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(54) **Method and composition for facilitating the removal of soil contaminants from solid surfaces.**

(57) A method of facilitating the removal of soil contaminants from a solid surface is provided which method comprises washing the surface with a liquid composition characterised in that the liquid composition comprises a material which is deposited on the surface during washing and upon drying forms a layer adhered to the surface, said material having a cohesive strength such that at least the outermost surface portion of the layer is removable by further washing. The low cohesive strength material may be incorporated in a composition for cleaning solid surfaces e.g. a bathroom cleaner for removing contaminants such as soap scum.

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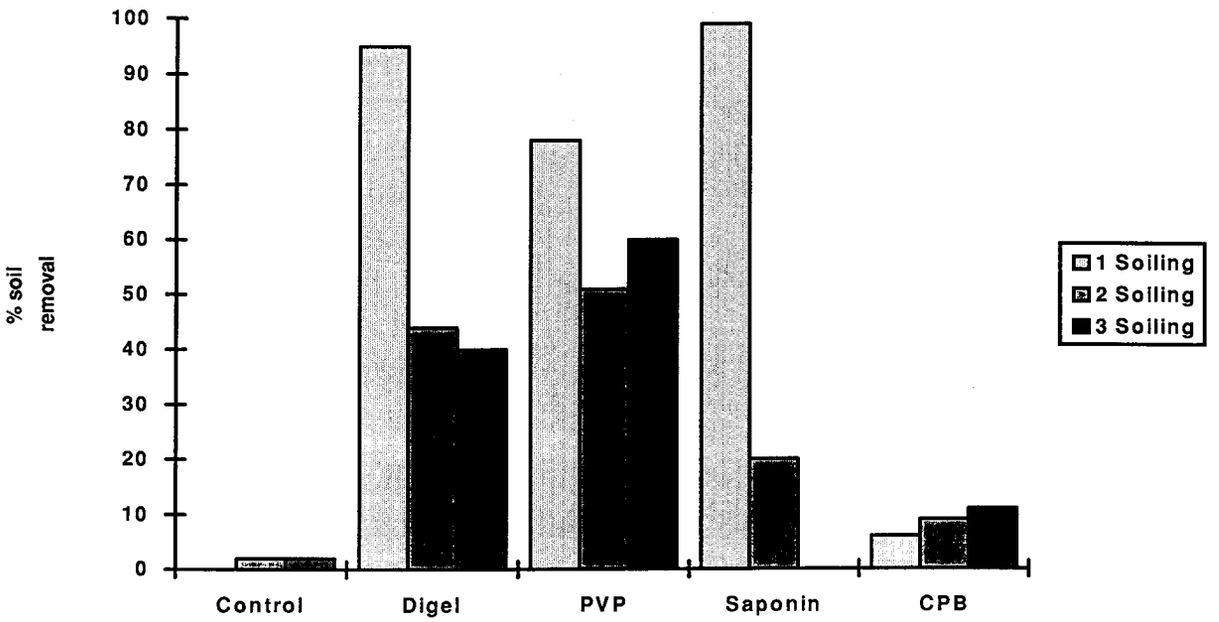

% soil removal
100
90
80
70
60
50
40
30
20
10
0
Control
Digel
PVP
Saponin
CPB
1 Soiling
2 Soiling
3 Soiling

Fig 1

Field of the Invention

The invention relates to a method and composition for facilitating the removal of soil contaminants from solid surfaces e.g. the removal of soap scum from bathroom hard surfaces such as ceramic tiles.

Background of the Invention

Known methods for facilitating the removal of soil contaminants from a solid surface have involved treating the surface to render it less prone to soil adhesion. For example, FR-A-2 639 353 describes coating a solid surface with a composition comprising a mixture of polymers to render the surface waterproof, oil-resistant, stain-resistant and self-cleaning.

A shortcoming of this approach is that the nature of the adhesive bond between a soil contaminant and the surface varies depending on the composition of the contaminant. For example, adhesion could result from electrostatic, dispersion, dipole/dipole, hydrophobic or hydrogen bond interactions as well as from rugosity effects. For contaminants which are a mixture of different components, adhesion usually occurs through a number of different adhesive bonds. Furthermore, solid surfaces are rarely, if ever, smooth and soil contamination can occur by physical entrapment.

By way of example, the composition of soap scum which is a common bathroom soil is a mixture of ionic, hydrophilic and hydrophobic components. Hence, a scum could form a variety of adhesive bonds to typical household hard surfaces such as metals, plastics, ceramics, glass and glazed surfaces.

It can be seen that chemically modifying a surface to reduce soiling will only be effective in respect of certain soil contaminants and is unlikely to be very effective against complex mixtures such as soap scums.

Problem to be Solved by the Invention

An object of the invention is to provide a method of facilitating the removal of soil contaminants from a solid surface which does not require chemically modifying the surface to render it less prone to soil adhesion.

Summary of the Invention

In accordance with the invention there is provided a method of facilitating the removal of soil contaminants from a solid surface which method comprises washing the surface with a liquid composition characterised in that the liquid composition comprises a material which is deposited on the surface during washing and upon drying forms a layer adhered to the surface, said material having a cohesive strength such that at least the outermost surface portion of the layer is removable by further washing.

In accordance with another aspect of the invention there is provided a liquid composition for cleaning solid surfaces comprising one or more cleaning agents characterised in that the composition comprises a material capable of being deposited on the surface during cleaning and of forming a dried layer adhered to the surface, said layer having a cohesive strength such that at least the outermost surface portion of the layer is removable by washing.

Advantageous Effect of the Invention

The removal of soil contaminants from a solid surface is facilitated since any contaminant can be readily removed without having to modify the surface to render it less prone to soil adhesion.

Brief Description of the Drawings

Figure 1 is a graph showing results achieved using the method of the invention.

Detailed Description of the Invention

The method of the invention can be used for any solid surface. It is particularly applicable to hard surfaces found in the household for which a variety of cleaning compositions are known, especially bathroom cleaning compositions. Typical household surfaces include metal, plastics, ceramic, fibreglass, enamel, glass and glazed surfaces.

The liquid composition used in the invention is preferably an aqueous composition in which the other components are dissolved or dispersed.

The material which is deposited on the surface to form a layer of low cohesive strength is preferably a film-forming polymeric material. The cohesive failure of the polymeric material can be controlled by choosing suitable molecular weight polymers.

It is desirable for the layer to be at least partially water-soluble. Preferably, the layer is uncharged over a reasonable pH range.

The layer is preferably clear.

Examples of materials which have been successfully used to form the layer include polyvinylpyrrolidone (PVP), gelatin and saponin.

The deposited layer provides a weak link between the adhered soil contaminants and the solid surface. Hence, the soil contaminants can be removed easily by washing. It is possible to provide treated surfaces with resistance to multiple soiling since the layer can be made to become thinner after each washing with sufficient of the layer remaining for further protection. Upon washing, the layer strips partially from the surface to leave a thinner, but clean surface. In the preferred mode of operation, this surface is invisible to the naked eye.

The material from which the low cohesive strength layer is formed can be incorporated in a cleaning composition so that the layer can be formed on the solid surface during cleaning. Existing cleaning compositions can be modified in this way provided that the incorporation of the material has no adverse interactions with the other components. Typically, the cleaning composition comprises one or more components known in the art such as detergents, chelating agents, water-miscible organic solvents and pH control agents.

Other materials such as quaternary nitrogen or phenolic antimicrobial agents may be incorporated into the composition of the invention.

The invention is further illustrated by way of example as follows.

Example 1

Reduced soil adhesion has been demonstrated with pretreatments of saponin, deionised gelatin and polyvinylpyrrolidone (PVP). Experimental evidence is presented for PVP, which has been shown to provide protection against several soil applications.

Standard glazed black ceramic tiles were wipe-coated with a 5%w/w PVP (~40k MW) aqueous solution and allowed to dry. A standard bathroom soil was sprayed from an acetone/water mixture onto the treated tiles and allowed to dry. The composition of the bathroom soil (soap-scum) used is a mixture of ionic, hydrophilic and hydrophobic components as follows:

component	%w/w
hard water	95.54
bar soap	3.90
shampoo	0.35
sebum	0.15
clay soil	0.06

The tiles were then "aged" by heating at 110^0C for ~2 hours. After cooling to room temperature, the tiles were cleaned in water with a brush under standard conditions. Measurements (10x) were taken with a simple reflectometer (visible light) from different points of the area cleaned by the brush. The average (mean) was compared with that from a control untreated tile, which had been through the soiling process, and an untouched reference.

Following these experiments, a tile was treated with the same PVP solution, soiled, cleaned, re-soiled, cleaned etc several times to study it's anti-resoiling properties. The results from this and the initial test are given in Table 1. It is worth noting that an untouched tile has a reflectivity of ~81%. Hence, the higher reflectivity % relates to cleaner tiles and therefore better visual appearance to a consumer.

Table 1 below provides data showing the average percentage soil removal from PVP-treated and untreated tiles after one or more cycles of soiling and cleaning operations.

Table 1

Conditions	% Soil removal*	
	Untreated	PVP-treated
Reference	80.9	N/A
Soiled & cleaned 1x	39.8	57.7
Soiled & cleaned 2x	0.0	78.5
Soiled & cleaned 3x	1.9	51.0
Soiled & cleaned 4x	2.0	60.5

* % soil removals are calculated from reflectance readings

The data in Table 1 show clearly that the pretreatment of the glazed ceramic tiles makes the standard soap-scum easier to remove with water, under controlled cleaning conditions, compared with the control tile. Although the readings are not absolute, the consumer would notice the difference.

Similar results were obtained with deionised gelatin. Saponin worked for one cycle of soiling and cleaning but appears too water soluble for multiple protection against soil build-up.

Example 2

Four sample compositions were made as shown in Table 2 below.

Table 2

Coating Material	wt. % in water
Control	0
Digel (gelatin)	2.0
PVP (~10k MW)	5.0
Saponin	1.0
Cetyl pyridinium bromide (CPB)	0.1

Standard glazed black ceramic tiles were prepared and subjected to soiling/cleaning cycles in accordance with the procedure of Example 1. The cleaning results after three cycles of soiling/cleaning are shown in Figure 1. The results clearly show that the tiles treated with polyvinylpyrollidone were the most consistent in facilitating the rinsing off of soap scum.

Example 3

PVP was incorporated into a bathroom hard surface cleaner to provide the composition given in Table 3 below.

Table 3

Formulation		% by weight
1.	Hard surface cleaner	99.0
	EDTA	2%
	Propylene glycol monopropyl ether	5%
	Neodol™ 23.6	0.5%
	Sodium meta silicate	0.25%
	Water	to 100%
2.	PVP (~10k MW)	1.0
(Neodol™ 23.6 is a linear C_{12}-C_{13} alcohol ethoxylate nonionic surfactant)		

Standard glazed black ceramic tiles were wiped with 0.5g of the above composition until dry. About 0.01g of the composition is deposited on each tile.

Tiles were coated with soap scum in accordance with Example 1. The coated tiles were allowed to dry in air for 30 minutes and cured for 45 minutes at 85 °C. The tiles were cooled and rinsed. A comparison was made with untreated tiles used as controls. The results are shown in Table 4 below.

Table 4

Tile No.	Treatment	Removability of Soap Scum
1	Treated	100% removed with water rinse
Control	Untreated	No removal even after 15 rubbing strokes and cold water rinse
2	Treated	90% removal
Control	Untreated	0% removal
3	Treated	90-100% removal
4	Treated	90-100% removal

The results confirm that treatment in accordance with the invention prevents soap scum adherence.

Example 4

The object of the example is to determine if the coating provided by the composition of Example 3 is effective even after rinsing with water.

A test tile was prepared as in Example 3. The tile was treated with soap scum soil, air dried and then cured for 15-20 minutes at 90 °C. A portion of the tile was rinsed under cold water and then resoiled and rinsed. The results are shown in Table 5 below.

Table 5

Test No.	Treatment	% Soil Removal
1	Soiled/rinsed (1x)	100%
2	Soiled/rinsed (2x)	40%
3	None (Control)	0%

The results show that the coating was effective even after being subjected to a water rinse.

Claims

1. A method of facilitating the removal of soil contaminants from a solid surface which method comprises washing the surface with a liquid composition characterised in that the liquid composition comprises a material which is deposited on the surface during washing and upon drying forms a layer adhered to the surface, said material having a cohesive strength such that at least the outermost surface portion of the layer is removable by further washing.

2. A method according to claim 1 wherein the liquid composition is an aqueous composition.

3. A method according to claim 1 or claim 2 wherein the material is a film-forming polymeric material.

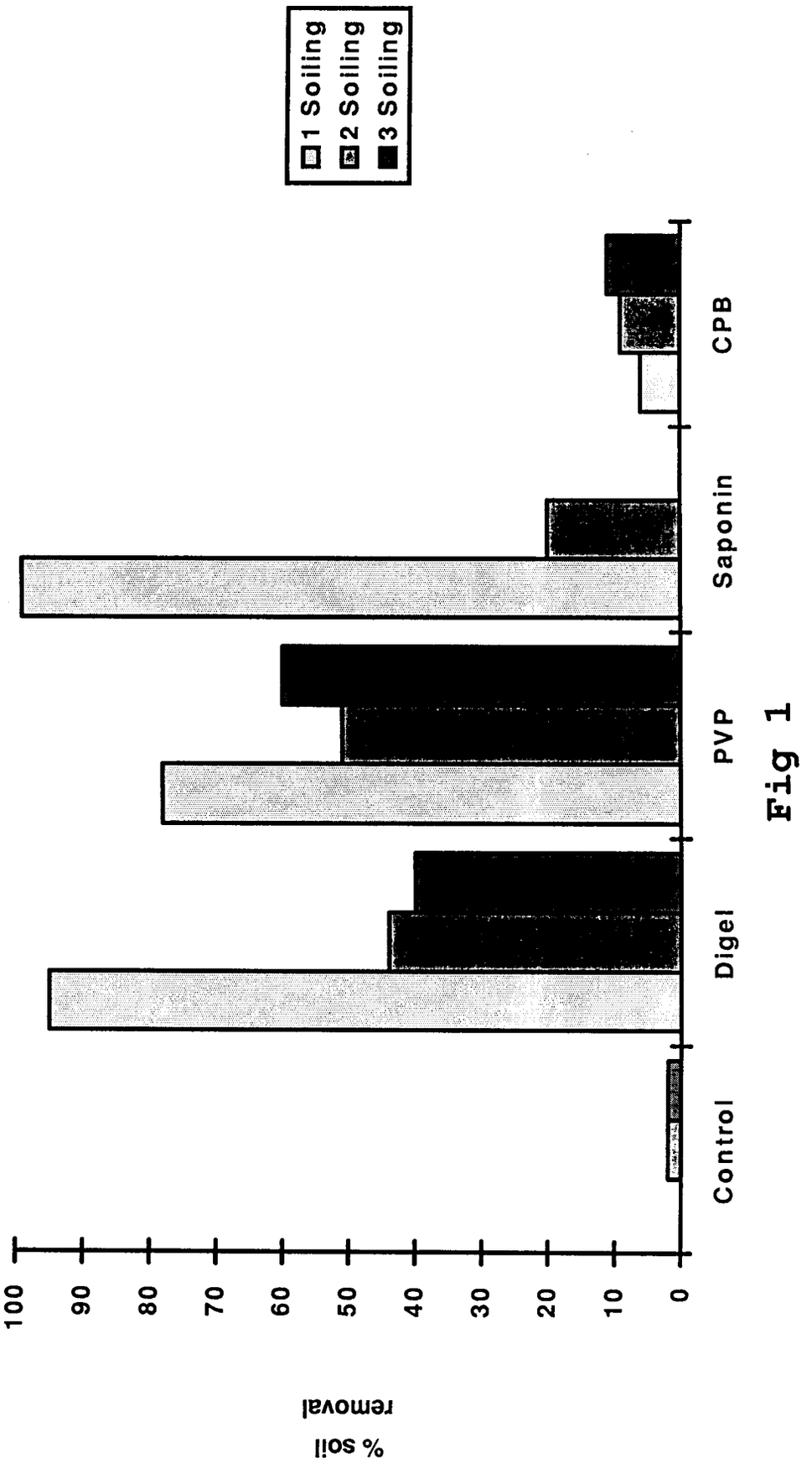
4. A method according to claim 3 wherein the polymeric material is polyvinylpyrrolidone.

5. A liquid composition for cleaning solid surfaces comprising one or more cleaning agents characterised in that the composition comprises a material capable of being deposited on the surface during cleaning and of forming a dried layer adhered to the surface, said layer having a cohesive strength such that at least the outermost surface portion of the layer is removable by washing.

6. A composition according to claim 5 wherein the liquid composition is an aqueous composition.

7. A composition according to claim 5 or claim 6 wherein the material is a film-forming polymeric material.

8. A composition according to claim 7 wherein the polymeric material is polyvinylpyrrolidone.


1 Soiling
2 Soiling
3 Soiling
% soil removal
100
90
80
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60
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Control
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Fig 1