

1

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CLEANING METHODS AND COMPOSITIONS
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This invention relates to a method for cleaning highly reflective surfaces, especially glass, tile, marble, porcelain and other vitreous materials, and to compositions for use in such a method. More specifically, the present invention relates to a method for cleaning highly reflective or polished vitreous surfaces by the use of aqueous compositions containing ethylenediamine. This is a continuation-in-part of my copending application Serial No. 803,066 filed March 31, 1959, for Method for Cleaning Superficial Material From a Surface, now abandoned.

There are today two general types of composition in general use for the cleaning of window glass, mirrors, bathroom tile, polished marble, and other highly reflective surfaces. These compositions may be roughly classified as household ammonias, that is, solutions of ammonium hydroxide, and soap and detergent compositions. Each composition has undeniably useful properties for the proposed use, but each is also attended by certain inherent disadvantages.

Household ammonia or solutions of ammonium hydroxide have generally favorable cleaning activity, but this composition is highly odorous and irritating. This is especially a factor where the ammonium hydroxide solution is to be employed indoors, as is usually the case. For example, the average housewife finds the use of such compositions for window cleaning very unpleasant and the vapors may even result in irritation to the eyes and nose of the user to the point of causing headache and nausea in hypersensitive individuals.

Because of the disadvantages of the ammonium hydroxide cleaners, a number of soap and detergent compositions have come into use which have no noticeable or unpleasant odor. However, from the standpoint of cleaning action, such soap or detergent compositions leave much to be desired. While soap and detergent solutions are generally effective to remove superficial soil from the surface to be cleaned, they invariably result in a streaked finish. This is occasioned by the fact that a thin film of the detergent material is generally left on the surface and appears in the form of visible streaks even though the surface has been wiped with a cloth following the application of the cleaner. It may be pointed out that the active ingredients in most of these soap and detergent type of cleaners are somewhat hygroscopic and have low vapor pressures. These materials do not volatilize readily after application and they draw from the air small amounts of moisture which result in very apparent streaking on the cleaned surface. Obviously, where the surface being cleaned is window glass, mirror glass, ceramic tiles or the like, the presence of streaking after cleaning is quite undesirable and actually defeats the purpose of the cleaning operation.

According to the present invention, there has been developed a method for cleaning highly reflective surfaces, especially vitreous surfaces such as glass, porcelain, tile and the like, which overcomes the noted disadvantages inherent in the use of other compositions known for such use.

It is, therefore, a primary object of this invention to provide a method for cleaning highly reflective surfaces which is not attended by the presence of strong or unpleasant odors and which does not result in streaking on the surface to be cleaned or retention by the surface of a residual film of cleaner.

A further object of the invention is the cleaning of highly reflective surfaces by means for aqueous composi-

2

tions which effectively remove from the surface all common varieties of soil, leave no streaks or residual film and are capable of use without unpleasant side effects, such as odor, skin irritation or the like.

Another object of the present invention is to provide compositions for the cleaning of highly reflective surfaces, especially glass, tile, marble, and like vitreous materials, which are capable of effectively removing greases, oils, gums and the other bases for the more common types of soil.

An additional object of the present invention is to provide cleaning compositions for use on the surface of glass, tile, and other vitreous or highly reflective surfaces which may be applied either by transfer from a saturated applicator or by spraying, which effectively clean and visibly brighten the treated surfaces and which may be employed without unpleasant odor, irritation or other undesirable side effects.

Broadly, the present invention comprises treating highly reflective surfaces with an aqueous solution of ethylenediamine, the ethylenediamine being present in amounts of from 0.2% to 12%. It has been found that such solutions do not irritate, have no unpleasant odor, and will effectively clean highly polished or reflective surfaces without streaking or depositing a residual film.

The remarkable cleaning properties of ethylenediamine solutions may be attributed to the powerful solvent action which they have on greases and oils which are a principal component of many types of soil and which account in large part for residual streaking when treated with other cleaners. Ethylenediamine solutions also solubilize gums and saponify many fatty materials present in oils, converting them to highly soluble soaps which enhance the cleaning properties.

It should also be noted that ethylenediamine has a vapor pressure that approaches that of water and, therefore, when applied in aqueous solution the ethylenediamine evaporates rapidly when compared to other solutions of soaps and detergents. This property accounts in some measure for the non-streaking cleaning properties of aqueous ethylenediamine solutions.

It has also been found to be highly advantageous to introduce into the composition small but significant amounts, generally about 1.0% to 5.0% by volume, of an enhancing material, such as sodium borate, trisodium phosphate, sodium hexametaphosphate, sodium tripolyphosphate, and the like.

It has generally been found desirable to prepare solutions of the present type for commercial use wherein the concentration of ethylenediamine is between 3.0% and 10.0% by weight of the solution. In such formulation, the enhancing substance will generally be present in amounts of from 1.0% to 5.0%. Thus, if the accumulation of soil is especially heavy and a fairly concentrated cleaning solution is called for, the compositions may be used directly without further dilution. Also, for light cleaning jobs, the more concentrated solutions may be further diluted with water to a point where the concentration of ethylenediamine is from about 0.2% to 1.0%. The cleaning activity of the composition is still quite effective even at such a low concentration of the ethylenediamine.

The compositions of the present invention lend themselves to a variety of types of application. According to more conventional practice, they may be used to saturate an applicator, such as an absorbent cloth, and then are wiped upon the surface to be cleaned. After the elapse of a short period of time, generally only a few seconds, during which the ethylenediamine penetrates, dissolves and loosens soil, the surface may then be wiped clean with a dry cloth without leaving any streaks or residual film on the surface.

3

By a slight modification the aqueous solutions of ethylenediamine may also be advantageously employed in spray application cleaning procedure by the addition of alcohol to promote more rapid drying. For example, from 5.0% to 35.0% ethanol or isopropanol may be combined with an aqueous solution of ethylenediamine, with or without an enhancer, to produce a remarkably effective cleaner for use in spray application on glass, tile, marble or other highly reflective surfaces.

In order to better understand the present invention, it may be well to consider the following specific examples of preferred methods and compositions within the scope of the present invention:

Example 1

[All formulae are expressed in percent by weight]

Ethylenediamine -----	0.5
Water -----	99.5

Example 2

Ethylenediamine -----	0.2
Sodium borate -----	0.2
Water -----	99.6

The cleaning compositions set forth in the above formulations are very useful for the cleaning of window panes and mirrors. The concentration of ethylenediamine is quite sufficient to remove ordinary surface soil and after application from a cloth or other absorbent applicator the composition and entrained or dissolved soil may be completely removed from the surface by buffing with a dry cloth without residual streaking.

Example 3

Ethylenediamine -----	7.0
Sodium phosphate -----	3.5
Water -----	89.5

The composition of Formula No. 3 is quite satisfactory for heavy cleaning jobs and it is a composition of this approximate formula which is considered well suited for bottling and commercial sale. The purchaser may use the composition in full strength or may dilute portions of the composition with water to obtain a reduced concentration of the ethylenediamine better suited to the particular need.

Example 4

Ethylenediamine -----	0.2
Trisodium phosphate -----	0.2
Isopropanol -----	5.0
Water -----	94.6

A composition of the above formula is especially suited to spray application to the surface to be cleaned. For example, such a composition might be introduced into one of the common, manually operated spray or atomizer bottles in wide use for applying cleaning materials to window glass.

Other examples of compositions within the scope of the present invention and for use in methods for cleaning polished and reflective surfaces include the following:

Example 5

Ethylenediamine -----	1.0
Trisodium phosphate -----	1.0
Water -----	98.0

Example 6

Ethylenediamine -----	3.0
Sodium hexametaphosphate -----	2.5
Water -----	94.5

Example 7

Ethylenediamine -----	12.0
Sodium tripolyphosphate -----	5.0
Water -----	83.0

Compositions of the above Formulae 5, 6 and 7 are suited for "wipe-on, wipe-off" application techniques.

4

Example 8

Ethylenediamine -----	1.0
Sodium borate -----	1.0
Ethanol -----	10.0
Water -----	88.0

Example 9

Ethylenediamine -----	0.5
Isopropyl alcohol -----	20.0
Water -----	79.5

Example 10

Ethylenediamine -----	1.0
Trisodium phosphate -----	1.0
Methyl alcohol -----	31.0
Water -----	63.0

Compositions according to the Formulae 8, 9 and 10 are especially useful for "spray-on, wipe-off" methods of application.

All of the foregoing compositions have been found to give excellent results and particular utility in the cleaning of polished vitreous surfaces, including ceramic tile, porcelain, window glass and the like.

According to the present invention, therefore, highly polished or reflective surfaces, such as those of glass, tile, marble and other like materials, may be efficiently and thoroughly cleaned by application of compositions of the type herein described, either by a "wipe-on, wipe-off" mode of application or by a "spray-on, wipe-off" technique, and this is accomplished without odor, irritation or other undesirable side effects and without streaking or retention of residual film on the cleaned surface.

It will be apparent to those skilled in the art that various modifications, changes, and substitutions may be made in the method and compositions comprising the present invention without materially departing from the scope of the invention and, therefore, the matter contained herein is intended to be illustrative rather than limitative.

What is claimed is:

1. The method for cleaning reflective vitreous surfaces which comprises applying to said surfaces a liquid composition consisting essentially of from 0.2% to 12.0% by weight of ethylenediamine dissolved in water, and then removing said composition from said surface.
2. The method for cleaning reflective vitreous surfaces which comprises wiping onto said surfaces an aqueous solution consisting essentially of from 0.2% to 12.0% by weight ethylenediamine and from 0.2% to about 5.0% by weight of a material selected from the group consisting of sodium borate, trisodium phosphate, sodium hexametaphosphate and sodium tripolyphosphate, and then wiping said solution from said surfaces.
3. The method for cleaning reflective vitreous surfaces which comprises spraying onto said surfaces an aqueous solution consisting essentially of from 0.2% to 12.0% by weight ethylenediamine, and from 5.0% to 35.0% by weight of an alcohol selected from the group consisting of methanol, ethanol, propanol and isopropanol and then wiping said solution from said surfaces.
4. The method of claim 1 where said surface is glass.

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