

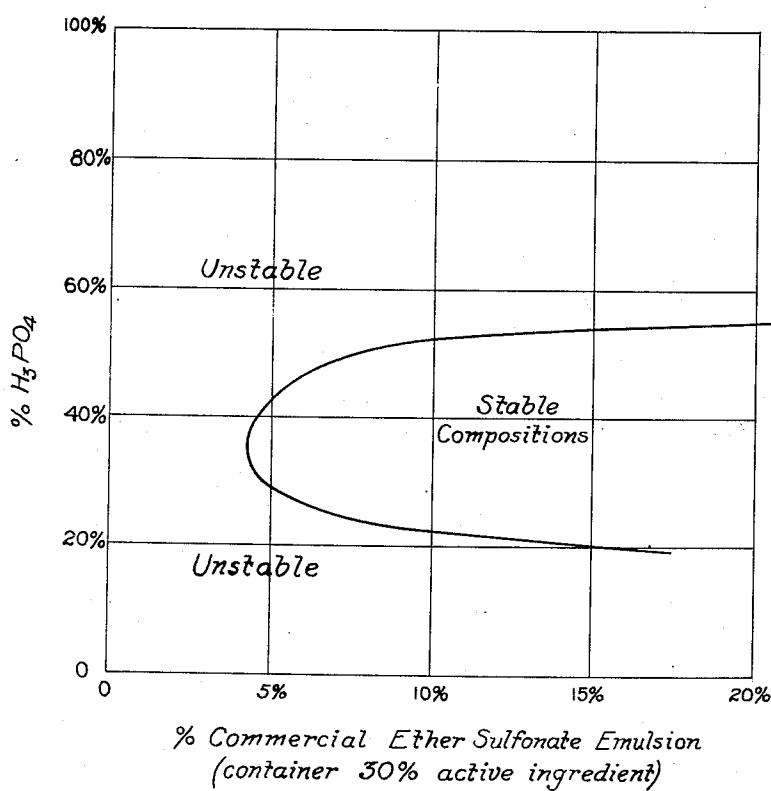
Dec. 31, 1946.

C. P. GIVEN

2,413,495

PHOSPHORIC ACID DETERGENT COMPOSITION

Filed March 30, 1943



Inventor

Charles P. Given

By Mason Fenwick & Lawrence
Attorneys

UNITED STATES PATENT OFFICE

2,413,495

PHOSPHORIC ACID DETERGENT
COMPOSITION

Charles P. Given, Washington, D. C., assignor to
Virginia-Carolina Chemical Corporation, Rich-
mond, Va., a corporation of Virginia

Application March 30, 1943, Serial No. 481,123

1 Claim. (Cl. 252—136)

1

This invention pertains to compositions comprising phosphoric acid combined with agents to form improved acidic cleansers, and generally to improve uses of phosphoric acid for various cleansing purposes, particularly when metallic surfaces are involved, this application being a continuation-in-part of my application Serial Number 343,494, filed July 1, 1940.

Cleansing agents, for illustration, generally are alkaline or basic in character. Such are ordinary soap, or various salts such as phosphate or carbonate cleansers. Many of these agents have good emulsifying effect and oftentimes are capable of "cutting" grease, but such alkaline reagents may be harmful to the materials being cleaned, and for certain types of cleaning and descaling operations are unsatisfactory or are less efficient than acidic cleansers.

Acid cleansers have been the subject of numerous suggestions for improvement. Many materials used as acidic cleansers involve risk of corroding metals, and lack desirable properties such as wetting-out ability and emulsifying power. However, because of their ability to function in the removal of certain types of soil and scales better than alkaline cleansers, they are utilized in spite of these disadvantages. For example, oxalic acid has been used to clean railway or street cars where traffic film or smoky grime are to be removed. But to give adequate body to oxalic acid cleansers, it is extensive practice to add substances such as molasses or glue or glucose. Such solutions do not readily penetrate a grimy film such as on railway coaches, but require considerable rubbing; nor do they readily flow nor rinse quickly from surfaces being cleaned. Moreover, their tendency to be sluggish in action and to be sluggish in removal, augments a fault of acids to corrode metal parts of surfaces being cleaned. This tendency to corrode metal parts is a serious problem in cleaning utensils used in the dairy industry. Such utensils become incrustated by deposits from milk, known as milk stone. Milk stone must be removed without impairment of the metal surface. After cleaning, the surfaces should be capable of being quickly rinsed, or at least be rapidly self-draining. The removal of certain types of hard-water scales from the surfaces of heat exchange equipment is another example where avoidance or reduction of corrosion is a factor of major importance in practical use of acidic cleansers.

An object of this invention is to provide acid cleansers that are effective to remove various sorts of soil or scale with minimum of injury to

2

exposed or underlying metal. A further object is to provide acid cleansers to remove oil, dirt and smoke from painted or lacquered surfaces such as railway coaches or automobiles, but without injury to the finish coat. Another object is to provide acid cleansers that rinse freely from the surface after cleansing. Also, an object is to provide acid cleansers that do not require addition of such substances as glue, molasses or glucose. A specific object is to increase the effectiveness and safety of phosphoric acid as a cleanser for various surfaces.

More broadly with respect to phosphoric acid, a purpose of this invention is to improve the practicability of phosphoric acid for various cleansing uses where contact of the cleansers with metallic surfaces is involved, and more particularly to minimize corrosion of metals that may contact the acid.

This invention provides unusually effective acid compositions comprising phosphoric acid in which is contained an aryloxy polyalkylene ether sulfonate. This is an agent for lowering interfacial tension, promoting the wetting of the soil or scale by the acid solution, and contributing other desirable properties. Although numerous such agents, often termed "wetting agents," are known, many are not at all suitable for the purposes of this invention, lacking suitable stability in acid, or otherwise failing to provide the desirable properties of my invention.

I prefer to utilize a sulfonated ether made, for example, by alkylating phenol with di-isobutylene; condensing the product with a dichloropolyalkylene ether such as B-B'dichloroethyl ether to substitute only one of the halogen atoms by the alkylated phenol. This aryloxy polyalkylene ether halide is then sulfonated by reaction with sulfite. Such a product is di-isobutyl phenyl diglycol ether sulfonate.

Specifically, I have used a material of this type, believed to be di-isobutyl phenyl diglycol ether sulfonate made in accordance with U. S. Patent No. 2,115,192, Bruson; and available under the trade name of Triton-720.

While addition of this material to phosphoric acid in accordance with my invention, as set forth below, has desirable effects not only from the point of view of detergent action, but also with respect to reducing the corrosive tendency of the acid toward metals, even more effective phosphoric acid compositions are provided by incorporating, further, aliphatic triamines in which the aliphatic groups contain from four to six carbon atoms. There is a synergistic action of

this combination of agents with phosphoric acid according to my invention which was not known and which is an important part of my invention.

As an example of this preferred cleanser is mentioned an aqueous composition containing about 2.5% orthophosphoric acid, 0.17% di-isobutyl, phenyl diglycol ether sulfonate, and 0.006% triamylamine. This composition has been found superior both to alkaline cleansers and to oxalic acid cleansers when used for the cleansing of street cars; its action being without the harmful effects of the former on enameled and varnished surfaces and metallic surfaces, and superior in its detergent and free rinsing qualities to the latter. Furthermore, operators prefer this composition as being easier to handle and less irritating to the hands.

A suitable range of composition of this cleanser may be approximately 1% to 5% orthophosphoric acid, 0.03% to 1% alkyl phenyl glycol ether sulfonate emulsion, and 0.002% to 0.02% triamylamine.

While such compositions are satisfactory for use in actual detergent or cleaning operations, it is desirable for economic reasons, including transportation, to market a product of much higher concentration which can be diluted as desired at the point of use. In this resides an additional element of my invention. While the marketing of concentrated products for dilution at point of use has long been known and practiced with respect to many products, mixtures of wetting agents in strong concentrations of acid are not generally adapted to such practice because of the instability of organic wetting agents in strong acid solutions.

I have found that compositions of the preferred ether sulfonate wetting agent (i. e. Triton-720), and phosphoric acid, are not stable in all proportions. The preferred ether sulfonate wetting agent (Triton-720) is commonly available as a heavy aqueous emulsion having a density of about 1.06 relative to water, and containing about 30% sulfonate in about 70% water. Although it is characterized by unusually good properties in acidic media, it will not form homogeneous compositions with phosphoric acid over all ranges of concentration. At certain concentrations the product separates into mutually insoluble liquid layers. At others, there appears to be a coagulation of the dispersed solid phase which tends to collect at the surface of a liquid phase. Such instability is not desirable in a commercial product. I have found, however, that in certain concentrations a stable homogeneous emulsion may be formed, which is far superior, and is a preferred composition. Generally in the concentrated form preferred in my invention, the concentrations of phosphoric acid and ether sulfonate should be related as shown in the drawing, the sole figure of which is a graph defining limits within which desirably homogeneous compositions are obtained and outside of which there is a tendency for the composition to break down as described above.

For example, a composition containing 7.5% of the heavy, commercially obtainable, ether sulfonate emulsion, should contain not more than 50% H_3PO_4 nor less than 25% H_3PO_4 .

In compositions within the scope of my invention there should be a sufficient amount of the ether sulfonate wetting agent to be effective under the conditions of use in adequately lowering the surface tension and wetting out time, and in promoting the detergent action of the composition.

and its free rinsing qualities. It is undesirable to have more than this amount of ether sulfonate wetting agent relative to phosphoric acid, because such additional amounts do not further increase the desirable properties of the composition, but may add undesirably to the expense.

Compositions lying toward the apex of the area of stable compositions, as shown in the figure, provide adequate concentrations of ether sulfonate under many conditions of use.

For example, I have used compositions which are homogeneous and stable, containing from about 20% to 53% of H_3PO_4 and from about 4% to 15% of ether sulfonate in the form of its heavy, commercially available emulsion, or approximately 1.3% to 5% of the sulfonate itself. More specifically, I find that homogeneous compositions within the range of 22% to 45% H_3PO_4 and containing 4% to 7.5% of ether sulfonate emulsion have excellent properties and are preferred for many uses.

The triamylamine in this composition is commercial, normal triamylamine, which contains some isomeric isotriamylamine. The composition with phosphoric acid may contain up to about 0.3% of commercial normal triamylamine which I have found sufficient in combination with ether sulfonate adequate to inhibit corrosion.

Illustrative of the novel and advantageous effects that have been found to be secured by the combination of these two ingredients with phosphoric acid are the following figures on the reduction of the corrosive properties of the acid.

In compositions containing 37.5% of H_3PO_4 together with alkyl phenyl polyglycol ether sulfonate, but without triamylamine, the rate of corrosion of steel specimens during a 24-hour test was reduced as follows:

Concentration of Triton-720 in composition	Reduction in rate of corrosion
Per cent 12.5 6.25	Per cent 83 76

Similarly, the reduction in rate of corrosion of steel specimens during a 24-hour test, by the presence of triamylamine alone in phosphoric acid solutions containing 50.6% of H_3PO_4 was as follows:

Concentration of triamylamine in composition	Reduction in rate of corrosion
Per cent 0.20 0.14	Per cent 97.9 97.4

The reduction in rate of corrosion of steel specimens during a 24-hour test, by compositions containing both the sulfonated ether emulsion and the triamylamine was determined to be as follows:

Concentrations in compositions of—			Reduction in rate of corrosion
H_3PO_4	Triton-720	Triamylamine	
Per cent	Per cent	Per cent	Per cent
50.6	7.5	0.20	99.6
50.6	7.5	0.14	99.3
42.2	6.25	0.11	99.5

5

These figures show the unusual and beneficial result obtained by the presence of both the triamylamine and the alkyl phenyl polyglycol ether sulfonate in reducing the corrosive properties of the composition. The rate of corrosion, reduced to slightly over 2% by the presence of the amine, is further cut to a fraction of one percent in the presence of both substances.

It should be pointed out at this point that as the efficiency of the process approaches 100%, further increases in efficiency are attained only with increasing difficulty. Thus the importance of the result obtained by the combined presence of both agents with the phosphoric acid must be recognized.

Reducing the rate of corrosion from about 2.5% as obtained with the addition of amine alone, to about 0.5% in the presence of the combination constitutes a five fold gain in the effectiveness of the corrosion reduction. Moreover, upon dilution such compositions maintain their high inhibition of corrosion. Thus in a dilute solution containing 5% H_3PO_4 , with only 0.74% ether sulfonate emulsion and 0.012% triamylamine, reduction of the rate of corrosion of steel was still 95%.

6

This application is directed broadly to phosphoric acid combinations with alkylaryloxyalkylol and more particularly with alkyl phenyl glycol ether sulfonate.

While in accordance with the patent statutes I have described a preferred embodiment of this invention, it will now be apparent to those skilled in the art that modifications and alterations may be made within the scope of the appended claim.

What I claim as my invention is:

A detergent composition comprising an aqueous solution of phosphoric acid containing an aqueous emulsion of di-isobutyl phenyl diglycol ether sulfonate, and triamylamine, characterized by high non-corrosive property towards metals due to the synergistic corrosion inhibiting property of the ether sulfonate and triamylamine, one hundred percent by weight of the composition comprising from 4% to 15% of the ether sulfonate emulsion, from 20% to 53% of H_3PO_4 , and from about 0.1% to 0.3% of triamylamine, the ether sulfonate emulsion containing 30% of the ether sulfonate.

CHARLES P. GIVEN.