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PAINT KILLER

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This invention relates to chemical agents which are added to the water used in a spray booth to trap the particles of paint which do not adhere to the articles being sprayed. These chemical agents are for the purpose of deactivating the paint particles so that they will not coalesce into a sticky mass that is difficult to handle, and so that neither the individual particles nor any coalesced masses of it will adhere to the spray booth or parts of the water circulating system.

Substantial effort has been expended in an attempt to deactivate the paint particles. These attempts have met with limited success. But all of the methods heretofore proposed fall far short from filling the requirements of an ideal "paint killer," as these materials are called. One method of deactivation is to utilize chemical agents which at least partially destroy the paint particles, such as sodium hydroxide. Sodium hydroxide is undesirable as an additive agent for several reasons. It is dangerous to use in commercial establishments, and the resulting saponification of the resins in the paint material produces soaps that are at least partially soluble in the water causing increased foaming of the spray booth water. Moreover, the water in the spray booth system becomes increasingly contaminated by the presence of these soluble soaps which gradually precipitate out and collect upon the various surfaces of the system.

Another approach to the system has been the addition of finely divided inert materials to the water such as graphite, bentonite, asbestine, and the like. Such particles may act somewhat as an absorbent of liquid or gaseous ingredients and as a solid protective coating about the solid particles which are recovered, but they are relatively ineffective in deactivating the various paints and finishing materials and relatively large quantities must be added to the water in the spray booth system before even partial deactivation is obtained.

Another approach has been to add agents to the spray booth water which will form a protective film around each particle of paint as it is taken in by the water. This film, in theory, would then remain around the particle of paint and would prevent the paint from coalescing into a large mass and would also prevent it from sticking to the surfaces of the spray booth. For example, Saunders in U. S. Patent No. 2,086,514 proposes the use of a mineral oil comprising an emulsion of soluble oil in water and in his Patent 2,208,647 proposes that an alkali salt of a sulphonated hydrocarbon of the resin class be added to the water of the spray booth. In U. S. Patent No. 2,161,122, Anderson describes the use of aluminum hydroxide for this purpose. However, this and other materials heretofore proposed and to some extent utilized, have been relatively ineffective. For example, some materials which immediately deactivate or "kill" each of the paint particles as it strikes the water gradually lose their protective effect, either because of the release of solvent from within the paint particle or because the film eventually is ruptured or otherwise removed from the particle: the particles then coalesce and form a sticky mass that

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is difficult to handle and which adheres to the surfaces of the spray booth.

Other materials which form somewhat more stable films do not form the films rapidly enough, so that after the particles strike the water, there is a substantial amount of coalescence before the formation of the surface film, at which time the ratio of the mass to surface area is so great that the film cannot effectively kill the paint particle. Moreover, if the paint particles is not deactivated immediately upon striking the water, some of the particles will adhere to the surfaces of the spray booth before the formation of the deactivating film. With a large volume of over-spray, the paint must be fairly permanently deactivated or it will sink to the bottom of the water and form a sticky mass very difficult to remove.

In accordance with the present invention, a method of killing paint is provided which has substantial advantages over the prior methods and additive agents.

Paint killer compounded and used in accordance with this invention deactivates the paint particles instantly when they strike the water and does not require heavy concentrations of chemicals in the water supply so that a large reserve can be maintained in the system and it is necessary to add the chemical agents only infrequently. The amount of reserve material which can be maintained in the water of the spray booth is not severely limited either by lack of solubility or by pH such as is the case with sodium hydroxide.

It is preferred, however, to add the paint killer continually and automatically thus preventing any possibility of the solution decreasing below the minimum concentration required for complete killing action. The addition of the reagents at the rate of only a few milliliters per minute will maintain the necessary concentration in spray booths of the usual capacity.

The paint particles are so thoroughly deactivated that they will not stick to each other or to the surfaces of the spray booth. It is particularly important that the protective films form substantially instantaneous around each individual particle. This is particularly important in spray booths in which the water moves over the water curtain at a high velocity. After the particles of paint have been killed by the formation of the protective film, the particles form into larger conglomerates, for example of $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, so that the material can be readily removed from the water. The paint remains deactivated for a substantial period of time, and the solvent action from within the paint particle does not reactivate it. The material is capable of deactivating a wide variety of materials, such as various types of paints, varnishes, lacquers, enamels, and the like, and also of operating effectively with different types of pigments.

In general, it is much easier to remove the killed paint if it is caused to float on the surface of the water. Over-spray treated in the manner described herein is formed into a conglomerate curdy mass that contains substantial air, and this trapped air causes the mass of the conglomerate to be substantially less than that of water, so that even heavy paint such as red-oxide primer and the like can be successfully floated, and therefore easily removed from the water.

It is difficult to determine the exact physical and chemical actions which take place at the interface of each particle and the surrounding liquids, but it is believed that the formation of several successive film layers occurs in the present system, and that it is this multiple layer system which provides the desirable properties of the paint killing system. Thus, when the particles first strike the water, a film is formed instantaneously around each particle. This film is sufficient to deactivate the particles

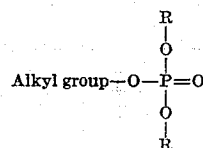
temporarily, but if no other film formation took place, the particle would soon be reactivated and would then return it its former sticky condition. However, other agents are added to the water of the spray booth, so that a second and more permanent film forms at a somewhat slower rate. This multiple film formation also permits the formulation of materials having a much wider range of operability than when only a single layer is to be formed. These and other objects and advantages of the present invention will be apparent from a consideration of the following specific examples of preferred embodiments of the invention.

Because the composition of the paint materials that are used in spray booths may vary widely, no single composition can be set forth with the optimum proportions to be used for each application. Although the examples set forth here will give satisfactory results in a wide variety of applications, the particular proportions of the ingredients may be modified in order to better suit the conditions of a particular use or in order to further reduce the cost of the agent while giving satisfactory results for the particular paint material being used in that particular spray booth.

In order to form a film around each particle of the paint as it strikes the water, I prefer to use an anionic surface active agent together with a non-ionic surface active agent. The anionic surface active agent serving to form a film instantaneously around the particle as it strikes the water, and the non-ionic film serving to reinforce this film to subsequent action.

For the anionic surface active agent, I prefer to use an organic phosphorous compound. For example, compounds containing sodium phosphorous and oxygen coupled to an organic hydrocarbon. One such material is manufactured by the Victor Chemical Company, 141 W. Jackson Boulevard, Chicago 4, Illinois, and is sold under the trade-name Victawet 35b. The composition of this compound is $\text{Na}_3\text{R}_5(\text{P}_3\text{O}_{10})_2$, where R is either 2-ethylhexyl or octyl-2, and is described in Surface Active Agents by Schwartz and Perry (Interscience Publishers, New York, 1949) at page 145 in chapter 6. This material forms a continuous film around each of the paint particles without dispersing them into fine separated particles which would be difficult to agglomerate. Only relatively small concentrations of this material are required in order to produce the thin protective film. The chemical structure of this compound is such as to provide a desirable balance in the relationship between the polar groups which are soluble in water, and the organic groups which form the interface with the paint particles. Another material, sold by the same company under the trade designation Victawet 34b, is also suitable and has the same general formula but in which the R is iso-octyl. Similar compounds in which the R represents normal butyl, isoamyl, 1-heptyl, capryl alkyl radicals, or the like are also suitable.

The non-ionic surface active agent also can be formed advantageously of an organic phosphate of the non-ionic type. Medium chain alkyl groups attached to a phosphate group are suitable. For this purpose, I prefer to use a detergent manufactured by the Victor Chemical Company and sold under the trade-name Victor T12. This material includes sodium tripolyphosphate an inorganic phosphates as well as the non-ionic organic component. There is approximately ten to twelve percent of this non-ionic organic phosphate surface active agent in the detergent T12. This active surface active agent in the detergent T12 is designated in the Handbook of Material Trade Names by Zimmerman and Lavine on page 604, as a substituted phosphate in which one of the oxygens is connected to the phosphorous atom and also to an alkyl group which may vary in the sizes of the medium chain hydrocarbons. Two of the other oxygens in the orthophosphate are connected onto the phosphorous atom and also to a water solubilizing group designated in this case as R. The general structure may be written as follows:



Alternatively, potassium tripolyphosphate or tetrasodium monopotassium tripolyphosphate ($\text{Na}_4\text{KP}_3\text{O}_{10}$) or trisodium dipotassium tripolyphosphate ($\text{Na}_3\text{K}_2\text{P}_3\text{O}_{10}$) or other similar phosphates may be used. However, I have found sodium tripolyphosphate ($\text{Na}_3\text{P}_3\text{O}_{10}$) to be the most versatile for all-around application. As an alkaline builder, which supplies additional phosphates and which also serves to control the pH of the solution for maximum film building action, I use sodium tripolyphosphate ($\text{Na}_3\text{P}_3\text{O}_{10}$) together with the surface active agents just mentioned.

In addition to the above components, a low specific gravity lubricating oil is included which forms an addition protective film on the solid interfaces. For this purpose, I have used the oil sold under the trade-name Shell Tellus oil 33 which contains an anti-oxidant surface active agent, and a blend of hydrocarbons that have a high adhesion to the surface interfaces. Other hydrocarbon oils can be employed if desired.

The hydrocarbon oil, together with the surface active agents, form a strong permanent isolating film around each of the paint particles so that even in the presence of the vehicle within the paint particle, the protective film is not ruptured and the paint particles do not coalesce into a sticky mass that would be difficult to handle.

The following composition is given as one example: 30 to 60 pounds of an alkali metal polyphosphate, preferably sodium tripolyphosphate, and 10 to 20 pounds of light hydrocarbon lubricating oil. In use the polyphosphate preferably mixed with a small amount of water and then emulsified by mixing with the oil. This mixture can then be added to the water in the spray booth: the above quantity being sufficient in most instances to treat 1000 gallons of water.

The above formulation, although working well with some organic coating materials, does not give ideal results with all materials. A somewhat more versatile formulation is as follows: sodium tripolyphosphate—61.5 pounds; alkyl phosphate substituted non-ionic surface active agent with 88 to 90 percent inorganic polyphosphates, such as Victor T12 detergent—30.8 pounds; Shell Tellus oil 33—35 pounds. The sodium tripolyphosphate and the T12 detergent were first added to a relatively small quantity of water, and when thoroughly dispersed therein, the oil was added gradually to form a relatively stable emulsion. This emulsion was then added to the water of the spray, which in this particular example contained 2800 gallons of water.

If desired, from two to four pounds of detergent Victawet 35b or other suitable anionic surface active agent can be added to the above formulation and will give still further improved results.

In order to prevent foaming of the liquid in the spray booth where there is substantial agitation of the liquid during the spraying operation, an anti-foam agent should be added to the composition. I have, in general, found the organic silicone anti-foam agents to be the most satisfactory for this purpose. For example, the silicone anti-foam materials sold by General Electric under the numbers 81224 or 81066 have been found satisfactory. Similar organic silicones sold by the Dow Company have also been found to be satisfactory. Certain other anti-foam agents may be used if desired, but they must be compatible with the solution, suppress the foam, and not interfere with the film-building action of the other materials. Octyl alcohol has been used with good results, but a relatively large volume of the anti-foam material is required and the odor may be objectionable. Generally, the silicone anti-foam agents will be found more satisfactory.

Because the material contains surface active agents so that the metal of the spray booth is thoroughly wet by the water, it is important to include in the spray booth solution a suitable amount of rust inhibitor, such as sodium dichromate. Accordingly, I have found that improved results are obtained if about 1.5 pounds of anti-foam emulsion General Electric No. 81224 are added to the above compositions, along with 0.1 pound of sodium dichromate rust inhibitor.

Preferably, the agent is packed and sold in two separate packages, one of which contains the solid components and the other of which contains the oil and anti-foam emulsions. In general, the solid material may be formulated by weight as follows: sodium tripolyphosphate—50 to 75%; detergent Victawet 35b—2½ to 5%; Victor T12 detergent—25 to 35%; rust inhibitor—.1% or less. The anti-foam silicone emulsion, such as GE 81224, may be added to the oil in the proportion of about one pound of organic silicone to 300 pounds of oil.

In use, about 30 to 50 pounds of the solid material are used for each thousand gallons of water in the spray booth equipment, and from 10 to 20 pounds of the oil containing the organic silicone anti-foam agent as set forth above.

I have found also that sodium aluminate may be added to the formulation and will provide better suspension and more effective film-building properties. The sodium aluminate may be added in the proportions between 2½ to 10% by weight of the total amount of solid material, the preferred range being between 3 and 4%. The pH may range between 7 and 10 or even as high as 12, but is preferably maintained between 8 and 9. The resulting solution is harmless so far as possible injury to the workmen is concerned.

I claim:

1. A paint killer composition for the purpose of altering the characteristics of overspray material in paint spray booths to enable easier handling of the overspray material comprising water containing sodium tripolyphosphate, an anionic surface active agent, and a non-ionic surface active agent.

2. A paint killer composition as claimed in claim 1 wherein said water contains the said ingredients in the following relative proportions by weight: 50 to 75 parts of sodium tripolyphosphate; 2.5 to 5 parts of anionic surface active agent; and 25 to 35 parts of non-ionic surface active agent.

3. A paint killer composition as claimed in claim 2 wherein said anionic surface agent is Victawet 35b and said non-ionic surface active agent is Victor T12 detergent.

4. A paint killer composition for use in handling the overspray material in a spray booth comprising water containing by weight: 50 to 75 parts of a sodium polyphosphate; 2.5 to 5.0 parts of $\text{Na}_3\text{R}_5(\text{P}_3\text{O}_{10})_2$, where R is 2-ethylhexyl, and from 25 to 35 parts of a non-ionic surface active agent.

5. A paint killer composition as claimed in claim 4 and wherein said water also contains from 10 to 20 parts of low specific gravity hydrocarbon oil.

6. A paint killer composition for use in collecting and disposing of overspray material in a spray booth comprising water having in solution therein the following ingredients in the following proportions by weight: about 60 pounds of sodium tripolyphosphate; about 30 pounds of Victor T12 detergent; and about 35 pounds of light hydrocarbon oil per about 2800 gallons of water.

7. A paint killer composition as claimed in claim 6 and wherein said water also contains from 2 to 4 pounds of detergent Victawet 35b.

8. A paint killer composition as claimed in claim 4 and wherein said non-ionic surface active agent is Victor T12 detergent.

9. A paint killer composition for deactivating and collecting organic overspray material from a spray booth comprising a water solution containing 30 to 60 pounds of an alkali metal phosphate and 10 to 20 pounds of light hydrocarbon oil per about 1000 gallons of water.

10. A paint killer composition as claimed in claim 9 and wherein said alkali metal is sodium.

11. A paint killer composition as claimed in claim 10 wherein the alkali metal polyphosphate is sodium tripolyphosphate.

12. A paint killer composition as claimed in claim 11 wherein said solution includes a non-ionic surface active agent.

13. A paint killer composition as claimed in claim 12 and wherein said solution includes an anionic surface active agent.

14. A paint killer composition for deactivating and collecting organic overspray material from a spray booth comprising a water solution containing per 1000 gallons of water between about 10 and about 20 pounds of light hydrocarbon oil containing about 1 part by weight of organic silicone per 300 parts of oil and between about 30 and about 50 pounds of a mixture comprising between about 50 and about 75% sodium tripolyphosphate; between about 2½% and about 5% of Victawet 35b detergent and between about 25% and about 35% of Victor T12 detergent.

15. A composition for use in deactivating and recovering overspray of coating materials comprising a solution of sodium polyphosphate in water emulsified with light hydrocarbon oil.

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