(54) Title: NOVEL POLYMER BASED CLEANING COMPOSITIONS FOR USE IN HARD SURFACE CLEANING AND LAUNDRY APPLICATIONS

(57) Abstract: An improved cleaning composition for use in carpet cleaners, dryer activated fabric softener sheets, laundry additives such as pre-treatment spotter liquids, gel and solid stick and laundry bar soaps is comprised of a sulfonated copolymer soil release polymer, one or more anionic nonionic, cationic and/or amphoteric surfactants, a solvent and water. Optionally, the compositions may comprise a second surfactant compound selected from the group consisting of gemini surfactants and excipients such as builders, deflocculating agents enzymes and the like.
NOVEL POLYMER BASED CLEANING COMPOSITIONS
FOR USE IN HARD SURFACE CLEANING
AND LAUNDRY APPLICATIONS

FIELD OF THE INVENTION

The present invention relates to cleaning compositions and more specifically their use in hard surface cleaners and laundry applications. More specifically, the present invention relates to the use of novel soil release polymer compounds in carpet cleaners, laundry bars, clothes dryer sheets, fabric softener sheets, laundry additives such as spot cleaners and other detergent formulations.

BACKGROUND OF THE INVENTION

Detergents and other cleaning compositions for use in laundry, dishwashing, floor cleaning and carpet cleaning applications are numerous and well known in the art. Generally these consist of one or more anionic, nonionic, or cationic surfactants, builders, enzymes, emulsifiers, stabilizers, pH modifiers and the like.

The present invention comprises a unique combination of surfactants and other excipients with a soil release polymer for enhanced cleaning and subsequent resistance to soilation in laundry bar soaps, clothes dryer sheets, fabric softener sheets and carpet cleaners. Laundry bar soaps, although not common in the United States, are used throughout the rest of the world, mostly in third world countries where clothes are manually washed by hand. Obviously, these systems are not as sophisticated and effective as the presently available detergent compositions for use in electric washers, dryers and carpet cleaning machines. Nevertheless, there is a growing need in this area for detergent systems that not only effectively clean the soiled materials but also protect the surface thus
cleaned by resisting subsequent re-deposition of dirt, grease, oils and the like.

United States Patent No. 5,510,042 to Hartman et al. discloses and claims fabric softening bar compositions comprised of from about 40 wt% to 90 wt.% of a hydrophobic fabric softener, 5.0 wt% to about 30 wt% of a nonionic surfactant and water. The fabric softener is selected from the group comprising quaternary ammonium compounds, carboxylic acid salts of tertiary amines, sorbitan esters of fatty alcohols and the like. The compositions are asserted to be low sudsing, low lathering, non-detergent fabric softening compositions.

United States Patent No. 5,813,086 to Ueno et al. discloses a carpet cleaner device that cleans the carpets using a foam composition comprised of 0.005% lauryl alcohol combined with 0.1% sodium lauryl sulfate in water. It is further disclosed however, that other suitable agents comprising anionic surfactants such as alkyl ester sulfates, nonionic surfactants such as alkyl phenols, ampholytic surfactants such as alkyl dimethyl amine oxides as well as higher order fatty alcohols may also be used.

United States Patent No. 5,728,669 to Tyerech teaches a carpet cleaning composition comprising urethane perfluoroalkyl esters, oxidizing agents, anionic surfactants and nonionic surfactants. The compositions are asserted to be effective in the removal of oxidizable carpet stains and for imparting oil repellancy to the carpet fibers.

Published International Application No. WO98/31776 A1 to Tyerech discloses carpet cleaning compositions consisting of a mixture of one or more anionic, nonionic and amphoteric surfactants in an amount of from about 0.1 wt.% to 11.0 wt%, an amino-polycarboxylic acid salt that serves as a resoiling inhibition agent in an amount of from about 0.1 wt% to 6.0 wt%, an organic solvent in an amount of 0.1-5.0 wt.% and
additives in an amount of about 0-20 wt.%.

Usually most commercially available carpet cleaning compositions are comprised of primary anionic surfactants, one or more amphoteric and/or nonionic secondary surfactants, an acrylic soil release polymer as an antiredeposition agent, a stabilizer and a solvent. None of the compositions known in the prior art utilize a copolyester soil release polymer in a cleaning system that provides the superior cleaning and stain-removal capabilities as those disclosed herein.

**SUMMARY OF THE INVENTION**

The present invention comprises novel cleaning compositions and their incorporation in a variety of end use formulations such as laundry bar soaps, carpet cleaners and laundry additives such as pre-wash spot removers and fabric softener sheets for use in the dryer. The compositions are comprised of a unique blend of a novel sulfonated copolyester soil release polymer, a surfactant blend consisting of one or more surfactants and amphoteric/zwitterionic surfactants, a stabilizer, a builder, a co-solvent, processing aids an aminocarboxylic or carbonate salt and water. A secondary surfactant component comprising one or more gemini type surfactants may also be added to the composition. The cleaning compositions are particularly useful in carpet cleaning compositions, heat activated laundry dryer fabric softener sheets and laundry bar soaps.

**DETAILED DESCRIPTION OF THE INVENTION**

The cleaning compositions of the present invention provide a surprisingly superior, efficacious cleaner that not only readily removes dirt, soil and stains from hard
surfaces, but also prevents the re-deposition of these materials onto the surface of whatever is being cleaned. The basic cleaning composition can be formulated into one of a number of different applications and additional excipients may be added as desired to more specifically tailor the formulation to its end use application. In particular, superior carpet cleaning, laundry bar soap compositions and dryer sheets and fabric softener sheets are realized.

Central to the novelty and efficacy of the cleaning compositions of the present invention is the incorporation of a sulfonated co-polyester soil release copolymer which is represented by the general formula:

\[-[(C(O)-Ar-C(O)-O-(CH₂CH₂O)₃]₈⁻\]

wherein C(O)-Ar-C(O)- is terephthalate, isophthalate or sulfoisophthalate, a is a whole number of from 1-4 and b is an anion such as -SO₃⁻, -PO₄⁻, Cl etc.

There water dispersible or water soluble sulfonated polyesters are prepared by the esterification and/or transesterification and polycondensation of a monomer composition. These are based on an unsulphonated diacidic monomer (A), as opposed to a sulfonated diacid monomer (SA), consisting of at least one dicarboxylic acid or anhydride chosen from terephthalic, isophthalic and 2,6-naphthalenedicarboxylic acids, anhydrides or their diesters in a quantity corresponding to a molar ratio (A)/(A)+(SA) of the order of 95/100 to 60/100, preferably of the order of 93/100 to 65/100; a sulphonated diacidic monomer (SA) consisting of at least one sulphonated aromatic or sulphonated aliphatic dicarboxylic acid or anhydride, or their diesters, in a quantity corresponding to a molar ratio (SA)/(A)+(SA) of the order of 5/100 to 40/100, preferably of the order of 7/100 to 35/100, it being possible for up to 50 mol %, preferably up to 30 mol %, of the quantity of
unsulphonated diacidic monomer (SA) to be replaced with a hydroxylated diacidic monomer (HA) consisting of at least one hydroxylated aromatic or aliphatic dicarboxylic acid or anhydride or a diester of the said hydroxylated aromatic or aliphatic dicarboxylic acid.

These polyesters are also comprised of a polyol monomer (P) consisting of at least one polyol chosen from ethylene glycol, propylene glycol, diethylene glycol, dipropylene glycol, glycerol, 1,2,4-butanol and 1,2,3-butanetriol, in a quantity corresponding to a ratio of number of OH functional groups of the polyol monomer (P)/number of COOH functional groups or functional group equivalents of the diacidic monomers (A)+(SA)+(HA) of the order of 1.05 to 4, preferably of the order of 1.1 to 3.5 and very particularly of the order of 1.8 to 3 in that the sulphonated diacidic monomer (SA) consists of at least one sulphonated aromatic dicarboxylic acids or anhydrides and of sulphonated aliphatic acids or anhydrides or their diesters when the polyol monomer (P) does not contain any polyol other than a glycol or when the hydroxylated diacidic monomer (HA) is absent and in that the said sulphonated polyesters exhibit a number molecular mass lower than 20,000, a sulfur weight content of the order of 0.5 to 10%, preferably of the order of 1.2 to 8% and a hydroxyl functional group content, expressed as OH equivalent/kg of polymer, higher than 0.2.

The copolymers and their preparation are more specifically set forth in co-pending application U.S.S.N. 08/737,548, which corresponds to WO95/32997 published Dec. 7, 1995, and PCT/FR/95/00658, filing date May 19, 1995, all of which are incorporated herein by reference in their entirety.

The liquid hard surface cleaner rinse compositions of the present invention
consist of the anionic surface active polymer, a primary anionic, nonionic or amphoteric surfactant, water, and a number of other optional ingredients which can vary as desired by
the formulator depending on the particular application, strength necessary, etc. Taken in
their broadest aspect, the anionic ester polymer surfactants of the present invention
comprise an oligomeric ester backbone which preferably contains anionic hydrophobes
connected to the ester backbone by means of aryl groups or by an ester or ether linkage.
Preferably, the anion source is a sulfonated group.

Polymers of the subject invention encompass oligomeric (low molecular
weight polymeric), substantially linear esters. These esters comprise, in their backbone,
oxyalkyleneoxy, preferably oxy-1,2-propyleneoxy and polyoxyethylene units, and
hydrophobic aryldicarbonyl, preferably oxy-1,2-propyleneoxy and oxyethyleneoxy units,
and hydrophobic aryldicarbonyl, preferably terephthaloyl units. Preferred esters
additionally comprise units of sulfonsophthalate and, optionally, poly(oxyethylene)oxy
units having a degree of polymerization from about 2 to about 4. Mixtures of such esters
with reaction by-products and the like retain their highly effective surface active properties
when such mixtures contain at least about 10%, preferably at least about 25%, more
preferably at least about 50%, by weight, of the subject esters. The esters useful herein are
of relatively low molecular weight (i.e., generally below the range of fiber-forming
polyesters) typically ranging from about 500 to about 20,000, preferably from about
550 to about 8,000, also preferably from about 650 to about 2500.

Preferred anionic hydrophobes connected to the ester backbone include
sulfoaroyl units, especially sulfobenzoyl units of the formula \( (MO_2S)(C_6H_4)C(O) - \) wherein
M is a salt-forming cation such as sodium or tetraalkylammonium. Preferably M is
sodium. Preferably not more than 0.15 mole fraction of the sulfobenzoyl backbone units
are in para-form. More preferred are the sulfobenzoyl backbone units being essentially in
ortho- or meta-form.

Other preferred backbone units include those derived from sulfonated polyethoxy/propoxy groups, which are connected to the backbone by an ester linkage. Preferred are those of the formula \((\text{MO}_3\text{S})(\text{CH}_2)_m(\text{RO})_n^+\), wherein \(M\) is a salt-forming cation such as sodium or tetraalkylammonium; \(m\) is 0 or 1, preferably 0; \(R\) is ethylene, propylene, or a mixture thereof, preferably ethylene; and \(n\) is on average from 1 to about 20, preferably 1-5. More preferred are capping units derived from monomers selected from the group comprising sodium 2-(2-hydroxyethoxy) ethanesulfonate, sodium.

2-(2(hydroxyethoxy)ethoxy)ethanesulfonate, and

2-(2-(2-hydroxyethoxyethoxy)ethoxy)ethanesulfonate.

Still other preferred backbone units include ethoxylated or propoxylated phenolsulfonate units of the formula \(\text{MO}_3\text{S}(\text{C}_6\text{H}_4)(\text{OR})_p^-\) wherein \(M\) and \(R\) are as defined above, and \(p\) is a number of from about 1 to about 20, preferably from about 2 to about 10.

Additionally suitable preferred backbone units include modified poly(oxyethylene)oxy monoalkyl ether units of the formula \(\text{RO}(\text{CH}_2\text{CH}_2\text{O})_k^-\) wherein \(R\) is about \(C_1\)-\(C_4\), preferably about \(C_1\)-\(C_2\) saturated alkyl, and \(k\) is a number of from about 3 to about 100, preferably from about 5 to about 50.

The ester "backbone" of the surfactant polymers, by definition, comprises all the anionic hydrophiles that are incorporated into the esters and these are interconnected by means of ester bonds.

The essential oxyalkyleneoxy units of the backbone of the subject polymers
are mixtures of symmetrical (a) -OCH₂CH₂O- (oxyethyleneoxy) units with unsymmetrical
(b) -OCHR₁CH(R₂)O- (oxy- 1,2-alkyleneoxy) units, wherein R₁ and R₂ are selected so
that in each of the units, one of R₁ or R₂ is H and the other is non-hydrogen R group (as
specified below), or R₁ and R₂ can be different non-hydrogen R groups. The (b) units are
believed to provide a sufficiently unsymmetrical character required for stability of the
desired viscosity of the anionic or nonionic surfactant polymers, whereas the (a) units are
believed to provide sufficient symmetry for superior surface active functionality. A
convenient measure of the unsymmetrical character required is given by the mole ratio of
(a) units to (b) units. For the subject invention processes, the ratio of (a) units to (b) units
in the subject polymers preferably varies from about 1:2 to about 4:1. At a ratio of greater
than about 4:1, the polymers spontaneously change from an amorphous character to a
crystalline form quickly, and are not useful in commercial scale processes where
concentrated aqueous solutions are prepared and kept for more than a few minutes. At a
ratio less than about 1:2, the polymer do not tend to change from amorphous to crystalline
form. As a result, more preferred ratios of (a) units to (b) units in the subject polymers is
from about 1:1 to about 3:1 and more preferred still is from about 1.3:1 to about 2:1.

In the above paragraph, R is preferably a non-hydrogen, non-charged group
with a low molecular weight (typically below about 500). R is chemically unreactive
(especially in that it is a non-esterifiable group) and is comprised of C and H, or of C, H
and O. The preferred R groups are selected from lower n-alkyl groups, such as methyl,
ethyl, propyl and butyl, especially methyl. Thus, the preferred oxy-1,2-alkyleneoxy and
oxy-1,2-hexyleneoxy units. Especially preferred are oxy-1,2-propyleneoxy as (b) units.

The backbones of the subject esters comprise, per mole of ester, from about
0.5 to about 66 moles of the oxyalkyleneoxy units, preferably from about 1 to about 22 moles, more preferably from about 3 to about 16 moles.

Certain non-charged, hydrophobic aryl dicarbonyl units are also in the backbone of the subject polymers. Preferably, these are exclusively terephthaloyl units. Other non-charged, hydrophobic dicarbonyl units, such as isophthaloyl, adipoyl, or the like, can also be present if desired, provided that the soil release properties of esters (especially polyester substantivity) are not significantly diminished. These other, non-charged, hydrophobic dicarbonyl units can aid in providing sufficient irregularity in the subject esters to avoid a too great tendency to crystallize.

The backbones of the subject esters comprise, per mole of ester, from about 1 to about 40 moles of the hydrophobic aryl dicarbonyl units; preferably from about 2 to about 24 moles, more preferably from about 3 to about 14 moles.

Generally, if it is desired to modify the units of the esters, use of additional hydrophilic units is preferred over the use of additional, non-charged, hydrophobic units. To this end, minor amounts, preferably comprising less than about 5% of the molecular weight of the ester, of additional units such as di- or tri- (oxyethylene) oxy units are incorporated into the esters.

It is also possible to introduce charged, hydrophilic units into the backbone; preferably such units comprise less than about 20%, more preferably less than about 14% of the backbone units. One example is to incorporate a charged moiety $R^c$ in place of one or more $R^a$ or $R^b$ moieties of the above oxy-1,2alkyleneoxy units. Such $R^c$ moiety preferably has the structure $MO_2SL^-$, wherein $M$ is a slat-forming cation such as sodium or tetraalkylammonium, and $L$ is a side chain connecting moiety selected from alkylene,
oxyalkylene, alkylenoxyalkylene, arylene, oxyarylene, alkyloxyarylxyrene,
polyoxyalkylene, alkylenoxyarylene, poly (oxyalkylene), alkylene poly (oxyalkylene),
and mixtures thereof. As used in this paragraph, the alkylene moieties are about a C_1-C_n
chain, preferably ethylene or 1,2-propylene; arylene is preferably phenylene.

As another example, anionic hydrophillic units capable of forming two
ester bonds may be included in the backbone of the esters. Suitable anionic hydrophillic
units of this specific type are well illustrated by sulfonated dicarbonyl units, such as
sulfosuccinyl, i.e., or more preferably, sulfoisophthaloyl, i.e., -(O)(C(6H_5)(SO_3M)C(O)-
wherein M is a salt-forming cation, such as an alkali metal or tetraalkylammonium ion.

The backbones of the subject esters comprise, per mole of ester, from 0
moles to about 20 moles of sulfonated dicarbonyl units, preferably from about 0.5 moles to
about 9 moles, preferably from about 1 mole to about 4 moles.

The anionic and nonionic low molecular weight poly(oxyethylene)
oxy/aryldicarbonyl ester polymer surfactants are incorporated in the cleaner formulations
in an amount of from about 0.01 wt% to about 5.0 wt% based upon the total weight of the
rinse formulation. Preferably, the ester polymer is in an amount of 0.5 wt.% to 3.0 wt. %.

A second element of the cleaning compositions of the present invention is a
surfactant component consisting of one or more and preferably a blend of surfactants
selected from the group consisting of anionic surfactants, nonionic surfactants, cationic
surfactants, amphoteric surfactants and natural surfactants such as tallow which are
commonly found in third world countries. Examples of suitable nonionic surfactants
useful in the practice of the present invention include fatty acid glycerine esters,
polyglycerine fatty acid esters, higher alcohol ethylene oxide adducts, single long chain
polyoxyethylene lanolin alcohol, polyoxyethylene fatty acid esters, polyoxyethylene glycerine fatty acid esters, polyoxyethylene propylene glycol fatty acid esters, polyoxyethylene sorbitol fatty acid esters, polyoxyethylene castor oil or hardened castor oil derivatives, polyoxyethylene lanolin derivatives, polyoxyethylene fatty acid amides, polyethylene alkyl amines, alkylpyrrolidones, glucamides, alkylpolyglucosides, mono- and dialkanol amides, polyoxyethylene alcohol mono- or diamides, alkylamine oxides and mixtures thereof.

Examples of the anionic surfactants used herein include fatty acid soaps, ether carboxylic acids and salts thereof, alkane sulfonate salts, \( \alpha \)-olefin sulfonate salts, sulfonate salts of higher fatty acid esters, higher alcohol sulfate ester salts, fatty alcohol ether sulfate salts, higher alcohol phosphate ester salts, condensates of higher fatty acids and amino acids, and collagen hydrolysate derivatives.

Examples of the amphoteric surfactants used herein include amino acids, betaine, sultaine, phosphobetaines, imidazoline type amphoteric surfactants, soybean phospholipid, and yolk lecithin.

The cleaner concentrate compositions may also optionally contain a secondary surfactant component comprising a class of surface active cleaners known as gemini surfactants. Whereas the conventional surfactants discussed earlier are generally linear chain molecules comprised of one hydrophilic "head" portion attached to a hydrophobic "tail" portion, gemini surfactants are comprised of two of these hydrophobic/hydrophilic chains attached by an alkylene bridge. These are described in the literature (Chemtech, Mar. 1993 pp. 30-33) and exhibit unusually low critical micelle concentration values and higher pC-20 values together with superior surface active...
Examples of suitable anionic gemini surfactants useful in the compositions of the present invention are disclosed in United States Patent No. 5,643,864 to Li et al., and United States Patent No. 5,710,121 to Tracy et al., both of which are incorporated herein by reference. Examples of suitable nonionic gemini surfactants useful in the compositions of the present invention are disclosed in United States Patent Nos. 5,846,926; 5,811,384 and 5,863,886 all to Tracy et al. which are also incorporated herein by reference. Examples of suitable cationic gemini surfactants useful in the compositions of the present invention are disclosed in United States Patent No. 5,643,498 to Li et al. while examples of suitable amphoteric gemini surfactants useful in the compositions of the present invention may be found in United States Patent Nos. 5,656,586 to Li et al., 5,789,371 to Tracy et al. and 5,846,923 to Riererson et al. all of which are incorporated herein by reference.

The surfactant or surfactant blend component is incorporated into said cleaning compositions in an amount of from about 5.0 wt. % - 80.0 wt. % and preferable from about 20 wt. % to 50 wt. % based upon the total weight of the cleaning composition. Any of the commonly used auxilliary additives such as inorganic salts such as Glauber salt and common salt, builders such as tetrapotassium pyrophosphate, humectants, solubilizing agents, deflocculating agents such as sodium tripolyphosphate, UV absorbers, softeners, whitening agents such as distyryl biphenyl derivates (Trupal® cyanuric chloride; diaminostilbene derivatives, chelating agents such as tetrassodium ethylene diamine tetracetic acid (NaEDTA), solvents, water and oils for pre-spotting stick applicators and cellulosic substrates for fabric softener dryer sheets. Viscosity modifiers
may also be added to the surfactants of the invention or blends thereof with other surfactants as disclosed herein.

When prepared as carpet cleaner formulations, the cleaning compositions of the present invention also include a number of other components which can be tailored for the specific application. Generally, the cleaner will comprise an additional salt such as citric acid salts, boric acid salts, alkali metal carbonates, aminopolycarboxylic acid salts, an absorbent such as cellulose, zeolite or amorphous silica. All the components are incorporated in an amount of from about 5.0 wt. % to about 30 wt. % and preferably 4.0-10 wt. % based on the total weight of the composition.

Laundry bar soaps are primarily used in third-world countries and those poorer countries where clothes washers and dryers are a luxury and a rarity. The laundry bar soaps are used to scrub the clothes and physically beat and pull the dirt out of the soiled fabric. Apart from the sulfonated copolyester soil release copolymer, the surfactant blend and excipients additives the laundry bar soaps may also contain fabric softeners, enzymes, color brighteners, antimicrobial agent, dispersants, bleach or other oxidizing agents. Long chain fatty acid sulfonates may also be employed.

The compositions of the present invention may also be incorporated in automatic clothes dryer sheets to impact desirable tactile and anti-static properties to the clothes as well as giving additional soil release properties. See United States Patent No. 4,849,257 to Barchet et. al. which is hereby incorporated by reference. The soil release polymer is incorporated in the sheets in an amount of from about 0.5 wt. % to about 50 wt. % as well as from 0.5 wt. % to 50 wt. % of a cationic fabric softener. A deflocculant and viscosity adjuster are also preferably added to the sheets comprising a non-woven fabric substrate,
see U.S. Patent Nos. 4,237,155 to Kardouche and 4,103,047 to Zaki et. al. which are also incorporated by reference.

Fabric conditioner sheets may also incorporate the soil release polymer compositions of the present invention for imparting additional protection to the garments while drying them. The fabric soil release components are combined with a fabric softener and a dispersing aid to be released from the sheet when exposed to heat generated during a clothes drying cycle. Suitable fabric softening agents include disteryl dimethyl ammonium methylsulfate, ditallowalkyl dimethyl ammonium methyl sulfate, dibehenyldimethyl ammonium methyl sulfate and dipalmityl dimethylammonium methyl sulfate. More specifically, the fabric softening sheets are prepared from a non-woven absorbant fabric substrate in which the soil release polymer, dispersing aid, fabric softener and viscosity control agent are imbedded. Suitable heat activated laundry dryer fabric softener sheets for the incorporation of the cleaning compound in the present invention and methods for their preparation are fully set forth in U.S. Patent No. 4,849,257 to Borcher et. al. which is hereby incorporated by reference.

The following examples are provided to more specifically set forth and define particular formulations of the present invention that exhibit superior claiming and soil removing attributes. They are presented for illustrative purposes only, and it is recognized that minor changes and modifications can be made with regards to the components or amounts that are not contemplated herein. To the extent any such changes do not materially alter the final product or its properties it is to be understood that any such differences are encompassed within the spirit and scope of the invention as recited in the subsequent claims that follow.
Example 1

A standard rug and upholstery shampoo composition was prepared using the following ingredients in their respective weight percentage (wt %) amounts.

<table>
<thead>
<tr>
<th></th>
<th>WEIGHT %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1) Sulphonated Copolyester Soil Release Polymer</td>
<td>2.0</td>
</tr>
<tr>
<td>2) Alkyl Sulfate Anionic Surfactant₁</td>
<td>7.0</td>
</tr>
<tr>
<td>3) Disodium lauramide anionic surfactant₂</td>
<td>15.0</td>
</tr>
<tr>
<td>4) Sodium Tripolyphosphate (deflocculating agent)</td>
<td>2.0</td>
</tr>
<tr>
<td>5) Ethyl Carbitol (Solvent)</td>
<td>1.5</td>
</tr>
<tr>
<td>6) Cyanuric Chloride/Diaminostilbene Disulfonic Acid³</td>
<td>0.05</td>
</tr>
<tr>
<td>7) Water</td>
<td>Q.S. to 100%</td>
</tr>
</tbody>
</table>

Mix all the ingredients and stir for approximately thirty (30) minutes until a clear, homogenous solution is formed. The rug shampoo exhibited the following physical properties.

**PHYSICAL PROPERTIES**

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>APPEARANCE</td>
<td>CLEAR, WATER-WHITE LIQUID</td>
</tr>
<tr>
<td>pH</td>
<td>10.2</td>
</tr>
<tr>
<td>SOLIDS</td>
<td>9.5</td>
</tr>
<tr>
<td>SPECIFIC GRAVITY</td>
<td>1.0</td>
</tr>
<tr>
<td>VISCOSITY</td>
<td>100 CPS MAX.</td>
</tr>
</tbody>
</table>
**Example 2**

A laundry bar soap was prepared from the following components in their respective weight percentage (wt%) amounts.

<table>
<thead>
<tr>
<th></th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sulfonated Copolyester Polymer</td>
</tr>
<tr>
<td>2.</td>
<td>Sodium Tripolyphosphate</td>
</tr>
<tr>
<td>3.</td>
<td>Dodecyl Benzene Sulfonic Acid</td>
</tr>
<tr>
<td>4.</td>
<td>Sodium Sulfate</td>
</tr>
<tr>
<td>5.</td>
<td>Sodium Carbonate</td>
</tr>
<tr>
<td>6.</td>
<td>Water</td>
</tr>
</tbody>
</table>

The laundry bar soap comprising the above listed ingredients was compared in terms of cleaning efficacy performance to a known conventional bar soap that did not contain the soil release polymer. Specifically, they were tested in their ability to release oily stains from synthetic fabrics namely, dacron single knit (DSK), dacron double knit (DDK) and a dacron/cotton blend (DCB). The fabrics were first pre-washed, stained and then washed with the laundry bar composition. Two stains were applied to the fabric; one a melted lard and violet dye mix and the other being lipstick. Each stain was applied evenly within a 3.0 cm diameter circle. The stains were allowed to set overnight for approximately sixteen hours in each instance. The reflectance (Rd) of each stain (1-3) on the fabrics was measured using a Gardner reflectometer and the soil release performance was calculated using the formula:
Soil release % = \frac{Rd3 - Rd2}{Rd1 - Rd2} \times 100 \%

The results obtained are recorded in the following Tables I - III

Table I

Detergent Bars: Test Method Development
Initial screening

Washing Conditions:
Tap water
Temp: approx. 70°C F

Hand washing, 15 sec. Scrub each side
Stain: liquefied lard/violet dye

6 DSK cloth avg.

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>Dacron/SK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detergent bar w/1 % active SRP</td>
<td>92</td>
</tr>
<tr>
<td>Detergent bar control, NO SRP</td>
<td>73.5</td>
</tr>
</tbody>
</table>

Table II

Detergent Bar Test Method Development
Duplication of results

Washing Conditions:
Tap Water
Temp; approx. 70°F

Hand washing, 15 sec. Scrub each side
Stain: liquefied lard/violet dye
6 DSK cloth avg.

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>Dacron/SK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detergent bar w/1% active SRP</td>
<td>91</td>
</tr>
<tr>
<td>Detergent bar control, NO SRP</td>
<td>61</td>
</tr>
</tbody>
</table>

Table III

Detergent Bars: Soil removal with lower soil release polymer concentration in bar (0.25% active) vs. control (no SRP)

Washing Conditions:
Tap water
Temp; 70°F
Pre-wash: Scrub each side 15 sec.
Final wash: 15 sec. each side for Soil Release Polymer treated and control

set #1
A second control set had a 2 min. final wash in order to try and remove the soil.

Stain: liquefied lard/violet dye

6 DSK cloth avg.

<table>
<thead>
<tr>
<th>SAMPLE</th>
<th>Dacron/SK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detergent bar w/0.25% active SRP</td>
<td>94</td>
</tr>
<tr>
<td>Detergent bar control set #1</td>
<td>67.5</td>
</tr>
</tbody>
</table>

Clearly, the bar soaps containing the soil release polymer exhibited superior results.
Example 3

A carpet extraction cleaner was prepared using the following components in their respective weight percentage (wt.%) amounts.

<table>
<thead>
<tr>
<th></th>
<th>WEIGHT %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sulphonated Copolyester Polymer</td>
</tr>
<tr>
<td>2.</td>
<td>Sodium Amphocarboxylate Amphoteric Surfactant¹</td>
</tr>
<tr>
<td>3.</td>
<td>Linear Alcohol Ethyleneoxide/Propylene Oxide Nonionic Surfactant²</td>
</tr>
<tr>
<td>4.</td>
<td>Sodium Polymethylacrylate Anionic Polymer³</td>
</tr>
<tr>
<td>5.</td>
<td>Glycol Monoether</td>
</tr>
<tr>
<td>6.</td>
<td>Tetrapotassium Pyrophosphate</td>
</tr>
<tr>
<td>7.</td>
<td>Fragrance/Optical Whitener</td>
</tr>
<tr>
<td>8.</td>
<td>Water</td>
</tr>
</tbody>
</table>

In order to prepare the cleaner, all the above ingredients were blended together in their respective amounts and mixed until uniformly dispersed for about forty-five (45) minutes. The cleaner had the following physical properties.

---

¹Miranol JEM Conc. (Rhodia Inc.)
²Antrarox BL-225 (Rhodia, Inc.)
³Colloid 226/35 (Rhodia)
Physical Properties

**APPEARANCE**
CLEAR, WATER-WHITE LIQUID

**pH**
11.3

**SPECIFIC GRAVITY**
1.01

**VISCOSITY**
<1000 CPS

---

**Example 4**

A liquid steam carpet cleaner was prepared using the following ingredients in their respective weight percentage (wt%) amounts.

<table>
<thead>
<tr>
<th></th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Sulphonated Copolyester Polymer</td>
</tr>
<tr>
<td>2.</td>
<td>Linear Alcohol Ethoxylate Anionic Surfactant&lt;sup&gt;4&lt;/sup&gt;</td>
</tr>
<tr>
<td>3.</td>
<td>Nonyl Phenol Aromatic Ethoxylate Nonionic Surfactant&lt;sup&gt;5&lt;/sup&gt;</td>
</tr>
<tr>
<td>4.</td>
<td>Sodium Polymethacrylate Anionic Polymer&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
<tr>
<td>5.</td>
<td>Sodium Metasilicate Builder (anhydrous)</td>
</tr>
<tr>
<td>6.</td>
<td>Tetrapotassium Pyrophosphate Detergent Base</td>
</tr>
<tr>
<td>7.</td>
<td>Water (with, optionally, fragrance and colorant)</td>
</tr>
</tbody>
</table>

---

<sup>4</sup>Rhodafac RA-600 (Rhodia, Inc.)

<sup>5</sup>Igepal co-710 (Rhodia, Inc.)

<sup>6</sup>Colloid 226/35 (Rhodia, Inc.)
The carpet cleaner was prepared by first dissolving the anhydrous sodium metasilicate in water. The surfactants and polymers were individually added slowly thereafter with constant agitation followed by the addition of the detergent base. The mixture was stirred until a uniform consistency was achieved in about 30 minutes.

**PHYSICAL PROPERTIES**

<table>
<thead>
<tr>
<th>Property</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>APPEARANCE</td>
<td>CLEAR LIQUID</td>
</tr>
<tr>
<td>pH (as is)</td>
<td>12.8</td>
</tr>
<tr>
<td>VISCOSITY</td>
<td>10.0 CPS</td>
</tr>
<tr>
<td>SPECIFIC GRAVITY</td>
<td>1.04</td>
</tr>
</tbody>
</table>

**Example 5**

A carpet shampoo with additional grease cutting functionality was prepared using the following components in their respective weight percentage (wt%) amounts.

<table>
<thead>
<tr>
<th>Component</th>
<th>Weight %</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Sulphonated Copolyester Soil Release Polymer</td>
<td>1.0</td>
</tr>
<tr>
<td>2. Sodium Lauryl Sulfate Anionic Surfactant(^7)</td>
<td>10.0</td>
</tr>
<tr>
<td>3. Disodium Lauramide Anionic Surfactant(^8)</td>
<td>3.0</td>
</tr>
<tr>
<td>4. Tetrasodium Ethylenediamine Tetraacetic Acid</td>
<td>5.0</td>
</tr>
</tbody>
</table>

(EDTA 38% sol.)

\(^7\)Rhodapon SB-8208/S (Rhodia, Inc.)

\(^8\)Gerapon SBL-203 (Rhodia, Inc.)
To prepare the cleaner composition, the sodium lauryl sulfate anionic surfactant was first mixed with the water until fully dispersed. This was then followed by the addition of the tetrasodium EDTA and the disodium lauramide anionic surfactant. After stirring for approximately thirty (30) minutes, and the system was uniform, the fragrance, dyes and glycol monoether are added. The cleaner exhibited the following properties.

**PHYSICAL PROPERTIES**

<table>
<thead>
<tr>
<th>Appearance</th>
<th>CLEAR, WATER-WHITE LIQUID</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH, (as is)</td>
<td>12.0</td>
</tr>
<tr>
<td>Specific gravity</td>
<td>1.00</td>
</tr>
<tr>
<td>Viscosity</td>
<td>&lt;10 CPS</td>
</tr>
</tbody>
</table>

**Example 6**

A carpet cleaner composition similar to that prepared in example 2 was prepared with 0.5 wt.% and 1.0 wt.% of the soil release polymer incorporated therein. These were tested against the control detergent containing no soil release polymer using the materials and apparatus listed below in the following procedure:

Nylon fiber light color carpet (off-white)

---

*Dowanol EB (Dow Corp., Midland, Mich.)*
Stain Sources:
    Dirty Motor Oil
    Red Lipstick
    Spaghetti Sauce
    Black Shoe Polish
    Tea
    Coffee
    Analytical Balance
    Micro Pipette
Applicator Sponge
    White Paper Towels
    Timer
    Vacuum Cleaner
    Steam Cleaner
    Professional Strength Steam Cleaning Concentrate

A. Carpet Preparation

The carpet was cleaned side to side and back and forth with professional strength steam cleaning concentrate diluted according to label directions (2oz/gal), using the steam cleaner. After drying, the carpet was cut into 4"x4" squares and marked on the underside to ensure all nap was going in the same direction to yield similar viewing characteristics (least reflection). Carpet swatches were coded to indicate replicate and product.
B. Staining/Cleaning

Two replicates were used for each of the above listed stains. Rd1 was measured before swatches were stained. Oil stains were delivered using the micro-pipette, whereas waxy stains were weighed first on the application sponge, then stamped onto the carpet swatches. Oils were applied at a rate of 0.12±0.05g to each carpet swatch within a 2"x2" square template using a spatula. Waxes were applied at 0.15±0.05g weight rate. The stains were allowed to dry overnight before cleaning. Rd2 was measured. Following the directions on the commercial carpet cleaner label, the carpet swatches were blotted, 4 times for 5 seconds each time, using white absorbent paper towels.

Carpets were then treated with 4.0±0.1g of the appropriate carpet cleaning product from a distance of 4-6 inches. The cleaner compositions were allowed to sit for the time indicated per label directions, to allow the foam to penetrate into the stain. Using an absorbent dry paper towel, stains were cleaned using 5 strokes working from top of the stain through the center. The paper towel was rotated to yield a clean surface and 5 more strokes were completed working from the bottom of the stain through the center. Steps 5 through 7 were repeated 4 more times for each swatch for a total of 5 cleaning cycle treatments. Carpets were allowed to dry and then vacuumed. The reflectance for stain 3 (Rd3) was measured and soil release performance was calculated as in example 2.

% Soil release = \(\frac{Rd2 - Rd3}{Rd2 - Rd1}\) x 100%

The following data was obtained with respect to the lipstick and dirty motor oil to stains.

Both stains were tested separately, differences of 10% soil release or greater are visibly
identified.

<table>
<thead>
<tr>
<th>FORMULA</th>
<th>CLEANING CYCLES</th>
<th>Lipstick</th>
<th>Motor Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control Formula 409 Carpet Cleaner</td>
<td>5x</td>
<td>19.61</td>
<td>52.00</td>
</tr>
<tr>
<td>Control Formula 409 Carpet Cleaner &amp; 0.5 wt. % Soil Release Polymer (SRP) &amp; 0.5% PF</td>
<td>5x</td>
<td>44.12</td>
<td>80.82</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FORMULA</th>
<th>CLEANING CYCLES</th>
<th>Lipstick</th>
<th>Motor Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTRL F-409</td>
<td>5X</td>
<td>17.35</td>
<td>84.00</td>
</tr>
<tr>
<td>F-409 &amp; 1.0% SRP</td>
<td>5X</td>
<td>68.37</td>
<td>80.54</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>FORMULA</th>
<th>CLEANING CYCLES</th>
<th>Lipstick</th>
<th>Motor Oil</th>
</tr>
</thead>
<tbody>
<tr>
<td>CTRL F-409 as is</td>
<td>5X</td>
<td>17.56</td>
<td>34.24</td>
</tr>
<tr>
<td>F-409 &amp; 1.0% SRP</td>
<td>5X</td>
<td>62.24</td>
<td>87.76</td>
</tr>
</tbody>
</table>

**Example 7**

A laundry dry fabric softener sheet was prepared using the following components in their respective percentage amounts.
1. Sulfonated Copolyester Soil Release Polymer 40.0
2. Ditallow dimethylammonium methyl sulfate 50.5
3. Bentonite Clay (viscosity adjuster) 3.0
4. Xylene Sulfonate (diffusulant) 12.0
5. Water 5.0

The components are mixed in their respective amounts and the liquid solution is applied to a flexible, non-woven fabric material comprised of cellulosic fibers that are bounded together with a binder resin. The mixture is subjected to high shear for a uniform molten nears which then is heated to about 75°C. Other suitable absorbant materials can be substituted as is known in the art such as rayon fibers, nylon fibers, etc. When added to the drying cycle, fabrics did not cling together, possessed no static charge and had a softer sheen and feel.

1. Repel-O-Tex® (Rhodia Inc.; Cranbury N.J.)
What is claimed is:

1. A cleaning compound useful in the preparation of carpet cleaners, anti-static, dryer sheets, fabric softener dryer sheets, laundry bar soap and laundry additives comprising:
   a. a sulfonated copolyester soil release polymer;
   b. one or more surfactants selected from the group consisting of anionic surfactants, nonionic surfactants, cationic surfactants, amphoteric surfactants and mixtures thereof;
   c. one or more organic solvents; and
   d. water.

2. The cleaning composition of claim 1 wherein said sulfonated copolyester soil release polymer is represented by the structure:

```
-[C(O)-Ar-C(O)-(CH₂CH₂O)ₓ]ₙ-
```

wherein a is a number of from about 1-4 and b is an anion.

3. The cleaning composition of claim 2 wherein said anion is selected from the group consisting essentially of -SO₃⁻, PO₄⁻, and CO₃⁻.

4. The cleaning composition of claim 3 wherein said anionic surfactant is selected from the group consisting essentially of fatty acid soaps, ether carboxylic acids and salts thereof, alkane sulfonate salts, α-olefin sulfonate salts, sulfonate salts of higher fatty acid esters, higher alcohol sulfate ester salts, fatty alcohol phosphate ester salts, fatty alcohol ether phosphate ester salts, condensates of higher fatty acids and amino acids, collagen hydrolysate derivatives and mixtures thereof.

5. The cleaning composition of claim 4 wherein said nonionic surfactant is selected from the group consisting essentially of fatty acid glycerine esters, sorbitan fatty acid esters, sucrose fatty acid esters, polyglycerine fatty acid esters, higher alcohol ethylene oxide
-28-

adducts, single long chain polyoxyethylene alkyl ethers, polyoxyethylene alkyl allyl ethers, polyoxyethylene lanolin alcohol, polyoxyethylene fatty acid esters, polyoxyethylene glycerine fatty acid esters, polyoxyethylene propylene glycol fatty acid esters, polyoxyethylene sorbitol fatty acid esters, polyoxyethylene castor oil or hardened castor oil derivatives, polyoxyethylene lanolin derivatives, polyoxyethylene fatty acid amides, polyoxyethylene alkyl amines, alkylpyrrolidones, glucamides, alkylpolylglucosides, mono- and diamides, alkylamine oxides and mixtures thereof.

6. The blend of surfactants of claim 5, wherein said cationic surfactant is selected from the group consisting of alkyltrimethylammonium salts, dialkyl dimethylammonium salts, alkylidimethylbenzylammonium salts, benzethonium chlorides, acylamino acid-type cationic surfactants and mixtures thereof.

7. The cleaning composition of claim 6 wherein said amphoteric surfactant is selected from the group consisting essentially of amino acids, betaine, sultaine, phosphobetaines, imidazoline type amphoteric surfactants, soybean phospholipid, yolk lecithin and mixtures thereof.

8. The cleaning composition of claim 7 wherein said solvent is selected from the group consisting of ethanol, protic solvents, non-protic solvents and mixtures thereof.

9. The cleaning composition of claim 8 wherein said sulfonated copolyester soil release polymer is incorporated into said cleaning composition in an amount of from about 0.01 wt% to about 20 wt% based on the total weight of the cleaning composition.

10. The cleaning composition of claim 9 wherein said one or more surfactants are incorporated in to said cleaning composition in an amount of from about 2.0 wt.% to about 80 wt.% based on the total weight of the cleaning composition.
11. The cleaning composition of claim 10 wherein said one or more surfactants are incorporated into said cleaning composition in an amount of from about 20 wt.% to about 50 wt.% based on the total weight of the cleaning composition.

12. The cleaning composition of claim 11 further comprising builders, deflocculating agents, whitening agents, anti-redeposition agents, perfumes and mixtures thereof.

13. A cleaning composition useful in the preparation of carpet cleaners, anti-static dryer sheets, fabric softener dryer sheets and laundry bar soaps comprising:
   a. a sulfonated copolyester soil release polymer;
   b. one or more surfactants selected from the group consisting of anionic surfactants, nonionic surfactants, amphoteric surfactants and mixtures thereof;
   c. one or more secondary surfactants selected from the group consisting of gemini surfactants;
   d. one or more organic solvents; and
   e. water.

14. The cleaning composition of claim 13 wherein said sulfonated copolyester soil release polymer is represented by the structure:

   \[ [C(O)_{-}Ar-C(O)-(CH_2CH_2O)_{a}]_b \]

   wherein \( a \) is a number of from about 1-4 and \( b \) is an anion.

15. The cleaning composition of claim 14 wherein said anion is selected from the group consisting essentially of \(-SO_3^-, PO_4^{3-}, \text{ and } CO_3^{2-}\).

16. The cleaning composition of claim 15 wherein said anionic surfactant is selected from the group consisting essentially of fatty acid soaps, ether carboxylic acids and salts thereof, alkane sulfonate salts, \( \alpha \)-olefin sulfonate salts, sulfonate salts of higher fatty
acid esters, higher alcohol sulfate ester salts, fatty alcohol phosphate ester salts, fatty alcohol ether phosphate ester salts, condensates of higher fatty acids and amino acids, collagen hydrolysate derivatives and mixtures thereof.

17. The cleaning composition of claim 16 wherein said nonionic surfactant is selected from the group consisting essentially of fatty acid glycerine esters, sorbitan fatty acid esters, sucrose fatty acid esters, polyglycerine fatty acid esters, higher alcohol ethylene oxide adducts, single long chain polyoxyethylene alkyl ethers, polyoxyethylene alkyl allyl ethers, polyoxyethylene lanolin alcohol, polyoxyethylene fatty acid esters, polyoxyethylene glycerine fatty acid esters, polyoxyethylene propylene glycol fatty acid esters, polyoxyethylene sorbitol fatty acid esters, polyoxyethylene castor oil or hardened castor oil derivatives, polyoxyethylene lanolin derivatives, polyoxyethylene fatty acid amides, polyoxyethylene alkyl amines, alkylpyrrolidones, glucamides, alkylpolyglucosides, mono- and diamides, alkylamine oxides and mixtures thereof.

18. The blend of surfactants of claim 17, wherein said cationic surfactant is selected from the group consisting of alkyltrimethylammonium salts, diakyl(dimethyl)ammonium salts, alkyldimethylbenzylammonium salts, benzethonium chlorides, acylamino acid-type cationic surfactants and mixtures thereof.

19. The cleaning composition of claim 18 wherein said amphoteric surfactant is selected from the group consisting essentially of amino acids, betaines, sultaines, phosphobetaines, imidazoline-type amphoteric surfactants, soybean phospholipid, yolk lecithin and mixtures thereof.

20. The cleaning composition of claim 19 wherein said gemini surfactant is selected from the group consisting of nonionic gemini surfactants, anionic gemini surfactants, cationic gemini surfactants, amphoteric gemini surfactants and mixtures thereof.
21. The cleaning composition of claim 20 wherein said solvent is selected from the group consisting of ethanol, protic solvents, non-protic solvents and mixtures thereof.

22. The cleaning composition of claim 21 wherein said gemini surfactant is selected from the group consisting of anionic gemini surfactants, nonionic gemini surfactants, cationic gemini surfactants, amphoteric gemini surfactants and mixtures thereof.

23. The cleaning composition of claim 22 wherein said sulfonated copolyester soil release polymer is incorporated into said cleaning composition in an amount of from about 20 wt% to about 40 wt% based on the total weight of the cleaning composition.

24. The cleaning composition of claim 23 wherein said one or more surfactants are incorporated into said cleaning composition in an amount of from about 20 wt.% to about 40 wt.% based on the total weight of the cleaning composition.

25. The cleaning composition of claim 24 wherein said one or more surfactants are incorporated into said cleaning composition in an amount of from about 20 wt.% to about 40 wt.% based on the total weight of the cleaning composition.

26. The cleaning composition of claim 25 further comprising builders, deflocculating agents, whitening agents, anti-redeposition agents, perfumes and mixtures thereof.
A. CLASSIFICATION OF SUBJECT MATTER
IPC(7) : C11D/1700
US CL : 510/299, 517, 528; 516/76, 920
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
U.S. : 510/299, 517, 528; 516/76, 920

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
none

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)
West

C. DOCUMENTS CONSIDERED TO BE RELEVANT

<table>
<thead>
<tr>
<th>Category*</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
<th>Relevant to claim No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>X</td>
<td>WO 95/32997 A 07 December 1995, pages 1-pages 7, line 13; pages 7, line 14-pages 8, line 22; page 8, line 23-pages 9, line 8; page 17, lines 9-17; page 12, lines 31-33.</td>
<td>1-13</td>
</tr>
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<td>Y</td>
<td>US 5,922,663 A (GABRIEL et al) 13 July 1999, col. 6, lines 30-40; col. 9, lines 16-22; col. 13, lines 1-6; col. 15, lines 35-col. 18, line 6; col. 21, line 48-col. 23, line 50; col. 26, lines 1-16.</td>
<td>1-26</td>
</tr>
</tbody>
</table>

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
** T ** later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

** X ** document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

** Y ** document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

** A ** document member of the same patent family

Date of the actual completion of the international search
03 NOVEMBER 2000

Date of mailing of the international search report
08 JAN 2001

Name and mailing address of the ISA/US Commissioner of Patents and Trademarks
Box PCT
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized for
NECHOLUS OGDEN

Telephone No. (703) 308-0661

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