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WATERPROOFING PROCESS

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The present invention relates to a new and improved method of waterproofing materials which are adversely affected by water, including a method of waterproofing explosive compositions containing water-soluble salts, as well as to the products obtained by such method of treatment.

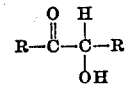
The use of hygroscopic ingredients in compositions which tend to be adversely affected by moisture or water is frequently necessary when a non-hygroscopic equivalent is not readily available. Where such conditions obtain, it is essential to protect the composition from moisture by some suitable means. This is sometimes accomplished by incasing the product in a water-impervious wrapper or jacket. An alternative procedure consists in coating the individual particles of the hygroscopic material with a waterproofing agent such as a mineral or vegetable oil, a fat, a wax or the like.

As heretofore carried out, the waterproofing has generally been accomplished by applying the agent in a liquid condition to the individual particles of the hygroscopic material. The results of such procedure, however, were not altogether satisfactory. Thus it was frequently found that, if sufficient oil were employed to waterproof the material, the physical and chemical properties of the coated material were markedly and adversely affected. This was particularly noticeable in waterproofing the water-soluble ingredients of commercial dynamites, for example ammonium nitrate, sodium nitrate, and the like. As is well known, waterproofing the ammonium nitrate by means of oily materials such as liquid petrolatum diminishes the sensitiveness of the dynamite to propagation by detonation. Moreover, these materials are not entirely effective in imparting water resistance, unless employed in amounts so large that the coated material has an excessive oxygen deficiency, which is very undesirable under many conditions.

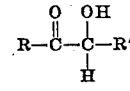
Various attempts have been made to bring about this waterproofing effect by a more satisfactory method. For example, lycopodium, starch, and other light powdery materials have been suggested as waterproofing agents. Again, Baker in the copending application No. 719,299, filed 4/6/34, discloses an improved waterproofing agent consisting of the metallic salts of high molecular weight fatty acids.

The object of my invention is an improved process for rendering impervious to water materials which are adversely affected by moisture. A further object is a water-soluble material so treated with a suitable composition as to be water-resistant. A still further object is an explosive composition containing a hygroscopic ingredient, the water resistance of which has been substantially improved without adversely affecting the explosive properties thereof. Other objects will be apparent as the invention is hereinafter described.

I have found that the foregoing objects are accomplished if the material which is adversely affected by water or moisture is treated at ordinary temperatures with an acyloin of a higher fatty acid. Acyloins, which have the general formula:



are reduction derivatives of fatty acids having the general formula R—COOH. The acyloins which I have found to be effective as waterproofing agents in accordance with the present invention are the acyloins of the fatty acids having more than six carbon atoms per molecule, e. g. stearoin, oleoin, lauroin, palmitoin and the like. These acyloins may be made by reduction of the corresponding fatty acid esters by means of alkali metals. By thus reducing a mixture of esters of two or more fatty acids, mixed acyloins may be prepared having the general formula:



where R and R′ represent the radicals of different fatty acids. Thus, for example, such a mixed acyloin containing the radicals of myrisitic and lauric acids may be made from the mixture of fatty acids obtained by saponification of cocoanut oil. My invention comprises the utilization of such mixed acyloins, as well as the single acyloins; in the present description and in the appended claims I use the term "acyloins" in its broad sense, i. e. to include the mixed acyloins as well as acyloins derived from single fatty acids. My invention also comprises the utilization of physical mixtures of different fatty acid acyloins and mixtures thereof with other waterproofing agents not incompatible therewith. While I prefer to use acyloins which are solid at room temperature, liquid acyloins, e. g., oleoin, will be useful in some cases.

In one method of practicing my invention, I may coat the surfaces of granules, crystals or other forms of hygroscopic materials or other

materials to be waterproofed with a thin layer of one of the fatty acid acyloins mentioned above. If desired, a mixture of two or more of the acyloins may be used. A convenient method of applying the acyloin coating comprises placing the material to be coated, together with a suitable quantity of the acyloin in a horizontal cylindrical container which preferably is equipped with longitudinally extending baffles and rotating the cylinder about its axis, whereby an intimate mixing of the acyloin and the material takes place and, as the rotation is continued, the particles of the material become coated with a layer of the acyloin. Because of the relatively soft, waxy nature of the acyloin, the particles of the two substances rubbing together by the tumbling action induced by the rotation of the container causes a thin layer of acyloin to be uniformly spread over the surface of each particle of the material to be waterproofed. In place of the above-described rotating cylinder, other known means for mixing and tumbling granular or powdered materials may be utilized. Also, various other means for coating the acyloins may be employed. For example, the material to be waterproofed may be treated with a solution of the acyloin in a volatile solvent and the latter then evaporated. Solvents suitable for this purpose include: chlorinated hydrocarbons such as chloroform, carbon tetrachloride, trichlorethylene, tetrachlorethane, dichlorethylene and others; low-boiling hydrocarbons such as gasoline, petroleum ether, naphthas, benzene, toluene and xylene; and other aliphatic ethers such as diethyl ether. I prefer to apply the acyloin by the above described tumbling method.

The quantity of acyloin to be coated on the particles or granules to be waterproofed may vary over a wide range, depending upon the thickness of waterproofing layer described on each particle. Preferably, I use amounts from 0.1 to 2.0% by weight of the material to be waterproofed; ordinarily around 0.5% is satisfactory.

The following example is given to further illustrate my invention:

Example

A waterproofed ammonia dynamite was made by tumbling ammonium nitrate and sodium nitrate with 0.5% stearoin until the salt crystals were well coated and then using the coated nitrates to prepare a dynamite by mixing the nitrates in the usual manner with nitroglycerin, wood pulp, starch, sulfur and chalk. A second dynamite of the same formula was made, using nitrates which had not been treated with stearoin or other waterproofing agent. The water resistance of the two dynamites was tested by immersing cartridges thereof in water and, at various intervals of time after immersion, attempting to detonate the cartridges by means of a commercial type blasting cap. It was found that the dynamite having no waterproofing agent would not detonate after 15 minutes of immersion. The dynamite made from the stearoin-coated nitrates did not fail to detonate until it had been immersed in water close to 6 hours.

My invention is generally applicable to various materials which are adversely affected by water or moisture. It may be employed, for example, to sodium chlorate, the hygroscopicity of which is objectionable for many purposes, as in chlorate explosive compositions. Again, it may be employed in waterproofing sodium nitrate, as used, for example, in black powder. It may be employed also to prevent the setting of any material which becomes caked or hardened by the absorption of moisture or water. I find it highly advantageous, for example, for protecting ammonium nitrate from setting by the absorption of moisture.

It will be apparent that any similar water soluble or hygroscopic material such as sodium chlorate, sodium nitrate, sodium chloride, ammonium phosphate and the like may be treated in a similar fashion with similar beneficial results.

It is apparent that other compositions such as black powder, cement, or any mixture containing hygroscopic or water-soluble materials, or which tends to become set from the effect of water, may be made water-impervious by the application of my invention. This may be accomplished either by coating the particular hygroscopic ingredients with one of the materials according to my invention, before incorporation in the composition, or the waterproofing material may be added to the composition at the time of mixing of the various ingredients. I prefer to coat the hygroscopic materials first, since it is unnecessary to coat the other ingredients of the composition.

My invention may be of advantage, for example, in preventing excess leaching of potassium compounds from fertilizers. Either the potassium salt itself, or the entire fertilizer composition may be made water-resistant according to my invention in the above described manner. By this means, the fertilizer gives up its soluble salts slowly.

Another example of the use of my invention is to be found in integrally waterproofed cement, wherein the sand and cement are incorporated at the time of mixing with a small amount of an acyloin. This material tends to prevent the filling of the interstices between the cement particles with water, with the resulting expansion of the material.

I claim:

1. A method of rendering water resistant a solid material adversely affected by water comprising coating the surface of said material with an acyloin derived from a fatty acid having more than 6 carbon atoms per molecule.

2. A method of rendering water resistant a solid material adversely affected by water comprising coating the surface of said material with about 0.1 to 2.0% by weight of an acyloin derived from a fatty acid having more than 6 carbon atoms per molecule.

3. A method of rendering water resistant a solid material adversely affected by water comprising coating the surface of said material with stearoin.

4. A method of rendering water resistant a solid material adversely affected by water comprising coating the surface of said material with a mixed acyloin of lauric and myristic acids.

5. A method of rendering water resistant an explosive material comprising coating the surface of said material with an acyloin derived from a fatty acid having more than 6 carbon atoms per molecule.

6. A composition of matter comprising a solid water soluble material coated with a water-resistant material comprising an acyloin of a fatty acid having more than 6 carbon atoms per molecule.

7. A composition of matter comprising a solid material adversely affected by water coated with

a water-resistant material comprising a mixed acyloin of myristic and lauric acids.

8. A composition of matter comprising a solid material adversely affected by water, said material being coated with a water resistant material comprising an acyloin of fatty acid having more than 6 carbon atoms per molecule.

9. A composition of matter comprising a soluble nitrate said material being coated with a layer of stearoin.

10. A composition containing a water soluble salt, the surface of which is coated with an acyloin of a fatty acid having more than 6 carbon atoms per molecule.

11. An explosive composition containing an ingredient imparting water resistance to solid water-soluble materials therein, said ingredient comprising an acyloin of a fatty acid having more than 6 carbon atoms per molecule, and forming a water-resistant coating on said water-soluble materials.

12. An explosive composition containing a water soluble nitrate, the surface of which is coated with about 0.1 to 2.0% of an acyloin of a fatty acid having more than 6 carbon atoms per molecule.

13. A dynamite composition comprising an explosive nitric ester and an ingredient imparting water resistance to the water-soluble materials therein, said ingredient comprising stearoin.

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