Title: METHOD OF LAUNDERING FABRIC

Abstract: Method of laundering soiled fabrics in an automatic washing machine, which method comprises the steps of: a) forming an aqueous laundering solution by mixing from 1 l to 40 l of water and a solid detergent composition comprising a surfactant system, said aqueous laundering solution comprising from 200 ppm to 5,000 ppm of the detergent composition; b) putting in contact soiled fabrics with said aqueous laundering solution; and c) washing said fabrics in said solution, wherein said solid detergent composition is such that at least 30% of the detergent composition dissolves in 60 seconds in water (as measured according to the dissolution of the solid detergent composition test in the specification) and wherein the surfactant system has a micellar stability (τ) of at most 30 seconds (as measured according to the micellar stability test in the specification).
METHOD OF LAUNDERING FABRIC

TECHNICAL FIELD

The present invention relates to a method for laundering soiled fabric, the method comprising the use of a detergent composition having a specific rate of dissolution and comprising a surfactant system having a specific micellar stability ($\tau_2$).

BACKGROUND OF THE INVENTION

Many consumers have a desire to conserve resources and eliminate what they perceive as waste or unnecessary, without a noticeable or significant reduction in the performance of the product. Consequently, there is interest in the so-called compact laundry product. However, even though compaction of laundry detergents may seem to be highly desirable, it is problematic and difficult to deliver a compact product which is having good economics, provides good cleaning and is perceived by a consumer as being good value. By way of example, the reduction or increase of the components of a laundry product, such as builders, fillers, surfactants etc., to arrive at a compact formula means that the relative amounts of these components is different to the one present in the non-compact product. With less solid detergent composition introduced into the aqueous laundering composition, the compact composition have less ability to clean well, and less ability to mitigate the negative effect of calcium ions on surfactant performance.

This means that, to produce a compact product which has comparable performance to a non-compact product, significant time and effort will be involved.

Consequently, the need remains for a compact detergent that is comparable in performance to existing non-compact laundry detergent.

SUMMARY OF THE INVENTION

In one embodiment of the present invention, the invention concerns a method of laundering soiled fabrics in an automatic washing machine, which method comprises the steps of:

a) forming an aqueous laundering solution by mixing from 1 l to 40 l of water and a solid detergent composition comprising a surfactant system, said aqueous laundering solution comprising from 200 ppm to 5,000 ppm of the detergent composition;

b) putting in contact soiled fabrics with said aqueous laundering solution; and

c) washing said fabrics in said solution,

wherein said solid detergent composition is such that at least 30% of the detergent composition dissolves in 60 seconds in water (as measured according to the dissolution of the solid detergent
composition test in the specification) and wherein the surfactant system has a micellar stability ($\tau_2$) of at most 30 seconds (as measured according to the micellar stability test in the specification).

Step a) and b) may be executed in any order and the soiled fabrics may be contacted to the water prior to, or after, or simultaneous with, contacting the solid detergent composition with water.

The inventors have found that detergent compositions having the dissolution of the invention and comprising a surfactant system having the $\tau_2$ of the invention were particularly suitable in compact compositions. The method of laundering of the invention is providing good cleaning performance while using a low concentration of detergent composition in the aqueous laundering solution.

Unless otherwise specified, the percentage and ratio in the claims and the present specification are by weight.

**DETAILED DESCRIPTION OF THE INVENTION**

In one of its embodiment, the invention concerns a method of laundering soiled fabrics.

**Method of laundering soiled fabrics**

The soiled fabrics are washed in an automatic washing machine. The automatic washing machine may be a top loading or a front loading machine typically, the soiled fabric are washed in a front loading machine. The automatic washing machine may comprise a rotatable wash drum. The wash drum may be rotatable around a substantially vertical axis or a round a substantially horizontal axis.

An aqueous laundering solution is formed by mixing water and a solid detergent composition. Typically, the aqueous laundering solution is formed inside the washing machine. The aqueous laundering solution may be formed directly in the wash drum. Typically, the solid detergent composition is placed in a detergent dispenser drawer and is mixed with water going through the drawer and then into the drum.

The aqueous laundering solution may comprise from 1 to 40 litres of water, for example from 6 to 35 or from 8 to 30 or even from 9 to 25 or from 10 to 20 litres of water.

The water may be tap water, cold, hot, or a mixture thereof. The water may be heated at a temperature of at least 20°C or at least 30°C or even 40°C.

The aqueous laundering solution may be formed by mixing water with from 25g to 100g, or from 30 to 95g or from 40 to 85g or even from 50 to 75g of solid detergent composition. The aqueous laundering solution may be formed by mixing water with 50 g or less, 45g or less, or
40g or less, or 35g or less, or 30g or less, or 25g or less, or 20g or less, or even 15g or less, or even 10g or less of solid detergent composition.

The aqueous laundering solution comprises from 200 ppm to 5,000 ppm of detergent composition. The aqueous laundering solution may comprise at least 250 ppm, or 300 ppm or even at least 350 or 400 or 450 or at least 500 or 600 or 700 ppm of detergent composition. The aqueous laundering solution may comprise at most 4,000 ppm or at most 3,000 ppm or at most 2,000 or 1,000 or 800 ppm of detergent composition.

In particular, the aqueous laundering solution may comprise from 6 to 20 litres of water, in particular from 8 to 15 litres of water, the aqueous laundering solution may be formed with 50 g to 75 g of solid detergent composition, in particular from 60 to 70 g of solid detergent composition, and the aqueous laundering solution may comprise from 500 to 5,000 ppm of detergent composition, in particular from 1,000 to 2,000 ppm of detergent composition.

In particular, the aqueous laundering solution may comprise from 20 to 40 litres of water, in particular from 30 to 35 litres of water, the aqueous laundering solution may be formed with 20 g to 50 g of solid detergent composition, in particular from 25 to 40 g of solid detergent composition, and the aqueous laundering solution may comprise from 400 to 1,000 ppm of detergent composition, in particular from 500 to 700 or 600 ppm of detergent composition.

The concentration of solid detergent composition in the aqueous laundering solution is the one of the main wash cycle. Any input of water during any optional rinsing step(s) is not included when determining the volume of the aqueous laundering solution.

Soiled fabrics are put in contact with the aqueous laundering solution. The soiled fabrics may be put in contact directly with the aqueous laundering solution. The soiled fabrics may also be put in contact with the aqueous laundering solution by first putting the soiled fabrics into contact with part of the aqueous laundering solution, (for example by first putting the soiled fabrics in contact with part of the water) and then by adding the remaining part of the aqueous laundering solution (for example adding the detergent composition and the remaining part of water).

The weight ratio of soiled fabric to aqueous laundering solution may be comprised between 1:25 and 1:1, or between 1:20 and 1:1.5 or between 1:15 and 1:2 or even between 1:10 and 1:3.

Typically from 0.01kg to 2kg of soiled fabric per litre of aqueous laundering solution is dosed into said aqueous laundering solution. Typically from 0.01kg, or from 0.02kg, or from 0.03kg, or from 0.05kg, or from 0.07kg, or from 0.10kg, or from 0.12kg, or from 0.15kg, or from
0.18kg, or from 0.20kg, or from 0.22kg, or from 0.25kg soiled fabric per litre of aqueous laundering solution is dosed into said aqueous laundering solution.

The soiled fabrics may be soiled clothes, sheets, towels, or mixtures thereof. The soiled fabrics may comprise natural and/or synthetic textiles. The textile may comprise wool, silk, cotton, flax, jute, hemp, modal, acetate, polyester, aramid, acrylic, nylon, spandex, and mixture thereof.

The soiled fabric may be soiled with clay, ground-in dirt, greasy and oily stains, food, body fluids, chocolate, dairy products, grass, blood, egg, cosmetics, cooking oils, animal fats, motor oils, body soils, and mixture thereof.

The soiled fabrics are at least partially washed in the aqueous laundering solution. The fabrics may be washed by keeping them in contact with the aqueous laundering solution for at least 5 seconds, or 30 seconds, or 2 minutes, typically for at least 4 minutes or 6 or 8 or even 10 minutes. Typically, while the fabrics are in contact with the aqueous laundering solution, agitation is provided, for example by rotation of the drum. While the fabrics are in contact with the aqueous laundering solution heating may be provided.

The at least partially washed soiled fabrics may then be rinsed in the automatic washing machine. They may be rinsed at least once or at least twice.

Solid detergent composition

The solid detergent composition comprises a surfactant system.

Micellar stability (τ2)

In the aqueous laundering solution, there is an equilibrium between micelles and monomers of surfactants. The time required for a micelle breakdown into monomers is called the micellar stability or the τ2.

The surfactant system has a micellar stability (τ2) of at most 30 seconds according to the micellar stability test. In particular, the surfactant system has a micellar stability (τ2) of at most 28 s, or 26 s, or 24 s, or 22 s, or 20 s, or 18 s, or 16 s, or 14 s, or even 12 s. The surfactant system may have a micellar stability of at least 10 s, or 12 s, or 14 s, or 16 s, or 18 s, or even 20 s.

Rates of dissolution

The solid detergent composition is such that at least 30% of the solid detergent composition dissolves in 60 seconds in water (as measured according to the dissolution of the solid detergent composition test below). In particular, at least 40% or 50 % or 60% or 70% or 80% of the detergent composition may dissolves in 60 s in water according to dissolution of the solid detergent composition test.
The solid detergent composition may be such that at least 50% or 60% or 70% or 80% or 90% of the organic matter of the solid detergent composition dissolves in 60 seconds in water (as measured according to the dissolution of organic matter of the solid detergent composition test below).

The solid detergent composition may be such that at least 50% or 60% or 70% or 80% or 90% of the anionic surfactant of the solid detergent composition dissolves in 60 seconds in water (as measured according to the dissolution of the anionic surfactant of the solid detergent composition test below).

Surfactant system

The solid detergent composition comprises a surfactant system, preferably from 2% to 40% by weight, preferably at least 4%, or 6%, or even at least 8%, or 10%, or 12%, or 15%, or 20%, or even at least 25% of a surfactant system. The composition may comprise less than 30%, or less than 20%, or less than 15%, or less than 10%, or less than 8% by weight of a surfactant system.

The surfactant system may comprise alkyl benzene sulphonate and one or more detersive co-surfactants. The surfactant may comprise C\textsubscript{10}-C\textsubscript{13} alkyl benzene sulphonate and one or more co-surfactants. The co-surfactants may be selected from the group consisting of C\textsubscript{12}-C\textsubscript{18} alkyl ethoxylated alcohols having an average degree of ethoxylation of from 3 to 7; C\textsubscript{12}-C\textsubscript{18} alkyl ethoxylated sulphates having an average degree of ethoxylation of from 1 to 5; and mixtures thereof. However, other surfactant systems may be suitable for use in the present invention.

Suitable surfactant systems include anionic detersive surfactants, nonionic detersive surfactants, cationic detersive surfactants, zwitterionic detersive surfactants, amphoteric detersive surfactants and mixtures thereof.

Suitable anionic detersive surfactants include: alkyl sulphates; alkyl sulphonates; alkyl phosphates; alkyl phosphonates; alkyl carboxylates; and mixtures thereof. The anionic surfactant can be selected from the group consisting of: C\textsubscript{10}-C\textsubscript{18} alkyl benzene sulphonates (LAS) preferably C\textsubscript{10}-C\textsubscript{13} alkyl benzene sulphonates; C\textsubscript{10}-C\textsubscript{20} primary, branched chain, linear-chain and random-chain alkyl sulphates (AS), typically having the following formula:

\[
\text{CH}_3(\text{CH}_2)_x\text{CH}_2^-\text{OSO}_3^-\text{M}^+
\]

wherein, M is hydrogen or a cation which provides charge neutrality, preferred cations are sodium and ammonium cations, wherein x is an integer of at least 7, preferably at least 9; C\textsubscript{10}-C\textsubscript{18} secondary (2,3) alkyl sulphates, typically having the following formulae:
wherein, M is hydrogen or a cation which provides charge neutrality, preferred cations include sodium and ammonium cations, wherein x is an integer of at least 7, preferably at least 9, y is an integer of at least 8, preferably at least 9; C_{10}-C_{18} alkyl alkoxy carboxylates; mid-chain branched alkyl sulphates as described in more detail in US 6,020,303 and US 6,060,443; modified alkylbenzene sulphonate (MLAS) as described in more detail in WO 99/05243, WO 99/05242, WO 99/05244, WO 99/05082, WO 99/05084, WO 99/05241, WO 99/07656, WO 00/23549, and WO 00/23548; methyl ester sulphonate (MES); alpha-olefin sulphonate (AOS) and mixtures thereof.

Preferred anionic detersive surfactants include: linear or branched, substituted or unsubstituted alkyl benzene sulphonate detersive surfactants, preferably linear Cs-Cs-alkyl benzene sulphonate detersive surfactants; linear or branched, substituted or unsubstituted alkyl benzene sulphate detersive surfactants; linear or branched, substituted or unsubstituted alkyl sulphate detersive surfactants, including linear C_{2}-C_{3} alkyl branched Cs-Cis alkyl sulphate detersive surfactants, linear or branched alkoxyalkylated Cs-Cis alkyl sulphate detersive surfactants and mixtures thereof; linear or branched, substituted or unsubstituted alkyl sulphonate detersive surfactants; and mixtures thereof.

Preferred alkoxyalkylated alkyl sulphate detersive surfactants are linear or branched, substituted or unsubstituted Cs-is alkyl alkoxyalkylated sulphate detersive surfactants having an average degree of alkoxylation of from 1 to 30, preferably from 1 to 10. Preferably, the alkoxyalkylated alkyl sulphate detersive surfactant is a linear or branched, substituted or unsubstituted Cs-isalkyl ethoxylated sulphate having an average degree of ethoxylation of from 1 to 10. Most preferably, the alkoxyalkylated alkyl sulphate detersive surfactant is a linear unsubstituted C_{8}-18 alkyl ethoxylated sulphate having an average degree of ethoxylation of from 3 to 7.

Preferred anionic detersive surfactants are selected from the group consisting of: linear or branched, substituted or unsubstituted, C_{12}-18 alkyl sulphates; linear or branched, substituted or unsubstituted, C_{10}-3 alkylbenzene sulphonates, preferably linear C_{10}-3 alkylbenzene sulphonates; and mixtures thereof. Highly preferred are linear C_{12}-13 alkylbenzene sulphonates. Highly preferred are linear C_{12}-13 alkylbenzene sulphonates that are obtainable, preferably obtained, by
sulphonating commercially available linear alkyl benzenes (LAB); suitable LAB include low 2-phenyl LAB, such as those supplied by Sasol under the tradename Isochem® or those supplied by Petresa under the tradename Petrelab®, other suitable LAB include high 2-phenyl LAB, such as those supplied by Sasol under the tradename Hyblene®. A suitable anionic detersive surfactant is alkyl benzene sulphonate that is obtained by DETAL catalyzed process, although other synthesis routes, such as HF, may also be suitable.

Suitable cationic detersive surfactants include: alkyl pyridinium compounds; alkyl quaternary ammonium compounds; alkyl quaternary phosphonium compounds; alkyl ternary sulphonium compounds; and mixtures thereof. The cationic detersive surfactant can be selected from the group consisting of: alkoxyate quaternary ammonium (AQA) surfactants as described in more detail in US 6,136,769; dimethyl hydroxyethyl quaternary ammonium as described in more detail in US 6,004,922; polyamine cationic surfactants as described in more detail in WO 98/35002, WO 98/35003, WO 98/35004, WO 98/35005, and WO 98/35006; cationic ester surfactants as described in more detail in US 4,228,042, US 4,239,660, US 4,260,529 and US 6,022,844; amino surfactants as described in more detail in US 6,221,825 and WO 00/47708, specifically amido propyldimethyl amine; and mixtures thereof. Preferred cationic detersive surfactants are quaternary ammonium compounds having the general formula:

\[(R)(R_1)(R_2)(R_3)N^+X^-\]

wherein, R is a linear or branched, substituted or unsubstituted C_{6-18} alkyl or alkenyl moiety, R_1 and R_2 are independently selected from methyl or ethyl moieties, R_3 is a hydroxyl, hydroxymethyl or a hydroxyethyl moiety, X is an anion which provides charge neutrality, preferred anions include halides (such as chloride), sulphate and sulphonate. Preferred cationic detersive surfactants are mono-C_6-is alkyl mono-hydroxyethyl di-methyl quaternary ammonium chlorides. Highly preferred cationic detersive surfactants are mono-C_6-1o alkyl mono-hydroxyethyl di-methyl quaternary ammonium chloride, mono-C_{12-1} alkyl mono-hydroxyethyl di-methyl quaternary ammonium chloride and mono-C_{10} alkyl mono-hydroxyethyl di-methyl quaternary ammonium chloride.

Suitable non-ionic detersive surfactant can be selected from the group consisting of: C$_2$-C$_8$ alkyl ethoxylates, such as, NEODOL® non-ionic surfactants from Shell; C$_6$-C$_{12}$ alkyl phenol alkoxylates wherein the alkoxyate units are ethyleneoxy units, propyleneoxy units or a mixture thereof; C$_7$-C$_8$ alcohol and C$_6$-C$_{12}$ alkyl phenol condensates with ethylene oxide/propylene oxide block polymers such as Pluronic® from BASF; C$_{14}$-C$_{22}$ mid-chain branched alcohols, BA,
as described in more detail in US 6,150,322; C_{14}-C_{22} mid-chain branched alkyl alkoxylates, BAEx, wherein x = from 1 to 30, as described in more detail in US 6,153,577, US 6,020,303 and US 6,093,856; alkylpolysaccharides as described in more detail in US 4,565,647, specifically alkylpolyglycosides as described in more detail in US 4,483,780 and US 4,483,779; polyhydroxy fatty acid amides as described in more detail in US 5,332,528, WO 92/06162, WO 93/19146, WO 93/19038, and WO 94/09099; ether capped poly(oxyalkylated) alcohol surfactants as described in more detail in US 6,482,994 and WO 01/42408; and mixtures thereof.

The non-ionic detersive surfactant could be an alkyl polyglucoside and/or an alkyl alkoxylated alcohol. Preferably the non-ionic detersive surfactant is a linear or branched, substituted or unsubstituted C_{8-18} alkyl ethoxylated alcohol having an average degree of ethoxylation of from 1 to 10, more preferably from 3 to 7.

**Solid detergent composition**

The detergent composition may comprise additional adjunct components. The precise nature of these additional adjunct components, and levels of incorporation thereof, will depend on the physical form of the composition and the nature of the operation for which it is to be used. Suitable adjunct materials include, but are not limited to, polymeric carboxylate, flocculating aid, chelating agents, dye transfer inhibitors, enzymes such as amylases, carboxydrases, cellulases, laccases, lipases, bleaching enzymes such as oxidases and peroxidases, proteases, pectate lyases and mannanases enzyme stabilizers, catalytic materials, bleach activators, hydrogen peroxide, sources of hydrogen peroxide, preformed peracids, polymeric dispersing agents, clay soil removal/anti-redeposition agents, brighteners, suds suppressors systems such as silicone based suds suppressors, dyes, perfumes, structure elasticizing agents, fabric softeners, carriers, hydrotrropes, processing aids, transition metal catalysts, brighteners, hueing agents, photobleach, fabric-softening agents such as clay, silicone and/or quaternary ammonium compounds; flocculants such as polyethylene oxide; dye transfer inhibitors such as polyvinylpyrrolidone, poly 4-vinylpyridine N-oxide and/or co-polymer of vinylpyrrolidone and vinylimidazolo; fabric integrity components such as oligomers produced by the condensation of imidazole and epichlorhydrin; soil dispersants and soil anti-redeposition aids such as alkoxylated polyamines and ethoxylated ethyleneimine polymers; anti-redeposition components such as polyesters; perfumes such as perfume microcapsules; soap rings; aesthetic particles; dyes; fillers, although it is preferred for the composition to be substantially free of fillers; silicate salt such as sodium silicate, including 1.6R and 2.0R sodium silicate, or sodium metasilicate; co-polyesters of dicarboxylic acids and diols; cellulosics polymers such as methyl cellulose, carboxymethyl
cellulose, hydroxyethoxycellulose, or other alkyl or alkylalkoxy cellulose; and any combination thereof and/or pigments.

**POLYMERIC CARBOXYLATE** - The composition may comprise polymeric carboxylate. It may be preferred for the composition to comprise at least 5wt% or at least 6wt%, or at least 7wt%, or at least 8wt%, or even at least 9wt%, by weight of the composition, of polymeric carboxylate. The polymeric carboxylate can sequester free calcium ions in the wash liquor. The carboxylate polymers can also act as soil dispersants and can provide an improved particulate stain removal cleaning benefit. Preferred polymeric carboxylates include: polyacrylates, preferably having a weight average molecular weight of from 1,000Da to 20,000Da; co-polymers of maleic acid and acrylic acid, preferably having a molar ratio of maleic acid monomers to acrylic acid monomers of from 1:1 to 1:10 and a weight average molecular weight of from 10,000Da to 200,000Da, or preferably having a molar ratio of maleic acid monomers to acrylic acid monomers of from 0.3:1 to 3:1 and a weight average molecular weight of from 1,000Da to 50,000Da.

**PHOSPHATE AND ZEOLITE BUILDER** - Preferably, the composition comprise from 0wt% to 10wt% phosphate builder, preferably to 8wt%, or to 6wt%, or to 4wt%, or even to 2wt% phosphate builder. The composition may even be substantially free of phosphate builder, substantially free means "no deliberately added". A typical phosphate builder is sodium tripolyphosphate. Preferably, the composition comprise from 0wt% to 10wt% zeolite builder, preferably to 8wt%, or to 6wt%, or to 4wt%, or even to 2wt% zeolite builder. The composition may even be substantially free of zeolite builder, substantially free means "no deliberately added". Typical zeolite builders are zeolite A, zeolite P and zeolite MAP.

**SOURCE OF CARBONATE** - The composition may comprise a source of carbonate. Preferred sources of carbonate include sodium carbonate and/or sodium bicarbonate. A highly preferred source of carbonate is sodium carbonate. Sodium percarbonate may also be used as the source of carbonate.

**BLEACHING AGENT** - The compositions of the present invention may comprise one or more bleaching agents. In general, when a bleaching agent is used, the compositions of the present invention may comprise from about 0.1% to about 50% or even from about 0.1% to about 25% bleaching agent by weight of the subject detergent composition. When present, suitable bleaching agents include bleaching catalysts, photobleaches for example Vitamin K3 and zinc or aluminium phthalocyanine sulfonate; bleach activators such as tetraacetyl ethylene diamine (TAED) and nonanoyloxybenzene sulfonate (NOBS); hydrogen peroxide; pre-formed peracids; sources of hydrogen peroxide such as inorganic perhydrate salts, including alkali metal salts such
as sodium salts of perborate (usually mono- or tetra-hydrate), percarbonate, persulfate, perphosphate, persilicate salts and mixtures thereof, optionally coated, suitable coatings including inorganic salts such as alkali metal; and mixtures thereof.

BLEACH ACTIVATOR - Preferably, the composition comprises a bleach activator.

Suitable bleach activators are compounds which when used in conjunction with a hydrogen peroxide source leads to the in situ production of the peracid corresponding to the bleach activator. Various non limiting examples of bleach activators are disclosed in U.S. Patent 4,915,854, issued April 10, 1990 to Mao et al, and U.S. Patent 4,412,934. The nonanoyloxybenzene sulfonate (NOBS) and tetraacetylethylenediamine (TAED) activators are typical, and mixtures thereof can also be used. See also U.S. 4,634,551 for other typical bleaches and activators useful herein. Another suitable bleach activator is decanoyloxybenzenecarboxylic acid (DOBA).

Highly preferred amido-derived bleach activators are those of the formulae:

\[ R^1 N(RS)C(O)R^2 C(O)L \quad \text{or} \quad R^1 C(O)N(RS)R^2 C(O)L \]

wherein as used for these compounds \( R^1 \) is an alkyl group containing from about 6 to about 12 carbon atoms, \( R^2 \) is an alkylene containing from 1 to about 6 carbon atoms, \( RS \) is \( H \) or alkyl, aryl, or alkaryl containing from about 1 to about 10 carbon atoms, and \( L \) is any suitable leaving group. A leaving group is any group that is displaced from the bleach activator as a consequence of the nucleophilic attack on the bleach activator by the hydroperoxide anion. A preferred leaving group is oxybenzenesulfonate.

Preferred examples of bleach activators of the above formulae include (6-octanamido-caproyl)oxybenzenesulfonate, (6-nonanamidocaproyl)oxybenzenesulfonate, (6-decanamido-caproyl)oxybenzenesulfonate, and mixtures thereof as described in U.S. Patent 4,634,551, incorporated herein by reference.

Another class of bleach activators comprises the benzoxazin-type activators disclosed by Hodge et al in U.S. Patent 4,966,723, issued October 30, 1990, incorporated herein by reference. A highly preferred activator of the benzoxazin-type is:
Still another class of preferred bleach activators includes the acyl lactam activators, especially acyl caprolactams and acyl valerolactams of the formulae:

wherein as used for these compounds $R^6$ is H or an alkyl, aryl, alkoxyaryl, or alkaryl group containing from 1 to about 12 carbon atoms. Highly preferred lactam activators include benzoyl caprolactam, octanoyl caprolactam, 3,5,5-trimethylhexanoyl caprolactam, nonanoyl caprolactam, decanoyl caprolactam, undecenoyl caprolactam, benzoyl valerolactam, octanoyl valerolactam, decanoyl valerolactam, undecenoyl valerolactam, nonanoyl valerolactam, 3,5,5-trimethylhexanoyl valerolactam and mixtures thereof. See also U.S. Patent 4,545,784, issued to Sanderson, October 8, 1985, incorporated herein by reference, which discloses acyl caprolactams, including benzoyl caprolactam, adsorbed into sodium perborate.

Highly preferred bleach activators are nonanoyloxybenzene sulfonate (NOBS) and/or tetraacetylethlenediamine (TAED).

It is highly preferred for a large amount of bleach activator relative to the source of hydrogen peroxide to be present in the laundry detergent composition. Preferably, the weight ratio of bleach activator to source of hydrogen peroxide present in the laundry detergent composition is at least 0.5:1, at least 0.6:1, at least 0.7:1, 0.8:1, preferably at least 0.9:1, or 1.0:1.0, or even 1.2:1 or higher.

**CHELANT** - The composition may comprise a chelant. Suitable chelants include diethylene triamine pentaaetate, diethylene triamine penta(methyl phosphonic acid), ethylene diamine-$N'N'$-disuccinic acid, ethylene diamine tetraacetate, ethylene diamine tetra(methylene phosphonic acid) and hydroxyethane di(methylene phosphonic acid). A preferred chelant is
ethylene diamine-NN'-disuccinic acid (EDDS) and/or hydroxyethane diphosphonic acid (HEDP). Preferably the ethylene diamine-NN'-disuccinic acid is in S'S' enantiomeric form.

The solid detergent composition is typically a laundry detergent composition or a dish washing detergent composition. Typically, the composition is a laundry composition.

The solid detergent composition is for example in particulate form, typically in free-flowing particulate form. The solid detergent composition may be in the form of an agglomerate, granule, flake, extrudate, bar, tablet or any combination thereof. The solid composition can be made by methods such as dry-mixing, agglomerating, compaction, spray drying, pan-granulation, spheronization or any combination thereof. The solid detergent composition typically has a bulk density of from 300 g/l to 1,500 g/l, typically from 500 g/l to 1,000 g/l.

The solid detergent composition may be in unit dose form, including tablets.

**Micellar stability (τ2) test**

The micellar stability of a surfactant system is measured by Stopped Flow Conductimetry.

The experiment is run at 25°C.

A composition 1 comprising 300 ppm of the surfactant system to be tested in deionised water is prepared. A composition 2 comprising water having a hardness of 20 gpg (ratio of calcium to magnesium of 3:1) is prepared.

Compositions 1 and 2 are pumped by the syringes of a MCS-200 equipment combined with a SFM-20 supplied by the company BioLogic. The equipment calculate the value of τ2.

**Dissolution of the solid detergent composition test**

The dissolution of the solid detergent composition is measured as follow.

Using a measuring cylinder 800ml of deionised water are added to a tergotometer pot.

The tergotometer is set to 20°C and 150 rpm. The stirrer is started and the solution is allowed to equilibrate for 20 mins.

Into the Tergotometer pot, 10 g of the solid detergent composition are added. After sixty seconds, approximately 70 ml of test solution is removed from the dissolution apparatus. This solution is immediately filtered through a medium fast filter paper and the filtrate is collected.

A 50 ml aliquot of the filtrate is removed using a glass pipette and added to a tared 400 ml beaker. The beaker is gently heated on a steam bath, to avoid spitting, until almost dry. The beaker is cooled in a fume hood and the last few ml of water allowed to evaporate. The beaker is heated for 10 minutes in an oven at 105°C and cooled in a dessicator until successive weightings
agree to within 0.001g. The residual solids are expressed as a proportion of the original sample weight in the solution.

% of the solid detergent composition dissolved in 60 seconds in water = 100 x wt of residual solids x 800 / 10 g x 50.

Dissolution of the organic matter of the solid detergent composition test

The weight of organic matter in the residual solids of the method above is measured as follow:

The residual solids are suspended in approximately 150 ml ethanol (reagent grade) covered with a watch glass and boiled on a steam bath for 5 minutes. The beaker and contents are cooled to about 60°C and the insoluble matter allowed to settle. Without disturbing the insoluble matter, the ethanolic portion is decanted through a medium grade filter paper into a tared beaker. This extraction is repeated twice more with new 150 ml portions of ethanol, and the filtrates combined in the tared beaker. The alcohol insoluble portion of the residue is rinsed into the filter paper with warm (40°C) ethanol and washed with 3 x 20mL portions of warm ethanol. The combined filtrates are evaporated on a steam bath in a fume hood, taking care to guard against loss of sample by excessive foaming or bumping. When the last few mL of solvent remain in the beaker, it is allowed to cool and 10 mL of acetone are added. The residue is evaporated to dryness taking care to guard against loss of sample by excessive foaming or bumping. The beaker is allowed to cool in a desiccator and weighed. The last drying and cooling steps are repeated until successive weighings agree to within 0.001 g.

The weight of organic matter in a sample of the solid detergent composition is measured as follow:

A sample of the solid detergent composition having the same weight as the residue from the Total Dissolved Solids determination is suspended in approximately 150 ml ethanol (reagent grade) covered with a watch glass and boiled on a steam bath for 5 minutes. The beaker and contents are cooled to about 60°C and the insoluble matter allowed to settle. Without disturbing the insoluble matter, the ethanolic portion is decanted through a medium grade filter paper into a tared beaker. This extraction is repeated twice more with new 150mL portions of ethanol, and the filtrates combined in the tared beaker. The alcohol insoluble portion of the residue is rinsed into the filter paper with warm (40°C) ethanol and washed with 3 x 20mL portions of warm ethanol. The combined filtrates are evaporated on a steam bath in a fume hood, taking care to guard against loss of sample by excessive foaming or bumping. When the last few mL of solvent
remain in the beaker, it is allowed to cool and 10mL of acetone are added. The residue is evaporated to dryness taking care to guard against loss of sample by excessive foaming or bumping. The beaker is allowed to cool in a dessicator and weighed. The last drying and cooling steps are repeated until successive weighings agree to within 0.001g.

The percentage of the organic matter of the solid detergent composition dissolved in 60 seconds in water = 100 x weight of organic matter in the residual solids / weight of organic matter in the sample of the solid detergent composition.

Dissolution of the anionic surfactant of the solid detergent composition test

the rate of dissolution of the anionic surfactant of the surfactant system of the detergent composition is measured as follow:

800ml of deionised water are added into a Tergotometer pot. The tergotometer pot is set at 20°C and 150rpm. The solution is allowed to equilibrate for 20 minutes.

Around 1g of the solid detergent composition is added into the tergotometer.

After 60 seconds, 10 ml of the test solution are removed and filtered through a 0.45μm acrodisc PDVF filter.

The excess of anionic surfactant in 5 ml of the filtrate is ascertained according to the standart method ISO 2271 (1989).

After 30 minutes stirring 5 ml aliquot of the test solution are removed and a titration according to the standart method ISO 2271 (1989) on this unfiltered sample is performed.

The percentage of the anionic surfactant dissolved in 60 seconds in water is calculated with the results of those titrations.

The following examples are given by way of illustration only and therefore should not be construed to limit the scope of the invention.

EXAMPLES

Example 1:

A detergent blown powder is prepared as follows.

A batch of slurry is prepared from the silicate, part of the polymers, part of the LAS and part of the carbonate. Identical batches are made during production as required. 10 bar steam is added as required to maintain temperature.
During transfer to the spray nozzle, HLAS and sodium hydroxide solution are injected into the slurry-containing line so as to increase the surfactant level in the slurry. The temperature of the slurry in the line just prior to spraying is 125 °C. high pressure air is may be injected into the slurry line to further lower density.

The resulting slurry is then sprayed through a Spray Systems T4 nozzle into a counter-current tower where it is dried by air at temperatures between 280 to 300 °C. These conditions give a blown powder of average repour cup density 300 g/l, a median particle size of 450 microns and an average moisture level of 1.75 %.

This blown powder is then further combined with a surfactant and polymer paste as follows.

Other anionic surfactant paste is blended in a food processor with a solution of part of the polymers.

The above paste is then dispersed by hand into the above blown powder. Following this the mix is mixed in a kitchen food processor at low speed for 30 seconds to further disperse the paste mix. zeolite is then added and mixed for a further 5 seconds at low speed. The resulting powder was then pushed through a 1.7 mm sieve to ensure no oversize.

The above blown powder/surfactant paste mix was then mixed with further detergent ingredients: bleach system, part of the carbonate, sodium sulphate, cationic surfactant, part of the polymers, enzymes and miscellaneous.

The following composition is obtained:

<table>
<thead>
<tr>
<th>Ingredient</th>
<th>Concentration (weight percent)</th>
</tr>
</thead>
<tbody>
<tr>
<td>non ionic surfactant</td>
<td>0-1</td>
</tr>
<tr>
<td>cationic surfactant</td>
<td>0.5-1</td>
</tr>
<tr>
<td>LAS</td>
<td>12-16</td>
</tr>
<tr>
<td>other anionic surfactant</td>
<td>6-10</td>
</tr>
<tr>
<td>Citric Acid</td>
<td>0-0.2</td>
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<tr>
<td>Silicate - 1.6R</td>
<td>3-4</td>
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<tr>
<td>Zeolite A</td>
<td>3-4</td>
</tr>
<tr>
<td>Na2SO4</td>
<td>10-15</td>
</tr>
<tr>
<td>Na2CO3</td>
<td>25-35</td>
</tr>
<tr>
<td>Bleach/ bleach activator/chelant</td>
<td>5-6</td>
</tr>
<tr>
<td>enzymes</td>
<td>1-2</td>
</tr>
<tr>
<td>polymers</td>
<td>10-15</td>
</tr>
</tbody>
</table>
This composition is showing good cleaning performances, even at a low concentration in an aqueous laundry detergent composition.

The dimensions and values disclosed herein are not to be understood as being strictly limited to the exact numerical values recited. Instead, unless otherwise specified, each such dimension is intended to mean both the recited value and a functionally equivalent range surrounding that value. For example, a dimension disclosed as "40 mm" is intended to mean "about 40 mm".

Every document cited herein, including any cross referenced or related patent or application, is hereby incorporated herein by reference in its entirety unless expressly excluded or otherwise limited. The citation of any document is not an admission that it is prior art with respect to any invention disclosed or claimed herein or that it alone, or in any combination with any other reference or references, teaches, suggests or discloses any such invention. Further, to the extent that any meaning or definition of a term in this document conflicts with any meaning or definition of the same term in a document incorporated by reference, the meaning or definition assigned to that term in this document shall govern.

While particular embodiments of the present invention have been illustrated and described, it would be obvious to those skilled in the art that various other changes and modifications can be made without departing from the spirit and scope of the invention. It is therefore intended to cover in the appended claims all such changes and modifications that are within the scope of this invention.
What is claimed is:

1. Method of laundering soiled fabrics in an automatic washing machine, which method comprises the steps of:
   a) forming an aqueous laundering solution by mixing from 11 to 40 l of water and a solid detergent composition comprising a surfactant system, said aqueous laundering solution comprising from 200 ppm to 5,000 ppm of the detergent composition;
   b) putting in contact soiled fabrics with said aqueous laundering solution; and
   c) washing said fabrics in said solution,

wherein said solid detergent composition is such that at least 30% of the detergent composition dissolves in 60 seconds in water (as measured according to the dissolution of the solid detergent composition test in the specification) and wherein the surfactant system has a micellar stability ($\tau_2$) of at most 30 seconds (as measured according to the micellar stability test in the specification).

2. Method of laundering soiled fabrics according to claim 1, wherein the aqueous laundering composition comprising from 6 to 15 litres of water.

3. Method of laundering soiled fabrics according to any one of the preceding claims, wherein the aqueous laundering composition comprises form 3000 to 6000 ppm of detergent composition.

4. Method of laundering soiled fabrics according to any one of the preceding claims, wherein the weight ratio of soiled fabric to aqueous laundering solution ranging from 1:1 to 1:10.

5. Method of laundering soiled fabrics according to any one of the preceding claims, wherein the solid detergent composition is such that at least 50% of the detergent composition dissolves in 60 seconds in water.

6. Method of laundering soiled fabrics according to any one of the preceding claims, wherein the solid detergent composition is such that at least 50% of the organic matter of the detergent composition dissolves in 60 seconds in water.
7. Method of laundering soiled fabrics according to any one of the preceding claims, wherein the solid detergent composition is such that at least 50% of the anionic surfactant of the detergent composition dissolves in 60 seconds in water.

8. Method of laundering soiled fabrics according to any one of the preceding claims, wherein the surfactant system has a micellar stability (τ2) of at most 26 seconds and of at least 10 s.
## INTERNATIONAL SEARCH REPORT

**A. CLASSIFICATION OF SUBJECT MATTER**

<table>
<thead>
<tr>
<th>Category</th>
<th>Citation of document, with indication, where appropriate, of the relevant passages</th>
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<tr>
<td>X</td>
<td>US 5 443 751 A (MAZZOLA LOUIS R [US]) 22 August 1995 (1995-08-22) claims; figure 3; examples</td>
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<td>DE 197 02 845 Al (HENKEL KGAA [DE]) 30 July 1998 (1998-07-30) claims; examples</td>
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**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

CIID

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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

EPO-Internal, WPI Data

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

- **Special categories of cited documents**
  - "A" document defining the general state of the art which is not considered to be of particular relevance
  - "E" earlier document but published on or after the international filing date
  - "L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
  - "O" document referring to an oral disclosure, use, exhibition or other means
  - "P" document published prior to the international filing date but later than the priority date claimed

- **Date of the actual completion of the international search**
  7 October 2010

- **Date of mailing of the international search report**
  18/10/2010

- **Name and mailing address of the ISA/EP**
  European Patent Office, P B 5818 Patentlaan 2 NL- 2280 HV RISWB
  Tel (+31-70) 340-2040, Fax (+31-70) 340-3016

- **Authorized officer**
  Pfannenstein, Heide

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* "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

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### Patent Document Information

**International Search Report**

**International application No:** PCT/US2010/041283


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*Form PCT/SA/210 (patent family annex) (April 2005)*