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## METHOD AND COMPOSITION FOR CORROSION PREVENTION

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This invention relates to a novel method for treating the surfaces of metals to render them less susceptible to corrosion. More particularly, it deals with a process in which a colloidal suspension in water of certain high molecular weight carboxylic acids is applied to the metal surface, leaving behind a very thin film of these acids which provides a corrosion preventive coating, and which, depending upon conditions, may remain effective for periods of weeks or even months.

It is already known that high molecular weight carboxylic acids in which at least two of the carboxylic radicals are relatively close together, e. g., are separated from each other preferably by two carbon atoms, are effective in preventing corrosiveness of hydrocarbon oils and more particularly of lubricating oils towards various metals. In order to be effective, these acids should contain at least 16 and preferably 20 or more carbon atoms, and in addition, they may also contain halogen, sulfur, hydroxyl and other substitution radicals. These acids should be relatively stable under normal atmospheric conditions, e. g., they should be resistant to oxidation, hydrolysis, etc. It is, therefore, desirable that they be substantially free from olefinic double bonds or other structural components tending to increase their susceptibility toward oxidation or other mechanisms of decomposition.

Among the most useful polycarboxylic acids for corrosion prevention are alkyl succinic acids in which the alkyl radicals contain 14 or more carbon atoms. Inasmuch as these acids are usually prepared by hydrogenation of the corresponding alkyl maleic acids, it is desirable that the saturation be carried to a point so that the bromine value of the resulting compounds be below 15 and preferably below 10. Other useful acids are alkyl phthalic acids, alkyl naphthalic acids, polymerized oleic acids, etc. All these acids may contain one or more polar substitution radicals which do not impair the stability of the acids toward oxidation and hydrolysis and which preferably are not more strongly acidic than the carboxylic radicals of the acids, such as —OH, —SH, —$NH_2$, —$NO_2$, etc., radicals. Alkyl malonic acids are less desirable because they tend to decompose and lose $CO_2$, thereby being converted to monocarboxylic acids.

It is the purpose of this invention to make use of the known corrosion protective properties of high molecular weight carboxylic acids in a simple, inexpensive and effective manner. It is another purpose to treat metal surfaces normally tending to corrode or rust so that they will become resistant to this corrosion or rusting for a considerable length of time. A further purpose is to achieve this last result without the use of an oily substance so that the treated metal may be touched, for example, with fine fabrics without the danger of causing them to become greasy.

We have discovered that when colloidal suspensions of the high molecular weight polycarboxylic acids in water are applied to metal surfaces, the acids spread over the surface as a thin film which effectively protects the metal against many corrosive influences. This film persists after the water has evaporated and lasts until the acids themselves have been destroyed as by decomposition, oxidation, etc.

Suitable colloidal suspensions may be prepared by dissolving the acids in a water-miscible solvent capable of dissolving them to produce a concentrate solution containing .1% to 10% and preferably .1% to 3% of the acids. This concentrate is then poured into an amount of water preferably while agitating it, which amount is sufficient to precipitate the acids from their solution and to dilute the acid concentration to between the limits of .0001% to .1%, preferably .001% to .01%. When maintaining the proper concentration of the acids both in the concentrate solution and after dilution with water, the resulting aqueous dispersion is of a colloidal nature. If the concentration of acids in the concentrate solution is too high, curds result which cannot be applied effectively to metals to result in corrosion protection; and if the amount of water into which the solution is poured is too small, resulting in a concentration of the acid in the dispersion which is too high, a coarse dispersion results which settles out in a short time and thus also prevents proper application of the acids.

The aqueous colloidal dispersion, if properly produced, is relatively stable and does not settle out or coagulate upon standing for twenty-four hours.

Before applying the aqueous dispersion to metal surfaces, the latter should be freed from loose oxides such as rust, because oxides "consume" the acids by forming salts therewith. These salts have a larger volume than the oxides, and are therefore prone to form a tight film which prevents the acids from coming in contact with the metal surface proper. This film being tied to the metal but loosely can give only very temporary protection. Almost any kind of rubbing is liable to remove it, whereupon the unprotected metal is exposed. Moreover, because of the orig-

inal low concentration of the acids in the dispersion, the reaction with a metal oxide is liable to exhaust the available supply of acids therein.

In some instances, the dispersion of acids will actually cause a removal of rust and other oxide films, and thus cleaning of the metal surface is often materially facilitated by the presence of some of the dispersion. For example, a mild abrasive, such as bentonite, silica powder, pumice, etc., wetted with the aqueous dispersion or with the concentrate may be excellently suited for cleaning a metal surface.

Application of the dispersion on the cleaned metal surface may be carried out by any convenient means, such as painting, spraying, dipping, etc. Excess dispersion, if any, is simply allowed to drain off and the wet metal surface is allowed to dry.

The protective film so produced cannot ordinarily be rubbed off unless abrasives are used. It gives particularly good protection against corrosion due to exposure to atmospheric conditions, i. e., rain, fog and the like. It may also be used to line the inside of cans in the canning of various goods which tend to attack the metals.

If desired, the aqueous dispersion may contain in solution substantial amounts of water-soluble, neutral organic liquids, such as lower alcohols, e. g., methyl, ethyl, n-propyl, isopropyl, tertiary butyl alcohols, ethylene glycol, propylene glycol, butylene glycols, glycerine; ethers, such as diethyl ether, dioxane; alcohol ethers as diethylene glycol, triethylene glycol, ethylene glycol mono methyl, ethyl or propyl ethers, diethylene glycol mono methyl, ethyl or propyl ethers; ketones, as acetone, diacetone alcohol; nitriles as acetonitrile, etc. Thus the colloidal dispersion may be formed in radiators of internal combustion engines, etc., when adding a solution of the dicarboxylic acids to the cooling liquid which may contain varying amounts of an organic antifreeze.

Solvents suitable for preparing the concentrate should preferably be neutral and must be sufficiently miscible with water so that in admixture with water they lose their solvent power for the acids. Thus we may use the lower alcohols, i. e., methyl, ethyl, isopropyl, n-propyl, tertiary butyl alcohol, diacetone alcohol; lower ketones as acetone methyl ethyl ketone, aldehydes as acetaldehyde, propionaldehyde; esters as ethyl acetate; lower alkyl cyanides as methyl, ethyl, propyl, etc., cyanides.

The protective effect of the aqueous dispersion is particularly pronounced towards ferrous metals, e. g., various kinds of steel and iron. However, other metals normally susceptible to corrosion as copper, lead, aluminum, various alloys, e. g., brasses, bearing metals, etc., may be benefited as well.

We claim as our invention:

1. A composition of matter suitable for protecting metals from corrosion comprising an aqueous colloidal dispersion of a polycarboxylic acid possessing anticorrosive properties and having at least 16 carbon atoms, said polycarboxylic acid being substantially chemically stable when exposed to atmospheric conditions, the amount of said acid in said dispersion being between .0001% and .1%.

2. A composition of matter suitable for protecting metals from corrosion comprising an aqueous colloidal dispersion of a polycarboxylic acid possessing anticorrosive properties and having at least 16 carbon atoms, said polycarboxylic acid being substantially chemically stable when exposed to atmospheric conditions, the amount of said acid in said dispersion being between .001% and .01%.

3. The composition of claim 1 wherein said acid is an alkyl succinic acid.

4. Method for preparing an aqueous colloidal solution suitable for protecting metals from corroding comprising dissolving a polycarboxylic acid which possessing anticorrosive properties, is chemically stable under atmospheric conditions and contains at least 16 carbon atoms, in a neutral water-miscible solvent for said acid to produce a solution containing from .1% to 10% of said acid, pouring said solution into an amount of water sufficient to cause precipitation of said acid from said solvent and to produce an aqueous suspension containing colloidally dispersed from .0001% to .1% of said acid.

5. Process for protecting from corrosion a metal normally susceptible to corrosion comprising applying to the surface of said metal which is substantially free from products of corrosion, an aqueous colloidal dispersion of a .0001% to .1% polycarboxylic acid which possessing anticorrosive properties, is chemically stable under atmospheric conditions and contains at least 16 carbon atoms, to wet said surface, and allowing it to dry.

6. The process of claim 5 wherein said metal is a ferrous metal.

7. The composition of matter of claim 1 wherein said polycarboxylic acid contains at least one alkyl group.

8. The process of claim 5 wherein said polycarboxylic acid possesses at least one alkyl group.

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