

ficiently wet so as to release the oil. Complete solution, however, was not effected until a period of more than 72 hours had elapsed.

It is understood, of course, that when the encapsulated particles are to be used in foods, a non-toxic encapsulating agent will be chosen.

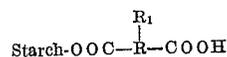
Summarizing, our invention provides a new type of encapsulating agent, comprising any substance which can be dispersed in water, but which upon drying forms a water-repellent film, and for the first time makes possible the production of particles of entrapped water-insoluble substances characterized by a controlled degree of water-repellency. If desired, the water-repellent encapsulating agents of our invention may be used in combination with the conventional water-soluble agents (such as dextrans or gums) of the prior art.

Variations may be made in proportions, materials and procedures without departing from the scope of this invention, which is limited only by the following claims.

We claim:

1. A method for entrapping water-insoluble substances which comprises making an aqueous dispersion of an encapsulating agent which forms water-repellent films upon drying, emulsifying in said dispersion the substance to be entrapped, and then drying the emulsion, producing particles which permit a slow, gradual release of the entrapped substance in the presence of moisture.

2. The method of claim 1 in which the encapsulating agent is the reaction product of a compound containing a polyvalent metal ion with a starch acid-ester of a substituted dicarboxylic acid having the following formula:



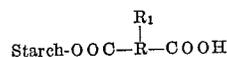
where R is a radical selected from the class consisting of dimethylene and trimethylene radicals, and R₁ is a hydrocarbon constituent selected from the class consisting of alkyl, alkenyl, aralkyl and aralkenyl groups.

3. The method of claim 1 in which the substance to be entrapped is selected from the class consisting of water-insoluble flavoring oils, perfumes and pesticides.

4. The method of claim 1 in which the emulsion is dried by spray-drying.

5. The method of claim 1 in which the emulsion is dried by passing over heated drums.

6. A method for encapsulating water-insoluble substances which comprises making an aqueous dispersion of an encapsulating agent comprising the reaction product of a compound containing a polyvalent metallic ion with a starch acid-ester of a substituted dicarboxylic acid having the following formula:



where R is a radical selected from the class consisting of dimethylene and trimethylene radicals, and R₁ is a hydrocarbon constituent selected from the class consisting of alkyl, alkenyl, aralkyl and aralkenyl groups, the dispersion containing from 15% to 45% by weight of said encapsulating agent, emulsifying the water-insoluble substance in said dispersion, and then spray-drying the emulsion, thus forming dry, free-flowing particles containing

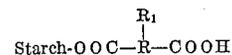
the substance encapsulated therein and having a controlled degree of water-repellency.

7. The method of claim 6 in which the water-insoluble substance is selected from the class consisting of flavoring oils, perfumes and pesticides.

8. A dry, free-flowing particle characterized by a controlled degree of water-repellency, said particle comprising a water-repellent encapsulating agent and a water-insoluble substance entrapped therein, said particle permitting a slow, gradual release of the entrapped substance in the presence of moisture.

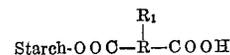
9. A dry, free-flowing particle characterized by a controlled degree of water-repellency, said particle comprising a water-repellent encapsulating agent and a volatile, water-insoluble substance entrapped therein, said particle permitting a slow, gradual release of the entrapped substance in the presence of moisture.

10. A dry, free-flowing particle characterized by a controlled degree of water-repellency, and containing a water-insoluble substance entrapped therein, said particle comprising the dried product of an emulsion of a water-insoluble substance in an aqueous dispersion of an encapsulating agent comprising the reaction product of a compound containing a polyvalent metal ion with a starch acid-ester of a substituted dicarboxylic acid having the following formula:



where R is a radical selected from the class consisting of dimethylene and trimethylene radicals, and R₁ is a hydrocarbon constituent selected from the class consisting of alkyl, alkenyl, aralkyl and aralkenyl groups.

11. A dry, free-flowing particle characterized by a controlled degree of water-repellency, said particle resulting from spray-drying an aqueous emulsion of a volatile, water-insoluble substance, said emulsion having dispersed therein as an encapsulating agent the reaction product of a compound containing a polyvalent metal ion with a starch acid-ester of a substituted dicarboxylic acid having the following formula:



where R is a radical selected from the class consisting of dimethylene and trimethylene radicals and R₁ is a hydrocarbon constituent selected from the class consisting of alkyl, alkenyl, aralkyl and aralkenyl groups.

12. The particle of claim 11 in which the volatile, water-insoluble substance is selected from the class consisting of flavoring oils, perfumes and pesticides.

References Cited in the file of this patent

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