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PROCESS AND PRODUCT FOR REMOVING AND INHIBITING CORROSION

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This invention relates to a product and process for the removal of corrosion from metallic and other surfaces, and for the prevention of corrosion when applied to such surfaces.

Heretofore, preparations used for the cleaning and removal of corrosion from metallic and other objects have been either of strongly acid reaction, and hence dangerous to the object being treated as well as to the user, or they have been strongly alkaline, thus being unpleasant to handle, and not fully effective for this purpose.

In accordance with the present invention, a corrosion inhibiting or removing composition is provided which is free from these defects, and which has a mildly acid reaction. This composition is economical, safe, non-toxic and non-inflammable, and does not require special equipment. Moreover, the composition described below removes corrosion without attacking or causing loss of the metal to which it is applied, forming at the same time a protective coating which serves to inhibit further corrosion formation. Among the surfaces which are successfully treated with the present composition and process are iron and steel, copper, brass, and chromium plating, from all of which rust and tarnish are removed and inhibited.

In the preparation of the corrosion inhibiting or removing compositions, it is desirable to achieve a product which will have a mild acid reaction, which will not attack the metal surfaces, which will not be injurious to the skin of the user, and which will have effective penetrating qualities.

It has been found that the corrosion removing properties of certain types of salts are unexpectedly enhanced and controlled when these salts are combined with substances which exercise a buffer action, and with certain types of surface-active agents.

As corrosion removing or inhibiting salts there are preferred for this purpose detergent phosphate salts having an acid reaction in aqueous solution. These include the various alkali metal phosphates, particularly sodium phosphates. Examples of detergent phosphate salts which have been found particularly effective in the composition of this invention include monobasic or acid sodium phosphate NaH_2PO_4, and acid sodium pyrophosphate

$$Na_2H_2P_2O_7$$

The aqueous solutions of these compounds exhibit pH values in the general vicinity of 4 to 5.

Among the substances which exert a buffer action which may be incorporated in the present composition, are salts of alkaline reaction, particularly the alkali metal phosphates of alkaline reaction. These are preferably alkaline phosphates which are at the same time of the general class of water softeners. Such phosphates serve the dual function of increasing the pH of the detergent phosphate of acid reaction, and of acting as water softeners to prevent scale formation. Alkali metal phosphates of alkaline reaction suitable for the present composition and method include, for example, sodium tripolyphosphate and tetra sodium pyrophosphate, although disodium orthophosphate may also be used. The combination of these alkaline phosphates with the acid detergent phosphates results in solutions having a pH in the range of about 5 to about 6, and which is characteristic of the present compositions.

The surface-active agents which are preferred as ingredients of the present compositions are those which exhibit stability in the mild or moderately acid phosphate combination, particularly those which are stable in the pH range of 5 to 6. Acid-stable surface active agents of this type include various sulfonates of aliphatic, aliphatic-aromatic, and aromatic hydrocarbons, fatty alcohol sulfates, and the like, which are usually sold commercially in the form of their sodium salts.

Among sodium salts of sulfonated aliphatic hydrocarbons which may be successfully incorporated into the compositions of the present there may be included, for example, Petrowet R, a trade-marked product believed to be made by the process disclosed in Du Pont Patent 2,334,764, which relates to sodium salts of sulfonated aliphatic hydrocarbons containing at least 16 carbon atoms. Such hydrocarbons are sulfonated, according to this patent, by means of concentrated sulfuric acid, or by sulfochlorination with sulfur dioxide and chlorine, followed by neutralization to form sodium salts. The hydrocarbons may be derived from refined petroleum fractions, high boiling oils, paraffin waxes, and the like.

The class of fatty alcohol sulfates is highly resistant to acids, and surface-active substances of this class may be successfully incorporated into the present compositions. For this purpose there may be used, for example, sodium lauryl sulfate.

Other types of acid-stable surface active agents which may be used in accordance with the present invention include the alkyl-aryl sulfonates of chain length ranging from 3 to about 18 carbon atoms. Examples of such surface-active agents include Nekal A, a trademarked product of General Dyestuff Corp., which is understood to be the sodium salt of di-isopropylnaphthalene sulfonic acid, and Santomerse No. 30, a trademarked product of Monsanto Chemical Company, which is understood to be the sodium salt of dodecylbenzene sulfonic acid.

In preparing the corrosion removing compositions, the amount of detergent phosphate salt used will generally range from about 5 to about 15 percent by weight of the finished solution, but it is preferred to use about 10% by weight. The amount of the buffer or water softener type of alkaline material added will generally be about half the amount of detergent phosphate, ranging from about 2.5 to 7.5% of the finished solution. The amount of surface-active agent added is small, being generally about 1%, or less.

The following examples illustrate the invention, but are not to be regarded as limiting.

Example I

A solution prepared from:

Sodium acid pyrophosphate	1 lb. per gal. of mixture.
Sodium tripolyphosphate	0.5 lb. per gal. of mixture.
Petrowet R, sodium salt of sulfonated aliphatic hydrocarbon, described above	1.5 ounces per gal. of mixture.

Water, to make 1 gallon.

This solution has a pH of about 5.1. It can be very effectively used for the removal of rust from iron and steel, and of tarnish from copper, brass, and chromium plated surfaces.

Example II

Another composition according to the present invention was prepared by mixing the following ingredients:

Sodium acid pyrophosphate	1 lb. per gal. of mixture.
Sodium tripolyphosphate	1 lb. per gal. of mixture.

Petrowet R, sodium salt of sulfonated aliphatic hydrocarbon, described above ------ 1.5 ounces per gal. of mixture.

Water, to make 1 gallon.

The pH of this solution is about 5.8.

Example III

Another composition according to the present invention was prepared by mixing the following ingredients:

Sodium acid pyrophosphate --- 1 lb. per gal. of mixture.
Sodium tripolyphosphate ----- 0.5 lb. per gal. of mixture.
Sodium lauryl sulfate -------- 1.5 ounces per gal. of mixture.

Water, to make 1 gallon.

Example IV

Another composition according to the present invention was prepared by mixing the following ingredients:

Sodium acid pyrophosphate --- 1 lb. per gal. of mixture.
Sodium tripolyphosphate ----- 0.5 lb. per gal. of mixture.
Nekal A, sodium di-isopropyl naphthalene sulfonate ----- 1.5 ounces per gal. of mixture.

Water, to make 1 gallon.

The proportions specifically mentioned in the above examples can be varied somewhat without materially changing the effectiveness of the various mixtures. The desired object is to have the pH of the finished solution sufficiently high so that the metal surface being treated is not affected. At the same time the pH should not be so high as to be alkaline. Thus, a solution of 1 part by weight of sodium acid pyrophosphate and 3 parts of tripolyphosphate would have a pH of 7.1. A decrease in the proportion of the tripolyphosphate would result in a lowering of pH below the figure of 5.1 for the mixture of Example I. Thus, if the tripolyphosphate were only about 20% of the weight of sodium acid pyrophosphate the pH would become about 4.8, which solution would not attack metals, but which approaches practicable limits.

Again, the avoidance of alkalinity in the final product places a practical limit on the proportion of sodium tripolyphosphate in the product. It is found that the use of 2 parts by weight of sodium acid pyrophosphate and 3 parts of sodium tripolyphosphate produces a solution with a pH of about 6, which is still effective to remove rust and inhibit corrosion, while at the same time reducing scale formation. In general, it has been found that a range of pH between about 5 and 6 in the final solution will accomplish the desired results.

To illustrate the effectiveness of the composition of this invention, and the method of its application, the following instances are given. The solution may be applied by immersing the article to be treated therein, or by spraying said article with the solution. Thus, a steel valve which was corroded to such an extent as to be frozen and incapable of being taken apart manually, was immersed in the solution of Example I. After a brief period, the valve was removed from the solution, and was easily taken apart, the rust having been removed. Pipes of various kinds have been treated with the solution, resulting in complete removal of rust, as well as the deposit of a protective inhibiting coating on the pipe.

A nut and bolt in badly corroded condition, particularly between the threads, was immersed in the solution, which removed the rust from the surfaces, as well as between the threads, leaving the parts clean, and without loss of metal.

Other uses of the solution of the present invention include the treatment of parts which are to be coated with protective coatings, such as by painting or galvanizing.

The present application is a continuation-in-part of my co-pending application Serial No. 375,557, filed August 20, 1953, now abandoned.

I claim:

1. A composition for the removal and prevention of corrosion on metal surfaces consisting essentially of an aqueous solution of about 10% by weight of a detergent phosphate salt selected from the group consisting of sodium acid phosphate and sodium acid pyrophosphate having an acid reaction, about 5% of an alkaline phosphate selected from the group consisting of sodium tripolyphosphate, tetrasodium pyrophosphate and disodium orthophosphate, and about 1% of an acid-stable organic surface active agent, the composition having a pH value from about 5 to about 6.

2. A method for the removal of corrosion from metal surfaces which comprises subjecting said surfaces to the action of the composition of claim 1.

3. A composition for the removal and prevention of corrosion on metal surfaces consisting essentially of an aqueous solution of about 1 lb. per gallon of sodium acid pyrophosphate, 0.5 lb. per gallon of sodium tripolyphosphate, and about 1.5 ounces of an acid-stable organic surface-active agent.

4. A method for the removal of corrosion from metal surfaces which comprises subjecting said surfaces to the action of the composition of claim 3.

5. A composition for the prevention and removal of corrosion on the surfaces of metals selected from the group consisting of copper, chromium, brass, and steel, consisting essentially of an aqueous solution of from about 5% to 15% of a member of the group consisting of sodium acid phosphate and sodium acid pyrophosphate, from about 2.5% to 7.5% of a member selected from the group consisting of sodium tripolyphosphate, tetrasodium pyrophosphate, and disodium orthophosphate, and about 1% of an acid-stable organic surface-active agent, the composition having a pH value from about 5 to about 6.

6. A method for the removal of corrosion from the surfaces of metals of the group consisting of copper, chromium, brass, and steel, which comprises subjecting said surfaces to the action of the composition of claim 5.

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