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**DETERGENT COMPOSITION FOR USE IN  
CLEANING PILE FABRICS**

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**ABSTRACT OF THE DISCLOSURE**

The monolithium, monosodium, and monoammonium N-lauroyl glutamates and aspartates, and the dilithium, disodium, and diammonium N-stearoyl glutamates and aspartates are superior detergents for cleaning pile fabrics such as carpets because of their good solubility in water and the strong foaming of their aqueous solutions. They leave non-sticky, powdery residues which are readily removed by vacuum cleaning.

The present invention relates to a detergent composition suitable for use in the cleaning of pile fabrics such as carpets, rugs, upholstery, tapestries, cushion and other fabric coverings for floors, walls and furniture.

For removal of the dirt and soil which are present in such pile fabrics, the pile fabrics have been treated by dry-cleaning or by wiping with a floor-cloth wetted with a detergent solution.

However, dry-cleaning is not suitable for cleaning rugs or carpets since it is very difficult to wash them wholly unlike the cleaning of clothes. And hence, the cleaning of rugs or carpets has been achieved by a method in which a detergent solution is applied to the surface of the fabrics to be cleaned and the fabrics are brushed to produce a rich foam, thereupon the dirt and soil are occluded in the foam, and thereafter the foam is wiped off or sucked up.

When treated by this method, the fabrics are clean in appearance but the residue of detergent material leaves a sticky or oily deposit which would accelerate resoiling. Several attempts have been made to solve this problem, e.g. by adding to a detergent solution finely divided siliceous materials (U.S. Pat. No. 3,206,408 (1965)), or by adding a polymer emulsion which is capable of drying to powdery form (South African Pat. No. 6,704,138 (1968)). However, each of these methods has a fault that the presence of such additives induces the lowering of foaming power. Also, the use of siliceous material tends to impair the elasticity of the fabrics. An alkali salt of higher alkyl sulphate, alkali salt of N-higher acyl sarcosinate or their mixtures (British Pat. No. 882,635 (1958)) and a lithium salt of higher alkyl sulphate have been employed as detergents (British Pat. No. 1,027,154 (1962)). Although all of these detergents can be applied as aqueous solutions and may foam powdery particles after the evaporation of water, the formed powdery particles turn into a sticky deposit owing to their hygroscopic properties, and soil is apt to adhere to the deposit. Moreover, when an aqueous solution of an alkali metal salt of higher alkyl sulphate is employed, it exerts relatively good foaming power toward woollen fabrics whereas it usually has poor foaming power toward fabrics made of polyamides.

An object of the present invention is to avoid the disadvantages of the detergent compositions hitherto employed for cleaning pile fabrics, particularly the problems of foaming properties and stickiness.

It has now been found that certain specific alkali salts

of N-acyl acidic amino acids are suitable for use in the cleaning of pile fabrics and have excellent properties which are not possessed by the hitherto employed detergents in the art.

The present invention relates to a detergent composition for pile fabrics containing one or more of the monolithium, monosodium and monoammonium salts of N-lauroyl acidic amino acids and dilithium, disodium and diammonium salts of N-stearoyl acidic amino acids.

Only these salts have good water solubility, high foaming power and good foam retaining properties on all kinds of natural or synthetic fabrics to be cleaned and they are capable of drying to a substantially non-sticky powdery deposit on fabrics.

In order to clean the soiled pile fabrics with the detergent composition of the present invention, therefore, said detergent composition is dissolved in water and the resulting aqueous solution is applied to the surface of the fabrics to be cleaned by suitable means. Thereafter, by moving a brushing appliance backwards and forwards on the fabrics, rich foams are produced. The dirt and water soluble or oily soil are loosened and occluded in the foam, and then the produced foams are wiped off or sucked up to achieve the cleaning purpose. After the evaporation of water, the detergent of the present invention forms a crystalline non-sticky deposit on the fabrics, which deposit can be readily removed by use of a vacuum cleaner, a sweeper or some similar equipment. Therefore, the cleaning of the pile fabrics may be conveniently achieved without removing them from their usual position. Also, the detergent of the present invention gives high brightness and smoothness to the cleaned fabrics without impairing their elasticity.

Similar salts such as potassium and triethanolamine salts of N-lauroyl or N-stearoyl acidic amino acids become very sticky in their dry state. Also, the corresponding dialkali metal salts of N-lauroyl acidic amino acid and the corresponding monoalkali metal salts of N-stearoyl acidic amino acids are not entirely suitable for this purpose for the reasons that some of them are hardly soluble in water and the water-soluble ones are deficient in foaming property. Furthermore, the similar alkali metal salts of N-acyl acidic amino acids having acyl groups other than lauroyl and stearoyl groups, such as N-myristoyl or N-palmytoyl, are not suitable as detergents for pile fabrics because the monoalkali metal salts are hardly soluble in water while the dialkali metal salts are soluble in water but are deficient in foaming property.

The results of tests of various N-acyl acidic amino acid salts for use in the cleaning of pile fabrics are summarized in Table 1 which also shows the results of tests carried out similarly with respect to the hitherto known detergents, sodium dodecyl sulphate (SDS), sodium N-lauroyl sarcosinate (L-Sar.), lithium lauryl sulphate (LLS), and a mixture of lithium lauryl sulphate and lithium decyl sulphate (a product of Cyclo Chemicals Ltd., referred to as Cyclo) for comparison.

It will be seen from Table 1 that the monolithium, monosodium and monoammonium salts of N-lauroyl acidic amino acids and the dilithium, disodium and diammonium salts of N-stearoyl acidic amino acids of the present invention have good water solubility and good foaming power that are comparable to the commercially available control samples and are markedly superior to the control samples with respect to non-stickiness of the powdery particles formed when a detergent solution was evaporated to dryness. Also, detergent solutions for cleaning pile fabrics are required to permeate the fabrics as little as possible, unlike the detergent materials for use in cleaning clothes. In view of this point, dilithium, disodium and diammonium salts of N-stearoyl acidic amino acids are superior compared with the control samples.

TABLE 1

N-Acyl acidic amino acid salt	Li salt			Na salt			NH <sub>4</sub> salt			Stickiness					
	Acidic amino acid	Acyl radical	Salt	Solubility	Foaming power (mm.)	Permeability	Stickiness	Synthetic valuation	Solubility	Foaming power (mm.)	Permeability	Stickiness	Synthetic valuation	TEA salt <sup>1</sup>	K salt
Glutamic acid.....	Lauroyl.....	(Mono.)	(Di.)	S	200	6''/0	10	Y	S	219	6''/5	7	Y	1	1
	Myristoyl.....	(Mono.)	(Di.)	S	14	48''/4	10	N	S	11	21''/8	7	N	1	1
	Palmitoyl.....	(Mono.)	(Di.)	S	115	28''/6	10	N	S	10	26''/1	8	N	1	1
	Stearoyl.....	(Mono.)	(Di.)	S	79	125''/0	9	N	S	42	36''/4	9	N	3	3
Aspartic acid.....	Lauroyl.....	(Mono.)	(Di.)	S	186	128''/4	10	Y	S	180	162''/2	10	Y	3	2
	Myristoyl.....	(Mono.)	(Di.)	S	191	>420''	10	Y	S	189	>420''	7	Y	1	1
	Palmitoyl.....	(Mono.)	(Di.)	X	0			N	X	0			N	1	1
	Stearoyl.....	(Mono.)	(Di.)	X	62			N	X	49			N	2	1
Control.....	SDS.....			S	180	>420''	10	Y	S	178	>420''	9	Y	3	3
	L-Sar.....			S	186	7''/4	6								
	L-Val.....			S	141	6''/7	7								
	Cybo.....			S	180	7''/3	7								

Notes: Solubility: Measured at room temperature; S=soluble in water, X=insoluble in water and crystals precipitate. Foaming power: Indicates foam height in mm. after five minutes in 10 mM concentration at 40° C., carried out by Res-Milles method. Permeability: Semi-micro disk method (felt one inch).

Stickiness: The crystals precipitated when 1% aqueous solution was evaporated to dryness and assessed with fingers for sensory test. A panel gives marks according to the following ten point system and the average value of fifteen members of panels was calculated and listed in Table 1. 10=Non-sticky; 9=Nonsticky, but poor in crystalline nature; 7=Very slightly sticky; 6=Slightly sticky; 5=Considerably sticky; 4=Considerably sticky and poor in crystalline nature; 2=Very sticky; 1=Like wheat gluten.

Synthetic valuation: Y=Qualified article; N=Rejected article.

<sup>1</sup> TEA salt: Triethanolamino salt.

In the monoalkali metal salts of N-lauroyl acidic amino acid, the acyl groups may be substituted by those of coconut oil fatty acid whose main component is lauroyl, and similarly, in the dialkali metal salts of N-stearoyl acidic amino acids, the acyl groups may be substituted by those of beef tallow, semi-hydrogenated beef tallow or hydrogenated beef tallow fatty acid whose main component is stearoyl. Acidic amino acids are glutamic acid and aspartic acid, and they may be optically active or racemic but the optically active form is preferable for practical use.

The N-lauroyl acidic amino acid salt preferably employed is the monolithium, monosodium or monoammonium salt, but there may also be employed a mixture of the monoalkyl metal salt and a small amount of the corresponding dialkali metal salt, as long as the mixture meets the requirements for the cleaning of pile fabrics. Similarly, with respect to the N-stearoyl acidic amino acid salts, a mixture of dialkali metal salt and a minor amount of the corresponding monoalkali metal salt may be employed.

Also, N-acyl acidic amino acid salts having other acyl groups than lauroyl and stearoyl groups, N-acyl derivatives of other amino acids or salts thereof may be added

to such an extent as not to spoil the characteristic properties of the above specific N-acyl acidic amino acid salts. Of course, the N-acyl acidic amino acid salts may be employed together with other surface active agents which have hitherto been employed for cleaning pile fabrics. Furthermore, other adjuvant materials such as a lustering agent, solvent and antistatic agent may be incorporated. A detergent composition of the present invention has the following outstanding features:

- (1) It has high foaming power to result in easy and efficient cleaning.
- (2) It is capable of drying to an easily removable powdery form. And, since the resulting powder has no stickiness and no hygroscopic property, there is no danger of redepositing it on the pile fabrics cleaned.
- (3) It has good water-solubility. Its aqueous solution exerts sufficient cleaning effect, usually at 0.2-1.0% concentration.
- (4) The dialkali metal salts of N-stearoyl acidic amino acids have little permeability.
- (5) It cleans a large area of rugs or carpets in a short time because of excellent cleaning power and is capable

of drying on fabrics to leave substantially non-sticky powdery particles which can be readily removed.

(6) It gives high brightness and smoothness to the fabrics cleaned without impairing the elasticity of the fabrics.

The following examples are illustrative of the present invention.

EXAMPLE 1

5.4 kg. of monolithium N-lauroyl-L-glutamate was dissolved in water to produce 18 l. of solution. This detergent solution was further diluted with water to 1% and then placed in a cleaner. The solution was applied to carpets soiled by normal traffic. By moving the brushing appliance of the cleaner backwards and forwards over the carpets, a rich foam was produced and sucked up while the brushing appliance was operated to clean the carpets. The area of carpets cleaned thus reached 1000 m.<sup>2</sup>. The carpets were allowed to dry and a vacuum cleaner was used to remove the powdery residue of detergent and the dirt loosened by the detergent action. The carpets treated so were observed to be cleaned satisfactory, with brightness and softness.

5

## EXAMPLE 2

2.9 kg. of the diammonium salt of N-hydrogenated tallowyl\* L-glutamic acid and 0.7 kg. of ditriethanolamine salt of N-cocoyl\*\* L-glutamic acid were dissolved in water to prepare 18 l. of detergent solution. This solution was diluted with water to about 1% and then used to treat soiled carpets as in Example 1. The carpets were allowed to dry, the powdery deposit retained on the carpets was less sticky than a deposit of a control sample, and removed completely by a vacuum cleaner.

The carpets treated so were clean.

## EXAMPLE 3

180 g. of disodium N-stearoyl-DL-glutamate and 20 g. of disodium N-oleoyl-DL-glutamate were dissolved in water to prepare 10 l. of solution. This solution was diluted with water to about 1% and scattered over the soiled carpets. Upon brushing the carpets a rich foam was produced. The carpets were washed with water once and allowed to dry. A small amount of powdery deposit of detergent and soil was left on the carpets. This deposit was almost not sticky and was completely removed by a vacuum cleaner. The carpets treated thus became clean.

## EXAMPLE 4

125 g. of monosodium N-lauroyl-L-aspartate and 75 g. of monolithium N-lauroyl-DL-aspartate were dissolved in water to prepare 1 l. of solution. The solution was diluted with water to 1%. Soiled carpets were treated with this solution in the same manner as in Example 3. After drying, the residue of detergent retained on the carpets was non-sticky and in powdery form and was easily removed by a vacuum cleaner. The carpets treated thus were well cleaned with brightness and softness.

## EXAMPLE 5

A mixture of 100 g. of monolithium N-distilled cocoyl-L-glutamate, 90 g. of dilithium N-distilled cocoyl-L-glutamate and 10 g. of lithium lauryl sulphate was dissolved in water to prepare 1 l. of solution. The solution was diluted with water to 1% and then applied to the soiled carpets as in Example 3. After drying, the powdery detergent retained on the carpets was good and the carpets became clean.

## EXAMPLE 6

A mixture of 200 g. of diammonium N-semi-hydrogenated tallowyl-L-glutamate, 20 g. of sodium-DL-alaninate and 30 g. of triethanolamine salt of lauryl sulphuric acid was dissolved in water to prepare 1 l. of solution. The solution was diluted with water to 1% and then applied to the carpet became clean.

\*Hydrogenated tallowyl means acyl residue of hydrogenated tallow fatty acid.

\*\*Cocoyl means the acyl residue of coconut oil fatty acid.

6

## EXAMPLE 7

150 g. of disodium N-stearoyl-DL-aspartate and 50 g. of monosodium N-stearoyl-DL-aspartate were dissolved in water to prepare 1 l. of solution, which was diluted with water to 1%.

The soiled carpet was treated with the solution as in Example 3. The carpet cleaned had a luster and became clean.

## EXAMPLE 8

30 kg. of powdery monosodium N-cocoyl-L-glutamate was mixed with 0.6 kg. of powdery sodium lauryl sulphate and the mixture was dissolved in warm water of 40° C. to prepare 150 l. solution. The solution was diluted with water to 1%, and then the soiled carpet was treated with the solution according to the same manner as in Example 1. The carpet was allowed to dry and the powdery state of detergent retained on the carpet was good. The carpet became clean.

What we claim is:

1. A method of cleaning a fabric of soil which comprises applying to said fabric a foam of an aqueous solution of a monoalkali metal or monoammonium salt of N-lauroyl glutamate or N-lauroyl aspartate, or of a dialkali metal or diammonium salt of N-stearoyl glutamate or N-stearoyl aspartate, the alkali metal in said salts being lithium or sodium, the amount of said foam being sufficient to occlude said soil, and thereafter removing said foam from said fabric.

2. A method as set forth in claim 1, wherein said aqueous solution is applied to said fabric and thereafter converted to said foam by brushing said fabric.

3. A method as set forth in claim 2, wherein said foam, prior to said removing, is permitted to dry on said fabric.

4. A method as set forth in claim 3, wherein said fabric is a pile fabric.

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