets.

In still another aspect, one or more of Compositions X1, X2, X3 and X4 are applied simultaneously to yarns, fibers, textiles, fabrics or carpets.

In another aspect, as any foam produced by agitating X1, X2, X3 or X4 is short-lived, compositions X1, X2, X3, and X4 of the present disclosure find particular utility in systems that apply liquids under low- or no-foam conditions. Application methods wherein no- or low-foam compositions are desired include spray bar and rotary spray liquid applicator methods.

In yet another aspect of the disclosure, should foam application prove necessary, any foaming agent used in the trade is suitable to add in order may be employed for applying to one or more of a Composition X1, X2, X3 or X4 as a foam. Examples of foaming agents suitable for use include, but are not limited to alkyl amine oxides, for example Lavorin 118 SK (Pulcrea Chemicals, Germany) and Genamin® CSL (Clariant, Switzerland), C12 to C14 coconut fatty acid alkyl dimethyl amine oxides, available from Clariant, sodium alpha olefin sulphonates (e.g. Hansanyl® OS, Hansa Group AG, Germany) and sodium laureth sulfate (e.g. Hansanol® NS 242 conc, Hansa Group AG, Germany). However, should foam application prove necessary, any of standard foaming agents used in the trade are suitable. Examples of foaming agents suitable for use include, but are not limited to alkyl amine oxides, for example Lavorin 118 SK (Pulcrea Chemicals, Germany) and Genamin® CSL (Clariant, Switzerland), C12 to C14 coconut fatty acid alkyl dimethyl amine oxides, available from Clariant, sodium alpha olefin sulphonates (e.g. Hansanyl® OS, Hansa Group AG, Germany) and sodium laureth sulfate (e.g. Hansanol® NS 242 conc, Hansa Group AG, Germany).

In another aspect, one or more of Compositions X1, X2, X3 and X4 are transported to manufacturers, diluted accordingly, and applied individually to yarns, fibers, textiles, fabrics or carpets.

In another aspect, the acidity of Compositions X1, X2, X3, or X4 is adjusted to be between pH 5.0 and pH 10, prior to application to yarns, fibers, textiles, fabrics or carpets. A preferable pH is between pH 5.5 and pH 6.5.

In yet another aspect, one or more of Compositions X1, X2, X3 and X4 are transported to manufacturers together as a kit, or chemical package. In this aspect they are diluted accordingly, and then co-applied to yarns, fibers, textiles, fabrics or carpets.

In still another aspect, one or more of Compositions X1, X2, X3 and X4 are transported to manufacturers together as a kit, or chemical package. In this aspect they are combined at the manufacturing site, diluted accordingly, and the resulting liquor is applied onto yarns, fibers, textiles, fabrics or carpets.

Stain-Blocker

The fluorine-free fiber protection compositions included herein may additionally contain one or more stain-blocker chemistries, in order to combine soil protection and water repellency with suitable stain protection. If a stain-blocker is used, it is preferred to also add a dispersing agent in order to support better application of the composition in aqueous form. Anti-stain components for use in the disclosed stain blocker compositions have a component bearing
an acidic moiety which associates with polymer amine end groups and protects them from staining by acidic dye stains. The general category of chemicals suitable to the process of the instant invention can comprise any chemical that blocks positively charged dye sites. Stain blockers are available in various forms such as syrups, sulfonated novolacs, sulfonated aromatic aldehyde condensation products (SACs) and/or reaction phenolics, olefins, products of formaldehyde, phenolics, substituted thiophenolics, sulfones, substituted sulfones, polymers or copolymers of branched olefins, cyclic olefins, sulfonated olefins, acrylates, methacrylates, maleic dianhydride, and organosulfonic acids. They are usually made by reacting formaldehyde, phenol, polymethacrylic acid, maleic dianhydride, and sulfonic acid depending on specific chemistry. Further, the stain blocker is typically water soluble and generally penetrates the fiber while the anti-soil, usually a fluorochemical, is a non-water soluble dispersion that coats the surface of fiber.

[0069] Examples of stain blockers include, but are not limited to: phenol formaldehyde polymers or copolymers such as CAESESTAIN and STAINAWAY (from American Emulsions Company, Inc., Dalton, Ga.), MESITOL (from Bayer Corporation, Rock Hill, N.C.), ERIONAL (from Ciba Corporation, Greensboro, N.C.), INTRATEX (from Crompton & Knowles Colors, Inc., Charlotte, N.C.), STAINKLEER (from Dyetech, Inc., Dalton, Ga.), LANOSTAIN (from Lenmar Chemical Corporation, Dalton, Ga.), and SR-300, SR-400, and SR-500 (from E. I. du Pont de Nemours and Company, Wilmington, Del.); polymers of methacrylic acid such as the SCOTCHGARD FX series carpet protectors (from 3M Company, St. Paul, Minn.); sulfonated fatty acids from Rockland React-Rite, Inc., Rockmart, Ga.; the ARROSHEILD™ stain resist product line (ArrowStar LLC, Dalton, Ga., U.S.), I-Protect® 2126 (INVISTA S. a. r. l., Germany) and the Ultraguard SB-700 stain resist product line (Tri-Tex, Canada).

[0070] Stain-blockers are usually ionic in nature and can be equally well applied in both discontinuous and continuous application in the carpet manufacturing process. In the continuous application, the carpet runs through the usual dyeing and printing stages, whereas in the discontinuous application various separate bath uses are applied.

[0071] The procedure to apply the stain-blocker to the textile, e.g. a rug, can be in two steps or in a single application step. In the two step procedure the stain-blocker application is followed by a treatment with one or more of X1, X2 or X3. In the single step application, in which a co-application system is used, stain-block chemistry is applied and one or more of X1, X2 or X3 are applied simultaneously, using foam application process technology such as is practiced in the trade.

[0072] A dosage rate of 3.0 to 7.0% aqueous liquor on weight of fiber is recommended for the stain blocker. In the case of discontinuous application a separate treatment bath for the stain-blocking is used after the carpet dyeing process. The carpet is treated for a time period of from 20 to 30 minutes at a temperature of from 70 to 75° C. The pH-value depends on the type of stain-blocker and should be held between 2.5 and 7.0. In the case of continuous application, the carpet runs through the usual dyeing and printing stages. The stain-blocker is applied through a suitable application mechanism such as a dip trough, waterfall applicator or fluidizer. The stain block liquor should be applied at or around 60° C. ± 10° C., although the process will also work at colder temperatures. The stain-blocker is fixed in the steamer with a steaming time of 60 to 90 seconds. The carpet is then washed, vacuumed and dried. Ideally, a soil resistant and water repellent application with one or more of components X1, X2, or X3 follows the stain-blocker, in the same process.

[0073] Suitable dispersing agents for this purpose include, but are not limited to, fatty alcohol polyglycol ethers (e.g. Sera® Sperser M-DEW, DyStar Textilfarben GmbH & Co.) and alkyl aryl aminethoxylates (e.g. Avolan® JFW liquid, Tanatex® Chemicals, The Netherlands), both of which are nonionic in nature.

[0074] As mentioned already before, the textile fibers for the substrate, the carpet or the floor covering which is subjected to treatment with the compositions of the invention is of synthetic or natural origin. Suitable synthetic textiles are made from polymer bases such as polyamide like polyamide 6.6, which is known as poly(hexamethylene adipamide), or polyamide 6, which is known as poly(caprolactam), or polyesters like poly(ethylene terephthalate) and poly(propylene terephthalate), or poly(propylene), or mixtures or blends of one or more of such suitable polymer bases. Suitable textiles of natural origin are fibers made from wool or cotton.

[0075] Soil resistant and water repellent chemicals are usually applied as the last step in carpet finishing, after application of stain resist chemistry, and prior to dying or backing. Soil resistant and water repellent chemicals may be applied to the carpet via spray application or foam application, which is known in the art. Following dilution of as-received formulated products, industry-recommended rates for application are from 3.0 wt % to 1.6 wt % on weight of carpet fiber (corresponding to 500 ppm to 800 ppm elemental fluorine content). However, application ranges for the fluorine-free fiber protection compositions useful for purpose of this disclosure are usually from 0.25 to 3.5 wt %.

[0076] Spray application is the easiest method of applying soil resistant and water repellent chemicals. A spray facility may be installed in front of a dryer after coloration or in front of a latex backing oven. In order to prevent spray spreading, a suction hood should be installed above the spray bar. An aqueous solution of the composition is pumped through spray nozzles, installed above the running carpet, onto the carpet pile. For better distribution/penetration into the pile the solution should be applied to moistened carpet fiber. Alternatively, an aqueous liquor of the composition is pumped into a tank where it is metered for application by a spinning rotary plate. The rotary plate acts to apply microscopic droplets of the aqueous composition in uniform fashion onto the moving fiber, yarn, fabric, textile or carpet substrate.

[0077] Foam application is the most advanced method for the treatment of carpets with soil resistant and water repellent chemicals. By using this minimum moisture application system, highly concentrated liquors in a foam state are applied to carpets running past. A further advantage of the foam application method is its improved penetration. Foam application facilities can be installed in front of a dryer or a latex backing oven. In case of insufficient foam stability a foaming agent can be added advantageously. These foaming agents are formulated in such a way that they decompose under common drying temperatures and do not negatively impact the performance of the soil resistant and water repellent chemicals.
Suitable foaming agents include, but are not limited to alkyl amine oxides, for example Laviron 118 SK (Pulcra Chemicals, Germany) and Genaminox® CSL (Clariant, Switzerland), C_{12} to C_{18} coconut fatty acid alkyl dimethyl amine oxides, available from Clariant, sodium alpha olefin sulphonates (e.g. Hansa

Both spray application and foam application require a subsequent drying process. Raising the carpet pile face to a temperature of 110 to 130°C during the drying process is important to allow the soil resistant and water repellent chemicals to completely bond onto the fibre.

Experimental Part

The following working examples are useful to illustrate more specifically the instant invention.

For the determination of the results of the invention, the following test methods have been applied:


Carpet samples are mounted on the interior of a drum, and chrome alloy steel balls, nylon polymer pellets, and a standard dry soil are added. The soil used is AATCC 122/123 standard soil:

38 wt.-% Peat moss (dark)
17 wt.-% Portland cement
17 wt.-% Kaolin clay
17 wt.-% Silica (200 mesh)
1.75 wt.-% Carbon black (lamp or furnace black)
0.50 wt.-% Red iron oxide
8.75 wt.-% Mineral oil (medicinal grade)

After the drum is loaded it is sealed and the rotated for 1,000 revolutions, followed by vacuuming. Tests simulate initial soiling by dirty shoe soles (represented by the polymer pellets) in that the soil acts on both the carpet, and on the polymer pellets. 1,000 revolutions in a drum. The carpets are then evaluated according to a gray scale: level 1-, strong soiling, level 5—no soiling. Target—2.5 or higher.

The test is later abbreviated as: “ISO”

Water Repellency Test AATCC 193, ISO 23232:

This test (adapted from AATCC method 193) determines a finished carpet’s resistance to wetting by aqueous liquids. Drops of water-alcohol mixtures of varying surface tensions are placed on the fabric and the extent of surface wetting is determined visually. If after 10 seconds, four out of the five drops are still visible as spherical to hemispherical, the carpet is given a passing rating and the test is repeated with a higher rating number liquid. The repellency rating of the sample is the highest rating number liquid used to pass the repellency test. Carpets with a rating of 4 or higher have good anti-soiling properties. Without anti-soil treatment, most nylon carpets have a rating of 1 for water repellency.

The test is later abbreviated as: “WR”.

The following liquids were used for water repellency tests:

<table>
<thead>
<tr>
<th>Rating</th>
<th>Liquid Composition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>% Isopropanol</td>
</tr>
<tr>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>2</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>4</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>30</td>
</tr>
<tr>
<td>6</td>
<td>40</td>
</tr>
</tbody>
</table>

Kool Aid Test, AATCC Method 175

Acid dye stain resistance is evaluated using a procedure modified from the American Association of Textile Chemists and Colorists (AATCC) Method 175-2003, “Stain Resistance: Pile Floor Coverings.” 9 wt % of aqueous staining solution is prepared, according to the manufacturer’s directions, by mixing cherry-flavored Kool-AID® powder (Kraft/General Foods, White Plains, N.Y., a powdered drink mix containing, inter alia, FD&C Red No. 40). A carpet sample (4x6-inch) is placed on a flat non-absorbent surface. A hollow plastic 2-inch (5.1 cm) diameter cup is placed tightly over the carpet sample. Twenty ml of the Kool-AID® staining solution is poured into the cup and the solution is allowed to absorb completely into the carpet sample. The cup is removed and the stained carpet sample is allowed to sit undisturbed for 24 hours. Following incubation, the stained sample is rinsed thoroughly under cold tap water, excess water is removed by centrifugation, and the sample is dried in air. The carpet sample was visually inspected and rated for staining according to the FD&C Red No. 40 Stain Scale described in AATCC Method 175-2003. Stain resistance is measured using a 1-10 scale. An undetectable test staining is accorded a value of 10.

Hot Water Extraction Test

The carpet test sample is not pre-cleaned and is placed flat on a smooth, horizontal surface. The cleaning solution of 1.0% Sapu® Duo (available at Ecolab®, pH=7) is used to do the hot water extraction with a Kaercher spray-extraction cleaner. The cleaning solution is added into the tank of the spray-extraction unit, whereas cleaning is accomplished by moving the cleaning head over the carpet’s surface. Samples are cleaned over a maximum time period of 2 minutes or until the stain is completely removed (less than 2 min). The cleaned samples are air dried and rated as follows: 5.0—complete removal, 4.0—very good removal (>75%), 3.0—good removal (>50%), 2.0—fair removal (>50%) and 1.0—poor removal (<25%).

Example 1 was performed to demonstrate the soiling performance and water repellency of a Composition X2. The application liquor was applied manually in the lab using a hand-held spray device to a standard velour carpet dyed “baby blue” made from nylon 6,6, and having a fibre weight of 600 g/m². The chemical application was followed by a curing process in a laboratory oven at 130°C for about 15 minutes.

As can be seen in Table 5 the combination exceeds/meets the test requirements.
Example 2 was performed to demonstrate the soiling performance and water repellency of a carpet treated by co-application of a Composition X3 and X4. The application liquor was applied using a WEKO application system onto a carpet tile, light grey in colour and having pile weight 400 g/m², followed by a curing process in an oven at 130°C for about 8 minutes.

As can be seen in Table 6, the treatment exceeds/meets the test requirements.

### Table 5

<table>
<thead>
<tr>
<th>Amount owl</th>
<th>ISO</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.6%</td>
<td>X2</td>
<td>3</td>
</tr>
<tr>
<td>2.0%</td>
<td>X2</td>
<td>3.25</td>
</tr>
<tr>
<td>2.5%</td>
<td>X2</td>
<td>3.25</td>
</tr>
<tr>
<td>Untreated Carpet</td>
<td>1.75 to 2.0</td>
<td>0</td>
</tr>
</tbody>
</table>

Example 2 was performed to demonstrate the durability after hot water extraction (HWE) of carpets treated thusly:

[0096] a.) manually in the lab using a hand-held spray device to apply the given liquor noted in Table 7 to a standard velour carpet, 600 g/m², color “babyblue,” followed by a curing process in a lab at 130°C for about 15 minutes, and

[0097] b.) using the WEKO application system to apply the liquor noted in Table 7 onto a carpet tile, light grey in colour, and having a pile weight of 400 g/m², followed by a curing process in an oven at 130°C for about 8 minutes.

### Table 6

<table>
<thead>
<tr>
<th>ISO</th>
<th>WR</th>
</tr>
</thead>
<tbody>
<tr>
<td>X3</td>
<td>2-3</td>
</tr>
<tr>
<td>X4</td>
<td></td>
</tr>
</tbody>
</table>

Example 3 was performed to demonstrate the durability after hot water extraction (HWE) of carpets treated thusly:

Example 3 was performed to demonstrate the durability after hot water extraction (HWE) of carpets treated thusly:

1. A fiber protection composition comprising:
   a. at least one clay nanoparticle component;
   b. at least one acrylic copolymer component; and
   c. water.

2. The fiber protection composition comprising of claim 1, wherein:
   a. said at least one clay nanoparticle component is present at from 0.8 to 24 wt % solids, and
   b. said at least one acrylic copolymer component is present at from 1.4 to 23.8 wt % solids.

3. The fiber protection composition of claim 1, wherein said at least one clay nanoparticle component is selected from the group consisting of: montmorillonite, bentonite, pyrophyllite, hectorite, saponite, saucnite, nontronite, talc, beidellite, volchonskoite, vermiculite, kaolin, dickite, antigorite, anauxite, indellite, chrysotile, bravisite, susc-vite, paragonite, biotite, corrensite, peninnite, don-busite, sudoite, pinnine, sepiolite, and polygorskite.

4. The fiber protection composition of claim 1, wherein said at least one clay nanoparticle component is synthetic.

5. The fiber protection composition of claim 5, wherein said at least one clay nanoparticle component is synthetic hectorite.

6. The fiber protection composition of claim 1, wherein said at least one acrylic copolymer component is comprised of acrylate, methyl acrylate, ethyl acrylate, propyl acrylate, butyl acrylate, methacrylate, methyl methacrylate, ethyl methacrylate, propyl methacrylate, butyl methacrylate, ethacrylate, methyl ethacrylate, ethyl ethacrylate, propyl ethacrylate, butyl ethacrylate, acrylic acid, and ethylene monomers, and combinations and blends thereof.

7. The fiber protection composition of claim 1, wherein said at least one acrylic copolymer component is self-crosslinking.

8. The fiber protection composition of claim 1, wherein said at least one acrylic copolymer component is anionic or charge-neutral.

9. The fiber protection composition of claim 1, wherein said at least one acrylic copolymer component is nonionic.

10. The fiber protection composition of claim 1, wherein said at least one acrylic copolymer component is anionic.

11. The fiber protection composition of claim 1, further comprising at least one textile softening component.

12. The fiber protection composition of claim 1, wherein:
   a. said at least one clay nanoparticle component is present at from 0.8 to 22.5 wt % solids,
   b. said at least one acrylic copolymer component is present at from 1.4 to 19 wt % solids, and
   c. said at least one textile softening component is present at from 0.7 to 11 wt % solids.

13. The fiber protection composition of claim 1, wherein said at least one textile softening component is cationic, or non-ionic.

14. The fiber protection composition of claim 1, wherein said at least one textile softening component is non-ionic.

15. The fiber protection composition of claim 11, wherein said at least one textile softening component is selected from the group consisting of: a polyaminosiloxane, hydroxyterminated polyaminosiloxane, an alkoxysilanol, alkoxysiloxane, alkyl modified polyaminosiloxane, and combinations and blends thereof.

16. The fiber protection composition of claim 15, wherein said at least one textile softening component is polyaminosiloxane.

17. A fiber protection composition comprising:
   a. at least one acrylic copolymer;
   b. at least one textile softening component; and
   c. water.

18. The fiber protection composition of claim 17, wherein:
   a. said at least one acrylic copolymer component is present at from 2.3 to 38 wt % solids, and
   b. said at least one textile softening component is present at from 1.8 to 14.8 wt % solids.
19. The fiber protection composition of claim 17, wherein said at least one acrylic copolymer component is comprised of acrylate, methyl acrylate, ethyl acrylate, propyl acrylate, butyl acrylate, methacrylate, methyl methacrylate, ethyl methacrylate, propyl methacrylate, butyl methacrylate, ethacrylate, methyl ethacrylate, ethyl ethacrylate, propyl ethacrylate, butyl ethacrylate, acrylic acid, and ethylene monomers, and combinations and blends thereof.

20. The fiber protection composition of claim 17, wherein said at least one acrylic copolymer component is self-crosslinking.

21. The fiber protection composition of claim 17, wherein said at least one acrylic copolymer component is anionic or charge-neutral.

22. The fiber protection composition of claim 21, wherein said at least one acrylic copolymer component is anionic.

23. The fiber protection composition of claim 17, wherein said at least one textile softening component is cationic, or non-ionic.

24. The fiber protection composition of claim 23, wherein said at least one textile softening component is non-ionic.

25. The fiber protection composition of claim 17, wherein said at least one textile softening component is selected from the group consisting of a polyaminosiloxane, hydroxyterminated polyaminosiloxane, an alkoxyterminated polyaminosiloxane, alkyl modified polyaminosiloxane, alkoxy modified polyaminosiloxane, and combinations and blends thereof.

26. The fiber protection composition of claim 25, wherein said at least one textile softening component is polyaminosiloxane.

27. A fiber of treated with the composition of claim 1.

28. An article of manufacture treated with the composition of claim 1.

29. A fiber treated with the composition of claim 11.

30. An article of manufacture treated with the composition of claim 11.

31. A fiber treated with the composition of claim 17.

32. An article of manufacture treated with the composition of claim 17.

33. A method for the treatment of textiles or fibres of synthetic or natural origin with a composition as defined in claim 1 in an effective amount to render the textiles or fibres water repellent and soil resistant.

34. A method for the treatment of textiles or fibres of synthetic or natural origin with a composition as defined in claim 11 in an effective amount to render the textiles or fibres water repellent, soil resistant, and soft.

35. A method for the treatment of textiles or fibres of synthetic or natural origin with a composition as defined in claim 17 in an effective amount to render the textiles or fibres water repellent and soft.

36. The method of claims 33-35, wherein treatment is by gravure coating, silk screen printing, roll coating, size press coating, spray bar application, rotary spray applicator, bath application, or foam wet processing methods.

37. The method of claim 33, wherein treatment is by rotary spray applicator.

* * * * *