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METHOD OF MAKING SOAP BEADS OR THE LIKE

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The advantage of preparing soap in the form of hollow or solid beads or spheroids is well recognized, since soap in this form presents a large surface exposure, whereby its solubility is enhanced and a profuse lather may be quickly produced. Until about a decade ago, the only type of soap beads available were solid beads or balls which were not even of relatively pure soap, but included a considerable amount of non-soapy and non-saponified material, known to the art as filler material.

Present methods of producing the relatively pure soap beads which are extensively commercially used, involve what is known as the spray drying process, in which the minute droplets of soap are sprayed into the air and air-dried to cause them to assume the desired approximately spheroidal form. In all variations of the spray process, due to the fact that the soap is only molten at high temperature and due further to the fact that the sprayed molten droplets must not only be solidified but also dried in the air, careful control must be maintained over both the temperature and the humidity of the air in which the spheroidal particles are formed. This has heretofore involved many complexities in the construction of the apparatus for handling the soap as well as in the construction of the control mechanism for maintaining the desired temperature and humidity within a processing plant.

An object of the present invention is to provide a process of producing soap beads, flakes or the like which may be either solid or hollow, and consisting of pure soap or of soap combined with any other material, the process involving no spraying or spray drying and being far simpler, and less expensive than spray process and involving no complex apparatus and no problems of temperature and humidity control.

Another object is to provide a process by which I can produce soap beads devoid of "filler" material, but having any suitable type of detergent material incorporated in them.

My present invention is based partially on the discovery that minute drops of a soap gel falling into a bath of material which is a solvent for the material which has gelled with the soap, is effective not only to case harden or "set" the droplets to form beads but to partially or completely replace the original petroleum or other base of the gel so that the resultant beads are composed of pure soap or of soap containing part of the original petroleum of the gel or part of the gel solvent or both.

The bath of solvent into which the droplets

of gel fall serves the two-fold function of promptly case-hardening the droplets and of eliminating (to any desired extent) the solute from the soap.

I shall have occasion in the specification and claims to refer to two solvents (1) the solvent material which combined with the soap produces the soap gel, and (2) the solvent into which the droplets of molten gel are poured. To avoid confusion in terminology I shall refer, throughout the specification and claims, to the solvent originally present in the gel as a "solute" and to the bath of material into which the molten gel falls as a "solvent".

In practice, if a solvent is used having substantially the same or higher surface tension as the molten droplets of gel which fall into it, the soap beads upon case-hardening assume an almost perfect spherical form.

Factors which enter into the shape assumed by the solidified soap particles, however, involve the temperature of the molten gel, the temperature of the solvent into which the molten gel is poured, the nature of the nozzle or other discharge device from which the molten gel drops are emitted, and the method of agitating the solvent into which the molten gel falls (where agitation is resorted to).

One further important factor which seems to bear a definite relation to the shape assumed by the drops as they fall into the solvent is the relative surface tensions of the gel and the solvent. By properly regulating these relative surface tensions I am able to produce not only beads, but flakes or shapes intermediate flakes and beads, such for instance as generally flat elongated ovoids or granules.

If the bath of solvent is maintained at a temperature at which the solute in the soap gel will partially vaporize, the drops upon falling into the bath have the solute on their outside surfaces almost instantaneously dissolved and since the outside surfaces are simultaneously cooled the solute within the beads tends to expand and puff the beads up. Later, as cooling of the beads becomes complete and the gasified solvent at the interior of the beads is liquefied, it will be absorbed back into the material and the resultant product will be a hollow bead. If this material is left in the solvent long enough the solute will be completely replaced by the solvent and when the beads are removed from the bath, this solvent completely evaporates leaving hollow beads of pure soap.

In the event that the molten particles of gel

are dropped into a bath of solvent which is identical in nature with the solute in the gel, the beads which are formed will be chemically substantially identical with the original gel.

To illustrate this point—if a petroleum soap gel formed in accordance with my prior Patent No. 1,753,659 is melted and dropped into a petroleum solvent which is identical with the petroleum in the gel, the solvent will serve to cool the droplets with sufficient rapidity so that they are case-hardened into form sustaining, generally spheroidal shape, but since the petroleum solute in the gel is identical with the petroleum of the solvent there will be no change in the characteristics of the solvent. The soap beads will likewise be in the form of minute spheroidal petroleum soap gels.

It may be desirable in many places to replace the original solute of the gel with some other detergent material which is a solvent of the solute in which event such detergent solvent is used in the bath and by leaving the soap beads in the bath long enough the original solute will be replaced by the other detergent solvent and the original soap gel may be converted into soap beads having radically different characteristics from the gel.

The invention may perhaps be best understood from certain typical examples of the manner in which the process is carried out commercially.

Example 1

An anhydrous petroleum soap gel formed in accordance with the process disclosed in my Patent 1,753,659 and including typically a hydrocarbon solute, such, for instance, as kerosene, is heated until liquefaction thereof occurs, this temperature approximating, in the case of benzene, roughly 150–200° C.

The liquefied gel is delivered drop by drop into a tank containing another petroleum solvent such as gasoline solvent, naphtha, carbon tetrachloride etc., the introduction of the droplets into the tank being preferably unaccompanied by agitation.

I have found it desirable to prepare a gel in which the proportions of petroleum solute to the soap is not in excess of 1 to 1. If the proportion of the petroleum solute in the molten gel is less than 1, the granules assume more nearly spheroidal shape and the wall structures of the granules are substantial. If the proportion of the petroleum solute in the gel is more than 1 to 1 the walls of the granules are thinner and their structure is irregular.

Assuming that the melted petroleum gel containing somewhat less petroleum than soap is poured into the petroleum solvent, the first action of the solvent is to take up all of the petroleum solute on the surface of the droplet and by cooling to case-harden the droplet. If we assume that the surface tensions of the molten gel and of the solvent are approximately similar, the granules or beads of soap will be approximately of regular form. If these beads are quickly removed from the solvent they will still retain some of the original solute present in the gel because the solvent will not have had sufficient time to completely permeate the beads and entirely displace the original solute. If the beads are left long enough in the solvent, the solvent of course replaces all of the original gel solute. If the solvent is highly volatile the beads may be removed and dried in any suitable fashion to completely drive

out all of the solvent and leave pure soap. If this solvent is not volatile the soap beads will be in the form of pure soap combined with the solvent of the bath. This latter may be of any suitable detergent material capable of dissolving out the solute in the original soap gel. Also the non-volatile solvents may be used to replace only part of the original solute of the gel in which case I produce soap beads combining mixed detergent materials consisting of the solute and the solvent.

If a molten petroleum gel is poured into a non-hydrocarbon solvent, such for instance as alcohol, acetone, etc., which has considerable less surface tension than the molten gel itself, the soap does not assume a granular form but assumes a flaky form. If the solvent in the bath is a mixed solvent consisting of both hydrocarbon and non-hydrocarbon materials then the gel, when poured into the liquid assumes a shape somewhat intermediate the flaky or spheroid, that is, a somewhat oblate or egg-shaped granule. By merely varying the solvents used the shape of the bead, granule, flake or other minute self-sustaining saponified body may be varied at will.

If a petroleum soap gel is poured into solvent naphtha which has been heated to a temperature sufficient to partially or completely vaporize the petroleum in the gel, certain interesting results occur. The solute at the outer surfaces of the beads is immediately boiled off and the embedded and still heated solvent in the beads tends to swell them. Upon cooling and drying these swollen beads are found to be hollow. Apparently some of the petroleum within the beads is vaporized almost simultaneously with case-hardening of the beads, but being unable to escape merely expanded the beads and any excess liquid petroleum at the center point of the beads is subsequently absorbed by their walls. If these beads are maintained submerged in the solvent naphtha or equivalent solvent for a sufficient length of time to dry out all the petroleum, then subsequently exposed to the air to permit complete evaporation of the solvent, they will be found to be of hollow form and of pure soap containing no petroleum compound either on the surface or in the interior.

It is not necessary to use a petroleum soap gel which is completely anhydrous such as the gel disclosed in my prior patent above identified. Where anhydrous gels are used the beads will be anhydrous. If however, a petroleum gel made by other processes and containing a certain amount of water is used, the soap beads themselves may retain at least part of this original water.

Example 2

Alcoholic soap gel is prepared by neutralizing any fatty acid in alcohol. Desirably about 50% of fatty acid is dissolved in the alcohol. To this the required amount of alkali solution, either of hydroxide or of carbonate is added. The hydroxide or carbonate is preferably added at an elevated temperature. On cooling an alcohol gel or soap is formed in which the proportion of alcohol to soap is roughly 1 to 1. This gel is subject to liquefaction upon heating. The liquid gel containing water in the case noted above or made by any other process with or without water content is liquefied and poured into a tank containing a more volatile solvent of alcohol such as wood alcohol, acetone, ether, etc. The surface tension of the gel in the solvent being substantially identical, the droplets assume a generally spheroidal shape. If the alcohol solvent is heated the beads

will be hollow. If the alcoholic gel is poured into other solvents having different surface tensions from the gel such as petroleum compounds, benzene, carbon tetrachloride, etc. the droplets will assume shapes varying from the spheroid to the flat flake, these variations being apparently primarily determined by the extent of difference in the surface tensions of the solvent and the molten gel and also influenced to some extent by other factors as noted above.

In the above examples I have described two types of gels, but it is understood that it is within the spirit of the invention to use a soap gel made from any organic diluent. This includes petroleum compounds, coal tars, alcohols, ketones. In fact, even esters and chlorine or nitro compounds may be used in the soap gels. Similarly pure soap beads, either solid or hollow water-containing soap beads, flakes, elongated granules, or other particles exposing a large surface area and containing naphtha, alcohols, ketones or other useful or detergent materials may be made within the spirit and scope of the appended claims.

It will be more or less self-evident that when the solvent for the gel solute becomes saturated or has taken up an undesirable amount of solute, the solvent and solute may be readily separated by a standard fractional distillation process.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:—

1. A method of producing soap beads or the like, which includes the step of dropping a normally solid or gelled soapy substance in molten condition into a bath of non-aqueous organic volatile cooling liquid to effect rapid cooling and case hardening of the drops into the form of beads or the like.

2. A method of forming beads of soap which consists in melting a soap gel including a soapy material and a solute, and introducing it in the form of small drops into an organic non-aqueous liquid solvent for the solute which is sufficiently cool to harden the soapy material in the liquefied gel.

3. A method as set forth in claim 2 wherein the solvent is effective to quickly vaporize the solute on the outer surfaces of the drops.

4. A method as set forth in claim 2 wherein the solvent is volatile and substantially evaporates from the soap beads upon air drying of the latter.

5. A method as set forth in claim 1 wherein the surface tension of the molten gel and of the bath are substantially identical.

6. A method as set forth in claim 1 wherein the temperature differential between the bath and the droplets of molten gel is sufficient to cause swelling of the droplets as they fall into the bath and the production of resultant hollow beads.

7. A method of making soap beads, or the like, which includes the steps of melting an anhydrous petroleum soap gel and introducing drops of the liquefied gel into a tank containing a petroleum solvent, for the petroleum in the gel.

8. A method of making soap beads, or the like, which includes the steps of melting an anhydrous petroleum soap gel, and introducing drops of the liquefied gel into a tank containing a petroleum solvent, for the petroleum in the gel, while maintaining said solvent at a temperature low enough to effect case hardening of the drops of molten gel.

9. A method of making soap beads, or the like, which includes the steps of melting an anhydrous petroleum soap gel, including a hydrocarbon solute, such as benzene, and dropping this melted gel into a bath containing a petroleum solvent for the solute.

10. A method of making soap beads, or the like, which includes the steps of melting an anhydrous petroleum soap gel, including a hydrocarbon solute, such as benzene, dropping this melted gel into a bath containing a petroleum solvent for the solute, and maintaining such bath at a temperature low enough to effect hardening of the drops of gel.

11. A method of producing beads of soap, or the like, which includes the steps of liquefying an anhydrous petroleum soap gel, in which there is less petroleum solute than soap in the gel and dropping this liquefied gel into a hardening bath consisting of a solvent for the solute.

12. A method of producing soap in the form of beads, flakes, or the like, which includes the steps of introducing drop by drop a liquefied soap gel, which gel includes soap and a non-aqueous solute, into a hardening bath consisting of a volatile solvent for the solute.

13. A method of producing soap in the form of beads, flakes, or the like, which includes the steps of introducing drop by drop a liquefied soap gel, which gel includes soap and a solute into a hardening bath consisting of a volatile solvent for the solute, and after the solvent has displaced the solute evaporating the solvent to leave pure soap.

14. A method of preparing soap beads from an alcoholic soap gel, which includes the steps of liquefying the gel, and dropping the gel into a tank containing a more volatile solvent of alcohol than any solvent present in the gel.

15. A method of preparing soap beads from an alcoholic soap gel, which includes the steps of liquefying the gel, and dropping the gel into a tank containing a more volatile solvent of alcohol than any solvent present in the gel, said volatile solvent having a surface tension approximately equivalent to the surface tension of the molten gel.

16. A method of preparing soap beads from an alcoholic soap gel, which includes the steps of liquefying the gel and dropping the gel into a tank containing a more volatile solvent of alcohol, said volatile solvent having a surface tension approximately equivalent to the surface tension of the molten gel, and being at a temperature to effect case hardening of the drops as they fall into the bath of solvent.

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