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(54) **Thickened liquids.**

(57) A non-aqueous liquid comprising a polyalkoxylated material, such as a nonionic surfactant, is thickened with a dissolved polyvinylpyrrolidone or a derivative thereof, having a viscosity average molecular weight greater than 30,000, such as 360,000.

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THICKENED LIQUIDS

The present invention is concerned with the thickening of liquids comprising polyalkoxylated materials.

Polyalkoxylates have recently been of interest in the detergents industry as components of non-aqueous liquid cleaning products, especially when used as all or part of a liquid phase in which particulate solids, such as detergency builders, bleaches, abrasives and mixtures thereof, are dispersed.

There is a need for increasing the viscosity of polyalkoxylates, whether or not formulated with dispersed solids, for example for enhancing aesthetic appeal to the consumer and aiding dispensing into washing machines via shuttle devices. When dispersed solids are present, increased viscosity is advantageous in that it hinders settling of the particles of solid.

In searching for an agent to thicken such liquids, one may, inter alia think of using soluble polymers since there is already a wealth of knowledge on polymers for thickening both aqueous and non-aqueous liquids. However, when considering weakly polar liquids, polyalkoxylates in particular, there is a scarcity of information. Intuitively, one might expect polymers capable of hydrogen bonding to the oxygen atoms in the alkoxy groups, or to a terminal hydroxy group would define those which are soluble. However, we have failed to find this. Very many such polymers, for example polyacrylates, polyacrylamides, polyethylene oxides, polyvinyl acid esters and polyvinyl alcohols are all substantially insoluble at room temperature in all or most of the liquid polyalkoxylates of usual interest. Whilst in some cases, polyethylene oxides can be dissolved at temperatures above 60 °C, they precipitate-out when the liquid is cooled.

Surprisingly however, we have found that polyalkoxylate liquids may be thickened by dissolving therein, certain polyvinylpyrrolidones or derivatives thereof. Thus, according to the invention, there is provided a non-aqueous liquid comprising a polyalkoxylated material which liquid is thickened with a dissolved vinylpyrrolidone polymer or a derivative thereof, which polymer has a viscosity average molecular weight greater than 30,000.

We have found that these particular polymers are soluble at all accessible concentrations. However, since the thickening power of a polymer increases more than linearly with increasing molecular weight, molecular weights above 100,000 especially above 250,000 are preferred, for example up to one million.

However, the amount of polymer material to produce a given degree of thickening in a particular liquid phase decreases with increasing polymer molecular weight. Therefore the amount of polymer material incorporated in a given system will vary widely according to the polymer molecular weight, the polyalkoxylated material(s) of the liquid solvent phase and, if present, any other components in the system, including any non-polyalkoxylated liquids. As an example though, typical useful amounts of a polymer material of 360,000 viscosity average molecular weight will be from 0.5% to 5% by weight of the total polyalkoxylated liquid.

There is a wide range of possible ways of expressing polymer molecular weight, varying according to the particular assay used and how the average is calculated (e.g. number average, weight average, etc). However, the term 'viscosity average molecular weight' when used in respect of polyvinylpyrrolidones (or soluble derivatives thereof) will readily be understood by those skilled in the art and is widely used by manufacturers to characterise such polymer products.

Although the polymer material exhibits the unexpected advantage hereinbefore described, it can also endow additional benefits in the wash which are already known for such polymers when used in detergent compositions in general. Thus, US patent 3 000 830 (Fong et al) describes use of polyvinylpyrrolidone as a soil suspending agent and GB patent specification 1 348 212 (Procter and Gamble) discloses use of polyvinyl pyrrolidone and certain derivatives thereof for prevention of dye transfer. We are also aware of European patent specification EP-A-256 343 (Mira Lanza) which refers to the use of PVP with a molecular weight of 30,000 as a suspending agent in non-aqueous liquids.

Although polyvinylpyrrolidones are readily commercially available, in the light of the present teaching, the man skilled in the art will now appreciate that derivatives thereof with minor structural variations may be substituted therefore with the expectation of achieving the same effect, provided that any such derivative is soluble in the liquid solvent phase. For example, such derivatives may be co-polymers containing minor amounts of other monomer units. Such derivatives may be any of those described in patent specification GB 1 348 212, the text of which is incorporated herein by reference.

The compositions of the invention must contain a liquid polyalkoxylated material and must be such that the polymer material is soluble therein, although it is permissible for a portion of the polymer material to be present as dispersed solid. The polyalkoxylated liquids are chosen in particular for their ability to dissolve the polymer material although co-solvents may also be present, provided that the polymer is soluble in the resultant mixture. In the context of the present invention, a polyalkoxylated material is any which has a

molecule which contains two or more alkoxy groups, whether the same or different, bonded directly to one another. All references to liquids refer to materials which are liquid at 25 °C at atmospheric pressure.

It is particularly preferred for all, or failing that, a major amount, e.g. 50% by weight or greater, of the liquid phase to consist of one or more liquid polyalkoxylated materials.

5 Especially preferred are liquid polyalkoxylated nonionic surfactants such as are disclosed in our aforementioned EP-A-266 199, relevant parts of which are incorporated herein by reference. Usually, these will be chosen from liquids which are the condensation products of fatty alcohols with lower (C₁₋₄) alkylene oxides, especially ethylene oxide and/or propylene oxides. Other suitable polyalkoxylated liquids are poly-
10 lower (C₁₋₄) alkylene glycols, especially liquid polyethylene glycols and liquid polypropylene glycols. For example, the polyethylene glycols may be chosen from those which are liquid and have molecular weights in the range of from 200 to 600. Also suitable are alkylene glycol mono- or di-alkyl ethers. Such mono-alkyl ethers are disclosed in British patent specification GB 2 169 613 (Colgate-Palmolive). Typical such di-alkyl ethers are diethylene glycol di-ethyl or di-butyl ether (di-ethyl and di-butyl Carbitol, respectively), most preferably di-ethylene glycol dimethyl ether (diglyme). The polymer material is insoluble in the latter liquid
15 but when the diglyme is mixed with a polyalkoxylated nonionic surfactant liquid or a liquid polyalkylene glycol, especially a polyethylene glycol, then the polymer can be dissolved. For example, the polymer can be dissolved in mixtures of diglyme and polyethylene glycol, molecular weight 200, in weight ratios from at least 1:3 to 3:1.

Where non-polyalkoxylated co-solvents are also included, these may be selected from any co-solvent
20 which is miscible with the liquid polyalkoxylated materials yet do not cause insolubility of the polymer material to the extent that the thickening effect is lost. Suitable co-solvents are disclosed in said EP-A-266 199.

Although the liquids of the present invention may find application alone, they may also be formulated with one or more other ingredients to provide liquid cleaning product compositions. In particular, these other
25 ingredients may comprise a suspended particulate solid phase. However, such other ingredients must be selected so as to be compatible with the thickened liquid, i.e. they must not destroy the thickening action exerted by the polymer, although they may still act as 'thinners'. The compositions may be formulated in a very wide range of specific forms, according to the intended use. They may be formulated as cleaners for hard surfaces (with or without abrasives) or as agents for warewashing (cleaning of dishes, cutlery etc)
30 either by hand or mechanical means, as well as in the form of specialised cleaning products, such as for surgical apparatus or artificial dentures. They may also be formulated as agents for washing and/or conditioning of fabrics.

In the case of hard-surface cleaning, the compositions may be formulated as main cleaning agents, or pre-treatment products to be sprayed or wiped on prior to removal, e.g. by wiping off or as part of a main
35 cleaning operation.

In the case of warewashing, the compositions may also be the main cleaning agent or a pre-treatment product, e.g. applied by spray or used for soaking utensils in an aqueous solution and/or suspension thereof.

Those products which are formulated for the cleaning and/or conditioning of fabrics constitute an
40 especially preferred form of the present invention because in that role, there is a very great need to be able to incorporate substantial amounts of various kinds of solids. These compositions may for example, be of the kind used for pre-treatment of fabrics (e.g. for spot stain removal) with the composition neat or diluted, before they are rinsed and/or subjected to a main wash. The compositions may also be formulated as main wash products, being dissolved and/or dispersed in the water with which the fabrics are contacted. In that
45 case, the composition may be the sole cleaning agent or an adjunct to another wash product. Within the context of the present invention, the term 'cleaning product' also embraces compositions of the kind used as fabric conditioners (including fabric softeners) which are only added in the rinse water (sometimes referred to as 'rinse conditioners').

Thus, the compositions will contain at least one agent which promotes the cleaning and/or conditioning
50 of the article(s) in question, selected according to the intended application. Usually, this agent will be selected from surfactants, enzymes, bleaches, microbiocides, (for fabrics) fabric softening agents and (in the case of hard surface cleaning) abrasives. Of course in many cases, more than one of these agents will be present, as well as other ingredients commonly used in the relevant product form.

The compositions will be substantially free from agents which are detrimental to the article(s) to be
55 treated. For example, they will be substantially free from pigments or dyes, although of course they may contain small amounts of those dyes (colourants) of the kind often used to impart a pleasing colour to liquid cleaning products, as well as fluorescers, bluing agents and the like.

Any other ingredients before incorporation will either be liquid, in which case, in the composition they

will constitute all or part of the liquid phase, or they will be solids, in which case, in the composition they will either be dispersed particles in the liquid phase or they will be dissolved therein. Thus as used herein, the term "solids" is to be construed as referring to materials in the solid phase which are added to the composition and are dispersed therein in solid form, those solids which dissolve in the solvent and those in the liquid phase which solidify (undergo a phase change) in the composition, wherein they are then dispersed.

Thus, where surfactants are solids, they will usually be dissolved or dispersed in the liquid phase. Where they are liquids, they will usually constitute all or part of the liquid phase. However, in some cases the surfactants may undergo a phase change in the composition. In general, they may be chosen from any of the classes, sub-classes and specific materials described in 'Surface Active Agents' Vol.I, by Schwartz & Perry, Interscience 1949 and 'Surface Active Agents' Vol.II by Schwartz, Perry & Berch (Interscience 1958), in the current edition of "McCutcheon's Emulsifiers & Detergents" published by the McCutcheon division of Manufacturing Confectioners Company or in 'Tensid-Taschenbuch', H.Stache, 2nd Edn., Carl Hanser Verlag, München & Wien, 1981.

Nonionic detergent surfactants, both liquid and solid, are well-known in the art. They normally consist of a water-solubilizing polyalkoxyethylene or a mono- or di-alkanolamide group in chemical combination with an organic hydrophobic group derived, for example, from alkylphenols in which the alkyl group contains from about 6 to about 12 carbon atoms, dialkylphenols in which each alkyl group contains from 6 to 12 carbon atoms, primary, secondary or tertiary aliphatic alcohols (or alkyl-capped derivatives thereof), preferably having from 8 to 20 carbon atoms, monocarboxylic acids having from 10 to about 24 carbon atoms in the alkyl group and polyoxypropylenes. Also common are fatty acid mono- and dialkanolamides in which the alkyl group of the fatty acid radical contains from 10 to about 20 carbon atoms and the alkyl group having from 1 to 3 carbon atoms. In any of the mono- and di- alkanolamide derivatives, optionally, there may be a polyoxyalkylene moiety joining the latter groups and the hydrophobic part of the molecule. In all polyalkoxyethylene containing surfactants, the polyalkoxyethylene moiety preferably consists of from 2 to 20 groups of ethylene oxide or of ethylene oxide and propylene oxide groups. Amongst the latter class, particularly preferred are those described in European specification EP-A-225 654 (Unilever). Also preferred are those ethoxylated nonionics which are the condensation products of fatty alcohols with from 9 to 15 carbon atoms condensed with from 3 to 11 moles of ethylene oxide. Examples of these are the condensation products of C_{11-13} alcohols with (say) 3 or 7 moles of ethylene oxide. These may be used as the sole nonionic surfactants or in combination with those of the described in the last-mentioned European specification.

Another class of suitable nonionics comprise the alkyl polysaccharides (polyglycosides/oligosaccharides) such as described in any of specifications US 3 640 998; US 3 346 558; US 4 223 129; EP-A-92 355; EP-A-99 183; EP-A-70 074, '75, '76, '77; EP-A-75 994, '95, '96.

Mixtures of different nonionic detergent surfactants may also be used, provided the mixture is liquid at room temperature. Mixtures of nonionic detergent surfactants with other detergent surfactants such as anionic, cationic or ampholytic detergent surfactants and soaps may also be used. If such mixtures are used, the mixture must be liquid at room temperature.

Examples of suitable anionic detergent surfactants are alkali metal, ammonium or alkylamine salts of alkylbenzene sulphonates having from 10 to 18 carbon atoms in the alkyl group, alkyl and alkylether sulphates having from 10 to 24 carbon atoms in the alkyl group, the alkylether sulphates having from 1 to 5 ethylene oxide groups, olefin sulphonates prepared by sulphonation of C_{10} - C_{24} alpha-olefins and subsequent neutralization and hydrolysis of the sulphonation reaction product.

Other surfactants which may be used include alkali metal soaps of a fatty acid, preferably one containing 12 to 18 carbon atoms. Typical such acids are oleic acid, ricinoleic acid and fatty acids derived from castor oil, rapeseed oil, ground nut oil, coconut oil, palmkernel oil or mixtures thereof. The sodium or potassium soaps of these acids can be used. As well as fulfilling the role of surfactants, soaps can act as detergency builders or fabric conditioners, other examples of which will be described in more detail hereinbelow. It can also be remarked that the oils mentioned in this paragraph may themselves constitute part of the liquid, whilst the corresponding low molecular weight fatty acids (triglycerides) can be dispersed as solids or function as structurants.

Yet again, it is also possible to utilise cationic, zwitterionic and amphoteric surfactants such as referred to in the general surfactant texts referred to hereinbefore. Examples of cationic detergent surfactants are aliphatic or aromatic alkyl-di(alkyl) ammonium halides and examples of soaps are the alkali metal salts of C_{12} - C_{24} fatty acids. Ampholytic detergent surfactants are e.g. the sulphobetaines. Combinations of surfactants from within the same, or from different classes may be employed to advantage for optimising structuring and/or cleaning performance.

The compositions according to the present invention preferably also contain one or more other

functional ingredients, for example selected from detergency builders, bleaches or bleach systems, and (for hard surface cleaners) abrasives.

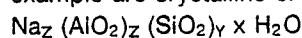
Detergency builders are those materials which counteract the effects of calcium, or other ion, water hardness, either by precipitation or by an ion sequestering effect. They comprise both inorganic and organic builders. They may also be sub-divided into the phosphorus-containing and non-phosphorus types.

In general, the inorganic builders comprise the various phosphate-, carbonate-, silicate-, borate and aluminosilicate-type materials, particular the alkali-metal salt forms. Mixtures of these may also be used.

Examples of phosphorus-containing inorganic builders, when present, include the water-soluble salts, especially alkali metal pyrophosphates, orthophosphates, polyphosphates and phosphonates. Specific examples of inorganic phosphate builders include sodium and potassium phosphates and hexametaphosphates, as well as sodium and potassium triphosphate.

Examples of non-phosphorus-containing inorganic builders, when present, include water-soluble alkali metal carbonates, bicarbonates, borates, silicates, metasilicates, and crystalline and amorphous aluminosilicates. Specific examples include sodium carbonate (with or without calcite seeds), potassium carbonate, sodium and potassium bicarbonates, silicates and zeolites.

The aluminosilicates are an especially preferred class of non-phosphorus inorganic builders. These for example are crystalline or amorphous materials having the general formula:



wherein Z and Y are integers of at least 6, the molar ratio of Z to Y is in the range from 1.0 to 0.5, and x is an integer from 6 to 189 such that the moisture content is from about 4% to about 20% by weight (termed herein, 'partially hydrated'). This water content provides the best rheological properties in the liquid. Above this level (e.g. from about 19% to about 28% by weight water content), the water level can lead to network formation. Below this level (e.g. from 0 to about 6% by weight water content), trapped gas in pores of the material can be displaced which causes gassing and tends to lead to a viscosity increase also. The preferred range of aluminosilicate is from about 12% to about 30% on an anhydrous basis. The aluminosilicate preferably has a particle size of from 0.1 to 100 microns, ideally between 0.1 and 10 microns and a calcium ion exchange capacity of at least 200 mg calcium carbonate/g.

Examples of organic builders include the alkali metal, ammonium and substituted ammonium, citrates, succinates, malonates, fatty acid sulphonates, carboxymethoxy succinates, ammonium polyacetates, carboxylates, polycarboxylates, aminopolycarboxylates, polyacetyl carboxylates and polyhydroxysulphonates. Specific examples include sodium, potassium, lithium, ammonium and substituted ammonium salts of ethylenediaminetetraacetic acid, nitrilotriacetic acid, oxydisuccinic acid, melitic acid, benzene polycarboxylic acids and citric acid. Other examples are organic phosphonate type sequestering agents such as those sold by Monsanto under the tradename of the Dequest range and alkanehydroxy phosphonates.

Other suitable organic builders include the higher molecular weight polymers and co-polymers known to have builder properties, for example appropriate polyacrylic acid, polymaleic acid and polyacrylic/polymaleic acid co-polymers and their salts, such as those sold by BASF under the Sokalan Trade Mark.

Suitable bleaches include the halogen, particularly chlorine bleaches such as are provided in the form of alkali metal hypohalites, e.g. hypochlorites. In the application of fabrics washing, the oxygen bleaches are preferred, for example in the form of an inorganic persalt, preferably with an precursor, or as a peroxy acid compound.

In the case of the inorganic persalt bleaches, the precursor makes the bleaching more effective at lower temperatures, i.e. in the range from ambient temperature to about 60°C, so that such bleach systems are commonly known as low-temperature bleach systems and are well known in the art. The inorganic persalt such as sodium perborate, both the monohydrate and the tetrahydrate, acts to release active oxygen in solution, and the precursor is usually an organic compound having one or more reactive acyl residues, which cause the formation of peracids, the latter providing for a more effective bleaching action at lower temperatures than the peroxybleach compound alone. The ratio by weight of the peroxy bleach compound to the precursor is from about 15:1 to about 2:1, preferably from about 10:1 to about 3.5:1. Whilst the amount of the bleach system, i.e. peroxy bleach compound and precursor, may be varied between about 5% and about 35% by weight of the total liquid, it is preferred to use from about 6% to about 30% of the ingredients forming the bleach system. Thus, the preferred level of the peroxy bleach compound in the composition is between about 5.5% and about 27% by weight, while the preferred level of the precursor is between about 0.5% and about 40%, most preferably between about 1% and about 5% by weight.

Typical examples of the suitable peroxybleach compounds are alkali metal perborates, both tetrahydrates and monohydrates, alkali metal percarbonates, persilicates and perphosphates, of which sodium perborate is preferred.

Precursors for peroxybleach compounds have been amply described in the literature, including in British patent specifications 836 988, 855 735, 907 356, 907 358, 907 950, 1 003 310 and 1 246 339, US patent specifications 3 332 882, and 4 128 494, Canadian patent specification 844 481 and South African patent specification 68/6344.

5 The exact mode of action of such precursors is not known, but it is believed that peracids are formed by reaction of the precursors with the inorganic peroxy compound, which peracids then liberate active-oxygen by decomposition.

They are generally compounds which contain N-acyl or O-acyl residues in the molecule and which exert their activating action on the peroxy compounds on contact with these in the washing liquor. Cationic
10 peracid bleach precursors such as those described in United States patent specifications US 4 751 015 and US 4 397 757 (Lever Bros) can be included.

When the composition contains abrasives for hard surface cleaning (i.e. is a liquid abrasive cleaner), these will inevitably be incorporated as particulate solids. They may be those of the kind which are water insoluble, for example calcite. Suitable materials of this kind are disclosed in patent specifications EP-A-50
15 887; EP-A-80 221; EP-A-140 452; EP-A-214 540 and EP 9 942 (all Unilever), which relate to such abrasives when suspended in aqueous media. Water soluble abrasives may also be used.

The compositions according to the present invention may also contain an auxiliary dispersant such as finely divided metal or metalloid oxides as referred to in patent specifications GB 1 205 711 and 1 270 040 or fine particulate chain-structure clay as described in European specification EP-A-34 387 (Procter &
20 Gamble). They may also contain one or more of the deflocculants disclosed in EP-A-266 199, for example dodecyl benzene sulphononic acid (added in the free acid form) or lecithin.

The compositions of the invention optionally may also contain one or more minor ingredients such as fabric conditioning agents, enzymes, perfumes (including deoperfumes), micro-biocides, colouring agents, fluorescers, soil-suspending agents (anti-redeposition agents), corrosion inhibitors, enzyme stabilizing
25 agents, and lather depressants.

The compositions are substantially non-aqueous, i.e. they contain little or no free water, preferably no more than 5%, preferably less than 3%, especially less than 1% by weight of the total composition. It has been found that the higher the water content, the more likely it is for the viscosity to be too high, or even for setting to occur.

30 Since the objective of a non-aqueous liquid will generally be to enable the formulator to avoid the negative influence of water on the components, e.g. causing incompatibility of functional ingredients, it is clearly necessary to avoid the accidental or deliberate addition of water to the product at any stage in its life. For this reason, special precautions are necessary in manufacturing procedures and pack designs for use by the consumer.

35 Thus during manufacture, it is preferred that all raw materials should be dry and (in the case of hydratable salts) in a low hydration state, e.g. anhydrous phosphate builder, sodium perborate monohydrate and dry calcite abrasive, where these are employed in the composition. In a preferred process, any solids in dry, substantially anhydrous form, are blended with the liquid phase in a dry vessel. In order to minimise the rate of sedimentation of the solids, this blend is passed through a grinding mill or a combination of
40 mills, e.g. a colloid mill, a corundum disc mill, a horizontal or vertical agitated ball mill, to achieve a particle size of 0.1 to 100 microns, preferably 0.5 to 50 microns, ideally 1 to 10 microns. A preferred combination of such mills is a colloid mill followed by a horizontal ball mill since these can be operated under the conditions required to provide a narrow size distribution in the final product. Of course particulate material already having the desired particle size need not be subjected to this procedure and if desired, can be
45 incorporated during a later stage of processing.

During this milling procedure, the energy input results in a temperature rise in the product and the liberation of air trapped in or between the particles of the solid ingredients. It is therefore highly desirable to mix any heat sensitive ingredients into the product after the milling stage and a subsequent cooling step. It may also be preferable to add the polymer at this stage so as to avoid mechanical degradation thereof. It
50 may also be desirable to de-aerate the product before addition of these (usually minor) ingredients and optionally, at any other stage of the process. Typical ingredients which might be added at this stage are perfumes and enzymes, but might also include highly temperature sensitive bleach components or volatile solvent components which may be desirable in the final composition. However, it is especially preferred that volatile material be introduced after any step of de-aeration. Suitable equipment for cooling (e.g. heat
55 exchangers) and de-aeration will be known to those skilled in the art.

It follows that all equipment used in this process should be completely dry, special care being taken after any cleaning operations. The same is true for subsequent storage and packing equipment.

The present invention will now be demonstrated by way of the following non-limiting examples.

Example 1

Various polymers as indicated below were separately added at 0.5g each to 100g batches of Dobanol 91/6T (nonionic surfactant, C₉₋₁₁ fatty alcohol alkoxylated with an average of 6 moles of ethylene oxide per molecule, ex Shell) and the solubility determined.

Polymer	MW	Solubility at:-	
		Room Temp	70 ° C
Polyvinyl alcohol (88% hydrolysed)	25,000	-	-
Hydroxypropyl cellulose	600,000	-	-
Polyvinylacetate	45,000	-	-
Polyvinylpyrrolidone	360,000	+	+
Polyethyleneoxide	300,000	-	+
Polystyrene	100,000	-	-
Polyacrylic acid	38,000	-	-
Polystyrene sulphonate	70,000	-	-
Solubility:			
+ soluble			
- substantially insoluble			

It is evident that only the polyvinylpyrrolidone was soluble at room temperature. It produced a readily perceptible thickening of the nonionic surfactant.

Example 2

To determine thickening effects with non-surfactant polyalkoxylated solvents, experiments were performed with liquid polyethylene glycol, MW 200 (PEG 200) ex BDH and diglyme, ex Fluka Chemie AG.

It was found that 2g of PVP (polyvinylpyrrolidone, MW 360,000 ex Polysciences Inc) dissolved in 20g of the PEG 200 to give a clear solution with a noticeable increase in viscosity over the PEG 200 alone.

It was found that the PVP at 0.2g was substantially insoluble in 20g of the diglyme alone. Therefore the miscibility of the PEG 200 with the diglyme was investigated. The two solvents were found to be completely miscible in mixtures of 2.5g/7.5g, 5.0g/5.0g and 7.5g/2.5g respectively.

It was found that the PVP was soluble at 0.5% w/w in 2.5g PEG 200 mixed with 7.5g diglyme and gave a clear solution although the observable thickening effect was marginal. However, the PVP at 4.5% w/w in 5g PEG 200 mixed with 5g diglyme gave not only a clear solution but a definite perceptible increase in viscosity relative to the diglyme alone.

Example 3

10% by weight solutions of polyvinylpyrrolidone having a molecular weight of 10K, 24K, 40K and 360K in Dobanol 91-6T were prepared and the equilibrium flow curve for each sample was measured using a Rheo-Tech International Visco-Elastic Rheometer over a torque range of 1 to 5 mNm. From the plots of viscosity against shear rate, it was apparent that the samples containing PVP with a molecular weight up to 40K gave no measurable change in viscosity with increasing shear rate. The measured viscosities were extrapolated to a shear rate of 21s⁻¹ with the following results.

Molecular weight	Viscosity (Pas)
10,000	0.13
24,000	0.22
40,000	0.27

The sample containing PVP with a molecular weight of 360,000 was found to be shear thinning, having a viscosity of 6.24 Pas at 21s^{-1} which was even higher at lower shear rates, indicative of significant thickening.

These results show that a substantial increase in thickening occurs when polymers with higher molecular weights are used.

Example 4: Fully formulated composition	
	wt %
Dobanol 91/6T (1)	37.85
Glycerol tri-acetate	5.0
Aerosil 380 (2)	1.25
PVP (3)	0.5
STP (4)	30.0
Sodium carbonate 0aq	4.0
Na Perborate monohydrate	15.0
EDTA (5)	0.15
SCMC (6)	1.0
TAED (7)	4.0
Dequest 2041	0.1
Fluorescer (Tinopal DMS-X)	0.3
Tylose MH20	0.5
Silicone DB100	0.25
Savinase 8.0 SL	0.6

(1) as Example 1.

(2) Finely divided silica

(3) Molecular weight 360,000

(4) Sodium tripolyphosphate

(5) Ethylene diamine tetraacetic acid

(6) Sodium carboxymethylcellulose

(7) Tetraacetyl ethylenediamine

Claims

1. A non-aqueous liquid comprising a polyalkoxylated material which liquid is thickened with a dissolved vinylpyrrolidone polymer or a derivative thereof, which polymer has a viscosity average molecular weight greater than 30,000.

2. A non-aqueous liquid according to claim 1, wherein the viscosity average molecular weight of the polymer is at least 40,000.

3. A non-aqueous liquid according to claim 2, wherein the viscosity average molecular weight of the polymer is at least 250,000.

4. A non-aqueous liquid according to claim 1, wherein the viscosity average molecular weight of the polymer is up to 1,000,000.

5. A non-aqueous liquid according to claim 1, wherein the polyalkoxylated material comprises a

nonionic surfactant.

6. A non-aqueous liquid according to claim 1, wherein the polyalkoxylated material comprises an alkylene glycol mono- or di-alkyl ether.

7. A non-aqueous liquid according to claim 1, wherein the polyalkoxylated material comprises a liquid
5 polyalkylene glycol.

8. A non-aqueous liquid according to claim 1, which comprises diglyme and a polyethylene glycol in a weight ratio of from 1:3 to 3:1.

9. A non-aqueous liquid cleaning composition comprising a liquid according to any preceding claim and one or more other components.

10. A non-aqueous liquid cleaning composition according to claim 9, wherein the one or more
10 components comprises a suspended particulate solid phase.

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