An anti-fogging surfactant mixture for use in a window cleaning composition consisting essentially of a mixture of a nonionic surface active agent having the formula

wherein R is an alkyl group having from one to four carbon atoms and R₁ is a radical selected from the group consisting of methyl, ethyl, cyclopropyl, and phenyl or the reaction product of the above glycol and from 2 to 200 moles of ethylene oxide and an anionic or nonionic surfactant in a weight ratio of 1:50 to 1:1. A non-fogging window cleaner containing from 0.1 to 3 percent of the above noted anti-fogging surfactant mixture as well as a method for utilizing the same is provided.

20 Claims, No Drawings
ANTI-FOGGING WINDOW CLEANER SURFACTANT MIXTURE

This invention relates to a non-fogging window cleaning composition. More particularly, this invention relates to a synergistic non-fogging surfactant mixture for use in a window cleaning composition.

The formation of fog on glass surfaces with its resultant loss of visibility is a problem which has troubled home owners, drivers, pilots or virtually anyone who depends upon clear visibility through a window or similar glass article. The attention which has been paid to this problem is evidenced by the remarkable number of glass cleaning compositions which are on the market claiming anti-fogging or defogging characteristics.

Window or mirror fogging is caused at least in part by the condensation of moisture droplets on the transparent surface. These individual condensed droplets form a whitish fog which renders the glass or mirror opaque and obstructs vision. It has been known to utilize the various surface active agents to reduce the surface tension and thereby enhance the coalescence of these individual water droplets into a larger, more transparent form. However, these prior art compositions, although they possess adequate defogging characteristics, possess a series of other undesirable properties, such as high initial film formation, heavy image distortion, streaking, smearing, and smudging of the surface. Obviously, a preferred window cleaner and anti-fogging composition would possess superior, or at least quite satisfactory, results in each of the above categories as well as possessing adequate anti-fogging properties.

It is within the above embodiment that the anti-fogging surfactant mixture for window cleaning compositions and window cleaning compositions of the present invention were developed. Briefly, such mixture comprises a mixture of a nonionic surface active agent having the formula

wherein \( R \) is an alkyl group having from one to four carbon atoms and \( R_1 \) is a radical selected from the group consisting of methyl, ethyl, isopropyl and phenyl or the reaction product of the above glycol and from 2 to 200 moles of ethylene oxide and an anionic or nonionic surface active agent, especially an anionic surface active agent having the formula \( R_2 \) \( O(C_2H_4O) \) \( n \) \( S \) \( O \) \( M \) wherein \( R_2 \) is an alkyl group having from 8 to 20 carbon atoms, \( n \) is a number from 2 to 200 and \( M \) is a cation selected from the group consisting of sodium, potassium and ammonium or a nonionic surface active agent having the formula \( R_2 \) \( O \) \( (C_2H_4O) \) \( n \) \( H \) wherein \( R_2 \) and \( n \) are defined as above in a weight ratio of 1:50 to 1:1, preferably 1:10 to 1:1.

The anti-fogging window cleaning composition of the present invention comprises from 0.2 to 3 percent by weight of the above synergistic anti-fogging surfactant mixture, from 80 to 93.7 percent water, from 3 to 8 percent by weight of at least one glycol ether, from 3 to 7 percent by weight of a monohydric alcohol and from 0.1 to 2 percent by weight of a hydroxide selected from sodium, potassium and ammonium hydroxides.

The acetylenic glycols which comprise one component of the anti-fogging surfactant mixture of the present invention have the following structural formula

wherein \( R \) is an alkyl group, either a branched or a straight chain group containing from one to four carbon atoms, such as methyl, ethyl, propyl, isopropyl, n-butyl, isobutyl or t-butyl and wherein \( R_1 \) is a radical selected from the group of methyl, ethyl, cyclopropyl and phenyl. Representative compounds of the above noted acetylenic glycols include the following

2,4,7,9-tetramethyl-5-decyne-4,7-diol
4,7-dimethyl-5-decyne-4,7-diol
2,3,6,7-tetramethyl-4-octyne-3,6-diol
3,6-diethyl-4-octyne-3,6-diol
3,819,522

3,819,522

2,5-dicyclopentyl-3-hexyne-2,5-diol
3,6-dimethyl-4-octyne-3,6-diol
2,5-diphenyl-3-hexyne-2,5-diol
5,8-dimethyl-6-dodecyn-5,8-diol, etc.
2,4,7,9-tetramethyl-5-decyn-4,7-diol is most preferred for use in the synergistic anti-fogging mixture and window cleaner of the present invention.

These symmetrical tertiary acetylenic glycols may be prepared by a number of well known techniques, such as by reacting calcium carbide, an alkali metal hydroxide and the corresponding ketone to give the desired glycol as disclosed in U.S. Pat. No. 2,250,445, or by reacting the ketones with an alkali metal acetylide as disclosed in U.S. Pat. No. 2,106,180, or, lastly, by reacting acetylene with an excess of the ketone in the presence of a solid caustic potash in a solvent medium.

Although the above noted acetylenic glycols have been utilized as non-foaming surface active agents for a great variety of uses, such as dentifrices, toilet soaps, shampoos, laundry detergents, pigment dispersants in water based paints, viscosity reducers, gel inhibitors and freeze-thaw additives, these materials have not been utilized as a component in an anti-fogging composition. This is, of course, due to the fact that the acetylenic glycols themselves without the anionic sulfates do not possess any significant anti-fogging properties and any anti-fogging activity is accompanied by heavy image distortion, streaking, smearing or initial film formation. Accordingly, these materials had been thought to be completely unsuitied for utilization in a window cleaning composition in any percentage and, especially unsuitied for use in an anti-fogging window cleaning composition.

The reaction products of the above noted acetylenic glycols and ethylene oxide may also be utilized in the anti-fogging window cleaning composition of the present invention. More particularly, this reaction product comprises the reaction product of one mole of the acetylenic glycol having the formula

\[
\begin{align*}
\text{R}_1 \quad \text{C} \quad \text{C} \quad \text{R}_2
\end{align*}
\]

wherein R and R1 are defined as above and from 2 to 200 moles of ethylene oxide. Although any amount of ethylene oxide within the above noted range may be utilized for producing the reaction product utilized in the mixture of the present invention, it is preferred to react the acetylenic glycols with from 2 to 20 moles of ethylene oxide. Representative ethoxylated acetylenic glycols include the following wherein the amount of ethylene oxide reacted with the acetylenic glycol is indicated as +EO wherein N is the number of moles reacted:

2,4,7,9-tetramethyl-5-decyn-4,7-diol + 3.5EO
4,7-dimethyl-5-decyn-4,7-diol + 20EO
2,3,6,7-tetramethyl-4-octyn-3,6-diol + 10EO
3,6-dimethyl-4-octyn-3,6-diol + 9EO
2,5-dicyclopentyl-3-hexyn-2,5-diol + 20EO
3,6-dimethyl-4-octyn-3,6-diol + 30EO
4,7-dimethyl-5-decyn-4,7-diol + 20EO
2,3,6,7-tetramethyl-4-octyn-3,6-diol + 2EO
3,6-dimethyl-4-octyn-3,6-diol + 10EO

A preferred class of anionic surfactants suitable for use in the synergistic mixture of the present invention has the formula RO(C₂H₄O)₉SO₃M wherein R is a fatty alkyl having from eight to 20 carbon atoms, n is a number from 2 to 200 and M is a cation selected from ammonium, potassium and sodium ions. Although any of the higher fatty acid ethoxylated sulfates may be utilized, it is preferred to utilize a sulfate wherein R is a fatty alkyl from between 10 and 18 carbon atoms, n is a number between two and 20 and M is ammonium. The most preferred sulfated anionic utilized in the anti-fogging window cleaner of the present invention is a mixed C₁₂₋₁₅ normal primary alkyl triethoxysulfate ammonium salt. This most preferred anionic sulfate salt produces the optimum results in combination with the above noted acetylenic glycol.

The anionic detergents generally have the fatty alkyl group terminaly joined to the polyoxyethylene chain which is of necessity terminaly joined to the sulfur of the sulfate group. Although a slight degree of a branching of the higher alkyl group may be tolerated, the degentry of the anionic sulfate is improved if the alkyl group is essentially straight chained. Furthermore, medial joiner of the alkyl to the ethoxyn chain should be minimized although a small percentage up to about 10 percent of medial joiner near one end of the alkyl chain is acceptable. As noted above, the preferred range of the alkyl is from 10 to 18 carbon atoms and within this range, the mixed alkyls having 12 to 15 carbon atoms are most preferred, these mixtures contain-
ing approximately between 10 and 50 percent of each chain length.

The ethylene oxide content of the anionic detergent is such that \( n \) is from 2 to 200 and preferably from 2 to 20 with the most preferred ethylene oxide content being about 3, especially when \( R \) is a mixed 12–15 carbon atom alkyl mixture. The value of \( n \) or the ethylene oxide content is determined by the desired hydrophobic-hydrophilic balance which may be varied markedly by variations in the ethylene oxide content and the length of the alkyl groups.

The salt forming cation may be any suitable solubilizing metal; however, the alkali metals, i.e. sodium and potassium and ammonium ions are preferred with the ammonium ion being most preferred.

Examples of the higher alcohol polyethoxylates ethoxylate the anionic surfactant in addition to the acetylenic glycol and anionic sulfates includes from 80 to 93.7 percent by weight of

\[ R_2O(C_2H_4O)\text{nH} \]

wherein \( R_2 \) and \( n \) are as defined above.

The configuration of the nonionic detergent should be roughly similar to those described with regard to the anionic detergents, i.e. the nonionic detergents could be formed primarily from straight chained fatty alcohols with the alcohol groups being terminaly joined to the alkyl radical. Generally, it is preferred to utilize nonionic compounds wherein the alkyl group has from between eight and 20 carbon atoms with the preferred nonionics having from between 11 to 16 carbon atoms. Furthermore, with regard to moles of ethylene oxides or length of the ethylene oxide is generally preferred that from 2 to 20 moles of ethylene oxide be utilized. Furthermore, since these materials are generally formed from mixed alkyl alcohols, the carbon atom chain length would generally be an average chain length with a most preferred nonionic being the reaction product of ethylene oxide with an alkyl alcohol having from 11 to 15 carbon atoms.

Examples of other suitable non-ionic detergents include alkaryl polyglycol detergents such as alkylphenol-ethylenoxide condensates (2–200 moles ethylene oxide), such as p-isooctyl phenol polyethylene oxide (10 ethylene oxide units); polyglycerol monolaurate, glycol dioleate, sorbitan monolaurate, sorbitan monostearate, sorbitan monopalmitate, sorbitan monooleate, sorbitan sesquioleate, the condensation products of ethylene oxide with sorbitan esters of long chain fatty acids (Tweens), alkylolamides, amine oxides, phosphate oxides, etc.

The anti-fogging window cleaner of the present invention in addition to the acetylenic glycol and anionic sulfates includes from 80 to 93.7 percent by weight of water, from 3 to 8 percent by weight of at least one glycol ether, from 3 to 7 percent by weight of an alcohol, from 0.1 to 2 percent of ammonium, hydroxide or an alkaline metal hydroxide and from 0.1 to 3 percent by weight of the mixture of anionic or nonionic surfactant and acetylenic glycol.

The glycol ethers which are suitable for use in the window cleaning composition of the present invention are employed primarily for their solvent and additional detrisive properties and include monoethers of ethylene glycols, such as the monomethyl, the monoethyl, the monopropyl and the monobutyl ethers of ethylene glycol and the monoethers of propylene glycol, such as the monomethyl, the monoethyl, the monopropyl and the monobutyl ethers of propylene glycol.

The alcohol utilized is generally a lower alkyl monohydric alcohol, such as methyl alcohol, ethyl alcohol, isopropyl alcohol and butyl alcohol. If ethyl alcohol is utilized, generally such material is utilized as denatured ethyl alcohol.

The hydroxides are utilized in the window cleaning composition so as to control the pH level of the resultant composition and, generally, the hydroxide corresponding to the anionic sulfate is utilized. Generally, the pH of the window cleaning compositions of the present invention is between 8 and 11 with the preferred pH being 10.

In addition to the above noted ingredients, small amounts of color, perfume and other agents, such as propellants for aerosol dispensing, may be utilized.

The window cleaning composition of the present invention may be packaged either for dispensing in an aerosol dispenser or utilizing a mechanical pump type valve dispenser. When an aerosol dispensing package is utilized, generally, the composition includes up to about 10 percent by weight of a suitable propellant, such as any of the well known fluorochloroethanes and similar materials; and the hydrocarbon propellants, such as isobutane, etc.

The mixture and window cleaning composition of the present invention will now be further illustrated by way of the following examples wherein all parts and percentages are by weight and all temperatures are in degrees centigrade.

**EXAMPLE 1**

A window cleaner having the following composition is prepared:

| Water, demineralized | 91.015% |
| Ethylene glycol monobutyl ether | 2.000 |
| Propylene glycol monomethyl ether | 2.500 |
| Isopropyl alcohol | 3.800 |
| C12-15 alcohol (3 EO) ammonium sulfate | 0.350 |
| TGA commercially available mixture containing 83% 2.4.7,9-tetramethyl-5-decane-4,7-diour, ethylene glycol and an alkyl phenyl-ethylene oxide adduct | 0.015 |

| 0.300 | 20° Be Ammonium Hydroxide |

| 0.0006% | 100.000% |

The cleaning performance of the above the above noted composition is determined by the ability of this composition to flush off from a pane of glass a film of mixed kitchen fats. The anti-fogging properties of the above noted composition is evaluated by applying the composition to a pane of glass followed by chilling the glass pane and exposing the same to steam. The anti-fog efficacy is judged by observing whether or not the
composition's sudsing is proper upon application, the absence of filming on application, the prevention of exposed to steam and the anti-fog and cleaning properties are noted.

### TABLE I

<table>
<thead>
<tr>
<th>Example No.</th>
<th>Cleaner</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp. Ex. 1</td>
<td>Com. Product W</td>
<td>Glass fogged on first exposure to steam. Poor anti-fog first exposure, very poor on second.</td>
</tr>
<tr>
<td>Comp. Ex. 2</td>
<td>Com. Product EO</td>
<td>Glass fogged on first exposure. Fair anti-fog effect, distorted sight.</td>
</tr>
<tr>
<td>Comp. Ex. 3</td>
<td>Com. Product A</td>
<td>Excessive sudsing. Good anti-fog. Moderate sight distortion.</td>
</tr>
<tr>
<td>Comp. Ex. 4</td>
<td>0.6% AAS</td>
<td>Excessive sudsing. Good anti-fog. Sight distortion. Moderate film formation.</td>
</tr>
<tr>
<td>Comp. Ex. 5</td>
<td>1.0% AAS</td>
<td>Excessive sudsing. Good anti-fog. Sight distortion.</td>
</tr>
<tr>
<td>Comp. Ex. 6</td>
<td>1.2% AAS</td>
<td>Excessive sudsing. Good anti-fog. Sight distortion.</td>
</tr>
<tr>
<td>Comp. Ex. 7</td>
<td>1.4% AAS</td>
<td>Excessive sudsing. Good anti-fog.</td>
</tr>
<tr>
<td>Comp. Ex. 8</td>
<td>0.05% TG</td>
<td>No anti-fog effect.</td>
</tr>
<tr>
<td>Example 2</td>
<td>0.010% TG</td>
<td>No anti-fog effect. Moderate sight distortion.</td>
</tr>
<tr>
<td>Example 3</td>
<td>0.250% AAS</td>
<td>No filming, no smearing.</td>
</tr>
<tr>
<td>Example 4</td>
<td>0.010% 2,4,7,9-tetramethyl-5-decyne-4,7-diol</td>
<td>Good anti-fog effect. Good sight.</td>
</tr>
</tbody>
</table>

1C12:15 alcohol (3EO) Ammonium Sulfate.

### COMPARATIVE EXAMPLES 1–8 and EXAMPLES 2–4

Three commercially available window cleaners plus the window cleaning composition of Example 1 wherein the surfactants are replaced with the surfactants, as shown in Table I with a corresponding reduction or increase in the amount of water present, are applied to a glass surface. These glass surfaces are then fogging when exposed to steam, the clarity of sight through the glass following steaming, the absence of film after steaming and drying, and the freedom from smearing when dry. When judged according to the above noted criteria, the composition has excellent cleaning properties, has adequate sudsing upon application with a slight film formed immediately. The anti-fogging properties upon exposure to steam are judged as very good with good clarity of sight and an absence of film after steaming and virtually no smearing when dry.

### COMPARATIVE EXAMPLES 9–16 and Examples 5–10

The formulation of Example 1 is varied utilizing the following surfactants in place of the TG and anionic sulfate with a concomitant change in the water content of the formulation.

### TABLE II

<table>
<thead>
<tr>
<th>Example number</th>
<th>Window cleaner of product Ex. 1 containing—</th>
<th>Evaluation</th>
<th>Initial film</th>
<th>Anti-fog</th>
<th>Image distortion</th>
<th>Streaking</th>
<th>Smearing</th>
<th>Glycol/ AAS, percent</th>
<th>Total surfactant, percent</th>
<th>Ratio glycol: AAS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comp. Ex. 9...</td>
<td>0.000% TG, No. AAS</td>
<td>Glass panel, Moderate</td>
<td>Poor</td>
<td>Heavy</td>
<td>Slight</td>
<td>None</td>
<td>0.2/0.0</td>
<td>0.200</td>
<td>2:1</td>
<td>1:4:2</td>
</tr>
<tr>
<td>Comp. Ex. 10...</td>
<td>0.200% 2,4,7,9-tetramethyl-5-decyne-4,7-diol</td>
<td>Glass panel, Moderate</td>
<td>Poor</td>
<td>Heavy</td>
<td>Slight</td>
<td>None</td>
<td>0.2/0.0</td>
<td>0.200</td>
<td>2:1</td>
<td>1:4:2</td>
</tr>
<tr>
<td>Comp. Ex. 11...</td>
<td>0.200% 3,4-dimethyl-4-cycte-3,4-diol</td>
<td>Glass panel, Moderate</td>
<td>Poor</td>
<td>Heavy</td>
<td>Slight</td>
<td>None</td>
<td>0.2/0.0</td>
<td>0.200</td>
<td>2:1</td>
<td>1:4:2</td>
</tr>
<tr>
<td>Example 5...</td>
<td>0.010% 2,4,7,9-tetramethyl-5-decyne-4,7-diol, 0.000% AAS</td>
<td>Glass panel, Moderate</td>
<td>Poor</td>
<td>Heavy</td>
<td>Slight</td>
<td>None</td>
<td>0.2/0.0</td>
<td>0.200</td>
<td>2:1</td>
<td>1:4:2</td>
</tr>
<tr>
<td>Example 6...</td>
<td>0.000% 2,4,7,9-tetramethyl-5-decyne-4,7-diol, 0.200% AAS</td>
<td>Glass panel, Moderate</td>
<td>Poor</td>
<td>Heavy</td>
<td>Slight</td>
<td>None</td>
<td>0.2/0.0</td>
<td>0.200</td>
<td>2:1</td>
<td>1:4:2</td>
</tr>
<tr>
<td>Example 7...</td>
<td>0.050% 2,4,7,9-tetramethyl-5-decyne-4,7-diol, 0.200% AAS</td>
<td>Glass panel, Moderate</td>
<td>Poor</td>
<td>Heavy</td>
<td>Slight</td>
<td>None</td>
<td>0.2/0.0</td>
<td>0.200</td>
<td>2:1</td>
<td>1:4:2</td>
</tr>
<tr>
<td>Example 8...</td>
<td>0.010% 2,4,7,9-tetramethyl-5-decyne-4,7-diol, 0.200% AAS</td>
<td>Glass panel, Moderate</td>
<td>Poor</td>
<td>Heavy</td>
<td>Slight</td>
<td>None</td>
<td>0.2/0.0</td>
<td>0.200</td>
<td>2:1</td>
<td>1:4:2</td>
</tr>
<tr>
<td>Example 9...</td>
<td>0.010% 2,4,7,9-tetramethyl-5-decyne-4,7-diol, 0.200% AAS</td>
<td>Glass panel, Moderate</td>
<td>Poor</td>
<td>Heavy</td>
<td>Slight</td>
<td>None</td>
<td>0.2/0.0</td>
<td>0.200</td>
<td>2:1</td>
<td>1:4:2</td>
</tr>
<tr>
<td>Example 10...</td>
<td>0.010% 2,4,7,9-tetramethyl-5-decyne-4,7-diol, 0.200% AAS</td>
<td>Glass panel, Moderate</td>
<td>Poor</td>
<td>Heavy</td>
<td>Slight</td>
<td>None</td>
<td>0.2/0.0</td>
<td>0.200</td>
<td>2:1</td>
<td>1:4:2</td>
</tr>
<tr>
<td>Example number</td>
<td>Window cleaner of product Ex. 1 containing</td>
<td>Evaluation surface</td>
<td>Initial film</td>
<td>Anti-fog</td>
<td>Image distortion</td>
<td>Streaking</td>
<td>Smearing</td>
<td>Glycol/ AAS, percent</td>
<td>Total surfactant, percent</td>
<td>Ratio glycol: AAS</td>
</tr>
<tr>
<td>----------------</td>
<td>------------------------------------------</td>
<td>--------------------</td>
<td>--------------</td>
<td>----------</td>
<td>-----------------</td>
<td>----------</td>
<td>----------</td>
<td>----------------------</td>
<td>--------------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Comp. Ex. 12</td>
<td>.000% AAS only</td>
<td>Moderate</td>
<td>Poor-fair</td>
<td>Moderate-heavy</td>
<td>Slight</td>
<td>Moderate</td>
<td>0.60/0.80</td>
<td>0.600</td>
<td>0.60</td>
<td></td>
</tr>
<tr>
<td>Comp. Ex. 13</td>
<td>.100% AAS only</td>
<td>None</td>
<td>None</td>
<td>Heavy</td>
<td>None</td>
<td>None</td>
<td>0.90/0.10</td>
<td>1.400</td>
<td>0.10</td>
<td></td>
</tr>
<tr>
<td>Comp. Ex. 14</td>
<td>.120% AAS only</td>
<td>Heavy</td>
<td>Good</td>
<td>Slight</td>
<td>Heavy</td>
<td>Severe</td>
<td>0.06/1.30</td>
<td>1.300</td>
<td>0.120</td>
<td></td>
</tr>
</tbody>
</table>

**Competitive products**

- Commercial product B: Glass panel, Slight
- Commercial product C: do, Moderate-heavy

As is apparent with reference to Table II only by the use of the acetylenic glycol and the anionic sulfate are the results regarding film formation, anti-fogging, image distortion, streaking and smearing acceptable. When either the acetylenic glycol or the anionic sulfate is utilized singly poor anti-fogging characteristics are observed or if acceptable anti-fogging characteristics are obtained, other undesirable properties, such as heavy initial film, streaking or smearing, are encountered. Regarding the commercial products B and C which are included for their comparative value, it is noted that the anti-fogging characteristics of these materials are judged fair to good and that these materials are inferior regarding initial film formation, image distortion, streaking and smearing when compared to the products of the present invention.

**EXAMPLE 11**

A window cleaner, having the following formulation, is prepared:

<table>
<thead>
<tr>
<th>Part 1 Liquid Base</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>90.958</td>
<td>Softened Water (deionized or Seelite)</td>
</tr>
<tr>
<td>2.000</td>
<td>Ethylene Glycol Monobutyl Ether</td>
</tr>
<tr>
<td>2.500</td>
<td>Propylene Glycol Monomethyl Ether</td>
</tr>
<tr>
<td>3.800</td>
<td>Isopropanol Alcohol, Anhydrous</td>
</tr>
<tr>
<td>0.417</td>
<td>C12-15 Alcohol EO 3:1 NH, Sulfate, (60.0% AAS; 14.0% Ethanol; 63.0% Solids)</td>
</tr>
<tr>
<td>0.025</td>
<td>Surfactant TG Mixture of Example 1</td>
</tr>
<tr>
<td>≤0.300</td>
<td>26% Be Ammonium Hydroxide (Vary as required to adjust pH to 10.0 ± 0.3)</td>
</tr>
<tr>
<td>100.000</td>
<td>TOTAL MATERIALS</td>
</tr>
</tbody>
</table>

The above noted formulation is packaged utilizing an aerosol container wherein 98.2 parts by weight of the above noted liquid base is mixed with 1.8 parts by weight of isobutane propellant.

A window cleaner composition identical to the liquid base for use in the aerosol container is also packaged in a mechanical spray dispenser and the cleaning and anti-fogging effects of each are compared on panes of glass. Each of the above noted window cleaning compositions performs adequately with regard to the removal of the mixed kitchen fats which have been previously streaked upon the glass panes; and, further, when these glass panes are subjected to steam, the anti-fogging properties are rated as good with virtually no image distortion, initial film formation, streaking or smearing.

**EXAMPLE 12**

The formulation of Example 1 is utilized except that the surfactant TG mixture is replaced with a similar amount of the following acetylenic glycols:
- A. 2,4,7,9-tetramethyl-5-decyn-4,7-diol;
- B. 4,7-dimethyl-5-decyn-4,7-diol;
- C. 2,3,6,7-tetramethyl-4-octyne-3,6-diol;
- D. 3,6-diethyl-4-octyne-3,6-diol;
- E. 2,5-dicyclopentyl-3-hexyne-2,5-diol;
- F. 3,6-dimethyl-4-octyne-3,6-diol;
- G. 2,5-dihexynyl-3-hexyne-2,5-diol;
- H. 2,5-dimethyl-3-hexyne-2,5-diol; and
- I. 1,5,8-tetrahydrolinaldehyde-5,8-diol.

Each of the above noted acetylenic glycols has adequate anti-fogging properties, however, the A and F acetylenic glycols produces slightly better results with regard to initial film formation and smearing.

**EXAMPLE 13**

The formulation of Example 1 is again utilized with the exception that the anionic sulfate is replaced with an equivalent amount of the following anionic sulfates:
- A. mixed C12-18 normal primary alkyl triethoxy sulfate, sodium salt;
- B. myristyl triethoxy sulfate, potassium salt;
- C. n-decyl diethoxy sulfate, sodium salt;
- D. lauryl diethoxy sulfate, ammonium salt;
- E. palmityl tetraethoxy sulfate, sodium salt;
- F. mixed C14-15 normal primary alkyl tri- and tetraethoxy sulfate, sodium salt;
- G. stearyl pentaethoxy sulfate, ammonium salt; and
- H. mixed C16-18 normal primary alkyl triethoxy sulfate, potassium salt.

Each of the above noted formulations has satisfactory anti-fogging properties; however, the anti-fogging properties of D and G are slightly better than the anionic sulfates utilizing potassium and sodium cations. This appears to be caused by the lower residue of the ammonium sulfates as compared to the sodium and potassium salts.

**EXAMPLE 14**

The formulation of Example 1 is utilized with the exception that the anionic sulfate and the acetylenic glycol are replaced with the following mixtures of acetylenic glycols and anionic sulfates (The glycols are taken from Example 12 and the anionic sulfates are taken from Example 13) with a corresponding increase or decrease in the amount of water present, all other components remaining stable.
- A. 0.01 Ex. 12(A), 0.19 Ex. 13(D); and
- B. 0.06 Ex. 12(C), 2.94 Ex. 13(A);
EXAMPLE 15

The composition of Example 1 is utilized except that the surfactant TG mixture is replaced with a similar amount of the following ethoxylated acetylenic glycols:

A. 2,4,7,9-tetramethyl-5-decyne-4,7-diol + 3.5EO
B. 4,7-dimethyl-5-decyne-4,7-diol + 30EO
C. 2,3,6,7-tetramethyl-4-octyne-3,6-diol + 200EO
D. 3,6-diethyl-4-octyne-3,6-diol + 10 EO
E. 2,5-dicyclopentyl-3-hexyne-2,5-diol + 20EO
F. 3,6-dimethyl-4-octyne-3,6-diol + 5EO
G. 2,5-diphenyl-3-hexyne-2,5-diol + 15EO
H. 2,5-dimethyl-3-hexyne-2,5-diol + 2EO
I. 5,8 -dimethyl-6-docydecyn-5,8-diol + 7EO

Each of the above noted formulations performs adequately with regard to both cleaning and anti-fogging properties.

EXAMPLE 16

The formulation of Example 1 is again utilized except that the anionic sulfate is replaced with an equivalent amount of the following nonionic surfactants:

A. p-isooctyl phenol polyethylene oxide (10 ethylene oxide units);
B. dodecyl alcohol-polyethylene oxides (6 ethylene oxide units)
C. mixed C12-15 alcohol polyethylene oxide (10 ethylene oxides);
D. sorbitan monolaurate;
E. mixed 11-15 alcohol polyethylene oxide having 11 ethylene oxide units.

Each of the above noted compositions performs adequately with regard to both cleaning properties and anti-fogging, streaking, and smearing properties. However, when a composition similar to the above noted composition with the exception of the deletion of the acetylenic glycol component is utilized, the anti-fogging properties are markedly reduced.

While the window cleaning composition and anti-fogging mixture of the present invention and process for utilizing the same have been described with reference to the foregoing specific examples, the same are for the purposes of illustration only and are to be in no way as construed as limiting the present invention which is properly defined by way of the following appended claims.

What is claimed is:

1. An anti-fogging mixture for use in a window cleaning composition consisting essentially of a mixture of a glycolic surface active agent selected from acetylenic glycols having the formula

   \[ R_1 - C = C - C = O - C = O - R_1 \]

   where R1 is an alkyl group having from one to four carbon atoms and R1 is a radical selected from the group consisting of methyl, ethyl, cyclopropyl and phenyl, or the reaction product of an acetylenic glycol having the formula

   \[ R_2 - C = C - G - O - R_2 \]

   wherein R2 is an alkyl group having from one to four carbon atoms and R2 is a radical selected from the group consisting of methyl, ethyl, cyclopropyl and phenyl, and from 2 to 200 moles of ethylene oxide, and a surface active agent selected from anionic surface active agents having the formula R3O(C2H4O)nSO3M wherein R3 is an alkyl group having from 8 to 20 carbon atoms, n is a number from 2 to 200 and M is a cation selected from the group consisting of ammonium, sodium, and potassium and nonionic surface active agent having the formula R4O(C2H4O)nH wherein R4 is a radical consisting of methyl, ethyl, cyclopropyl and phenyl, and from 2 to 200 moles of ethylene oxide, and a surface active agent selected from anionic surface active agents having the formula R3O(C2H4O)nSO3M wherein R3 is an alkyl group having from 8 to 20 carbon atoms, n is a number from 2 to 200 and M is a cation selected from the group consisting of ammonium, sodium, and potassium.

2. The composition of claim 1 wherein said anionic surface active agent is selected from the group consisting of mixed C10-12 normal primary alkyl triethenox sulfate, ammonium salt; myristyl triethenox sulfate, potassium salt, n-decyl diethenox sulfate, sodium salt; lauryl diethenox sulfate, ammonium salt, palmityl tetraethenox sulfate, sodium salt; mixed C10-12 normal primary alkyl mixed tri- and tetraethenox sulfate, sodium salt, stearyl pentaethenox sulfate, ammonium salt and mixed C10-12 normal primary alkyl triethenox sulfate, potassium salt.

3. The composition of claim 1 wherein said glycolic surface active agent is selected from the group consisting of

   2,4,7,9-tetramethyl-5-decyne-4,7-diol + 3.5EO
   4,7-dimethyl-5-decyne-4,7-diol + 30EO
   2,3,6,7-tetramethyl-4-octyne-3,6-diol + 200EO
   3,6-diethyl-4-octyne-3,6-diol + 10 EO
   2,5-dicyclopentyl-3-hexyne-2,5-diol + 20EO
   3,6-dimethyl-4-octyne-3,6-diol + 5EO
   2,5-diphenyl-3-hexyne-2,5-diol + 15EO
   2,5-dimethyl-3-hexyne-2,5-diol + 2EO
   5,8 -dimethyl-6-docydecyn-5,8-diol + 7EO
   2,4,7,9-tetramethyl-5-decyne-4,7-diol + 3.5EO
   4,7-dimethyl-5-decyne-4,7-diol + 30EO
   2,3,6,7-tetramethyl-4-octyne-3,6-diol + 10EO
   3,6-diethyl-4-octyne-3,6-diol + 10EO
   2,5-dicyclopentyl-3-hexyne-2,5-diol + 20EO
   3,6-dimethyl-4-octyne-3,6-diol + 30EO
   2,4,7,9-tetramethyl-5-decyne-4,7-diol + 15EO
   4,7-dimethyl-5-decyne-4,7-diol + 20EO
   2,3,6,7-tetramethyl-4-octyne-3,6-diol + 2EO
   3,6-diethyl-4-octyne-3,6-diol + 10EO
   2,5-dicyclopentyl-3-hexyne-2,5-diol + 15EO
   3,6-dimethyl-4-octyne-3,6-diol + 5EO
   2,5-diphenyl-3-hexyne-2,5-diol + 10EO
   2,5-dimethyl-3-hexyne-2,5-diol + 10EO
   5,8 -dimethyl-6-docydecyn-5,8-diol + 7EO
   2,4,7,9-tetramethyl-5-decyne-4,7-diol + 3.5EO
   4,7-dimethyl-5-decyne-4,7-diol + 30EO
   2,3,6,7-tetramethyl-4-octyne-3,6-diol + 10EO
   3,6-diethyl-4-octyne-3,6-diol + 10EO
   2,5-dicyclopentyl-3-hexyne-2,5-diol + 20EO
   3,6-dimethyl-4-octyne-3,6-diol + 30EO
   2,4,7,9-tetramethyl-5-decyne-4,7-diol + 20EO
   4,7-dimethyl-5-decyne-4,7-diol + 8EO
   2,3,6,7-tetramethyl-4-octyne-3,6-diol + 12EO
   3,6-diethyl-4-octyne-3,6-diol + 15EO
   2,5-dicyclopentyl-3-hexyne-2,5-diol + 15EO
   3,6-dimethyl-4-octyne-3,6-diol + 5EO
   2,4,7,9-tetramethyl-5-decyne-4,7-diol + 30EO
   4,7-dimethyl-5-decyne-4,7-diol + 10EO
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2,3,6,7-tetramethyl-4-octyne-3,6-diol + 5EO
3,6-dimethyl-4-octyne-3,6-diol + 2EO
2,5-diphenyl-3-hexyne-2,5-diol + 5EO
2,5-dimethyl-3-hexyne-2,5-diol + 2EO
5,8-dimethyl-6-dodecynyle-5,5-diol + 10EO, etc.

4. The composition of claim 1 wherein said glycolic surface active agent is a mixture of a major amount of 2,4,7,9-tetramethyl-5-decyne-4,7-diol, ethylene glycol and as a minor amount of alkyl phenyl ethylene oxide adduct.

5. The composition of claim 1 wherein in said anionic surfactant R₂ is mixed alkyl, said alkyl containing from 12 to 15 carbon atoms and wherein from about 10 to 50 percent of each alkyl chain length is present.

6. The composition according to claim 5 wherein said anionic surface active agent is C₁₂₋₁₅ normal primary alkyl triethanol sulfate ammonium salt.

7. The composition of claim 1 wherein M is an ammonium ion.

8. The composition of claim 1 wherein said glycolic surface active agent is an acetylenic glycol having the formula

\[
\begin{align*}
R_1 & \quad \text{R}  \\
\text{OH} & \quad \text{OH}
\end{align*}
\]

wherein R is an alkyl group having from one to four carbon atoms, and R₁ is a radical selected from the group consisting of methyl, ethyl, cyclopropyl and phenyl.

9. The composition of claim 4 wherein said glycolic surface active agent is 2,4,7,9-tetramethyl-5-decyne-4,7-diol.

10. The composition of claim 1 wherein said weight ratio of said glycolic surface active agent to said surface active agent is 1:20 to 1:4.

11. The composition of claim 1 wherein said weight ratio of said glycolic surface active agent to said surface active agent is 1:20 to 1:10.

12. A window cleaning composition comprising from 80 to 93.7 percent water, from 3 to 8 percent by weight of at least one glycol ether selected from the group consisting of monoalkyl ethers of ethylene glycol and propylene glycol from 3 to 7 percent by weight of a lower monohydric alcohol, from 0.1 to 2 percent by weight of an alkali or ammonium hydroxide and from 0.1 to 3 percent by weight of an anti-fogging mixture consisting essentially of a mixture of a glycolic surface active agent selected from acetylenic glycols having the formula

\[
\begin{align*}
R_1 & \quad \text{R}  \\
\text{OH} & \quad \text{OH}
\end{align*}
\]

14. The composition of claim 12 wherein said glycolic surface active agent is acetylenic glycol having the formula

\[
\begin{align*}
R_1 & \quad \text{R}  \\
\text{OH} & \quad \text{OH}
\end{align*}
\]

wherein R is an alkyl group having from one to four carbon atoms and R₁ is a radical selected from the group consisting of methyl, ethyl, cyclopropyl and phenyl, or the reaction product of an acetylenic glycol having the formula

\[
\begin{align*}
R_1 & \quad \text{R}  \\
\text{OH} & \quad \text{OH}
\end{align*}
\]

15. The composition of claim 12 having a pH between 8 and 11.

16. The composition of claim 12 wherein M is an ammonium ion.

17. The composition of claim 12 wherein said glycolic surface active agent is an acetylenic glycol having the formula

\[
\begin{align*}
R_1 & \quad \text{R}  \\
\text{OH} & \quad \text{OH}
\end{align*}
\]

18. The composition of claim 17 wherein said glycolic surface active agent is 2,4,7,9-tetramethyl-5-decyne-4,7-diol.

19. The combination of claim 12 wherein said weight ratio of said glycolic surface active agent to said surface active agent is 1:20 to 1:4.

20. The composition of claim 12 wherein said weight ratio of said glycolic surface active agent to said surface active agent is 1:20 to 1:10.