ABSTRACT: Process for preparing a granular denture cleanser composition of the effervescent gas liberating-type which when dissolved in water will remove oral deposits and stains from removable dentures soaking in the solution. The process comprises homogenizing and levigating the powdered components of the composition, extruding the composition mixture into a dense sheet of material and grinding the sheet of material into granules of a desired particle size. Granules of the desired size are then separated from oversized and undersized particles and collected as product while the oversized and undersized particles are reprocessed.
PROCESS FOR PREPARING GRANULAR DENTURE CLEANSER

This invention relates to granular denture cleansing compositions, and more particularly to a process for preparing granular denture cleansing compositions which when dissolved in water remove stains, plaque, food particles, and the like from removable dentures.

Denture cleansers soak formulas of the effervescent, gas liberating-type have generally been prepared as powders and tablets in preference to the granular form because of certain attendant disadvantages in the conventional prior art methods of granulation. One method of granulating requires the formation of a paste or slurry of the material, and drying and pulverizing to form a granular product whose shelf life as an effervescent and gas liberating agent is limited because of exposure during the several steps to wetting agents, drying temperatures and oxidative conditions. This process, known as wet granulation, requires long processing times, many consecutive steps and costly equipment, power consumption and floor space. Wet granulations which are ineffective for the preparation of the product, presumably because the oxidizing agents reduced the amounts of granules formed.

Another method consists of incorporating a granulating agent, for example, a polar organic compound having an alcoholic hydroxyl group as its only polar radical, into a flowable paste of the composition and thereafter aerating and mixing the paste until some form in a partially solidified mass which is subsequently aged until it rigidifies after which time the mass is granulated. A third method involves merely mixing the anhydrous components of the composition with a binding agent, such as a high molecular weight polyvinylpyrrolidone (PVP). The former procedure necessitates costly equipment, extensive handling by workers and consequently, a high manufacturing cost. In addition, both the former method and the latter method make use of an adulterant in the final composition. Many binding agents, except PVP, were found to react with the oxidizing agents, and are therefore, unacceptable.

Hence, the most widely used forms of denture cleaning compositions continue to be powders and tablets, notwithstanding the fact that powder and denture cleaners are highly susceptible to caking when placed in a moisture laden atmosphere as commonly exists in bathrooms, and that tablet forms of denture cleaners are generally more expensive to manufacture due to the final molding step in the manufacturing process. The molding of the tablets further requires the addition of lubricating agents to the composition. Further, tablets are inherently not readily capable of fast effervescence when placed in an aqueous solution because of their slow breakdown and poor solubility in water, and therefore the well-known technique of adding carbonating agents, such as tartaric acid and sodium carbonate or bicarbonate, to the tablet composition is commonly employed to increase effervescence. However, the great quantity of a carbonating agent or agents used in the tablet compositions has a serious disadvantage such that when used with oxygen liberating components the cleaning properties of the composition are impaired and tablets with short shelf lives are obtained. Further, a tablet containing citric acid and N\textsubscript{2}HCO\textsubscript{3} still takes longer to dissolve than the granules because of surface area effects. In addition to the fact that powdered forms of cleansers cannot remain free flowing indefinitely, the exposure of effervescing compositions to moisture impair the ability of the powder to bubble when placed in water which therefore reduces the ability of the components of the composition to disperse quickly and uniformly throughout the solution medium and thus the cleansing action of the composition is lowered. Furthermore, the addition of various agents to such compositions to reduce the aforementioned problems may form crumbling and unclear, cloudy solutions of the composition in water.

It is therefore the primary object of this invention to produce a granular effervescent denture cleanser which is stable, substantially dry, odorless, free flowing and nonlumping for cleansing removable dentures and for removing oral deposits therefrom.

It is another object of this invention to provide a process for producing a granular denture cleanser of the effervescent, gas liberating type which will eliminate lengthy processing times, costly equipment and reduce the power consumption and floor space of such equipment in addition to improving the shelf life and effervescent gas liberating characteristics of the composition.

A further object of this invention resides in the provision of a process for preparing a denture cleanser of the effervescent, gas liberating type which does not require the use of wetting agents, caking preventatives, binding or granulating agents, and which process produces a granular denture cleanser which shows no tendency to form a scum, and provides clear, noncloudy solutions when added to water.

In accordance with the object of the present invention, there is provided a process for producing a free flowing granular denture cleaning composition of the highly effervescent, gas liberating type. Although the active ingredients of the denture cleaning compositions prepared by this process include the conventional organic acid and metal carbonate or bicarbonate, the various components are combined in a manner which will prevent all of the foregoing problems attendant upon powdered and tablet forms of denture cleaners as well as the granulated forms which have heretofore been prepared. In this process the several dry components of the denture cleaning composition are first mixed together as powders, the components include for example an organic acid or other substance which reacts to evolve carbon dioxide when dissolved in water, a compound which releases oxygen upon addition to water and various other substances including minor proportions of a detergent, a dye, and/or flavoring agents. The powders are combined and homogenized before feeding to a device which partially compresses and deaerates the mixture. The thus pretreated mixture is fed between two compression or compaction rolls which are closely spaced to one another and which rotate in opposite directions toward the direction which the composition, now densified into a sheet, travels. This sheet of compacted material is broken first into chips and flake size and then into finely divided particles of the predetermined range of desired sizes by subjecting to the grinding action of revolving rotary blades. The particulate material is screened to remove dust and other contaminants and then sorted into particles of the desired size which constitute the finished product and the oversized and undersized granules which do not conform to the desired size. The oversized and undersized granules may be recycled back into the original feed system. Thus granulated composition containing the desired components are obtained in an apparatus which prepares the product in a minimum number of consecutive steps without requiring excessive handling by workers or cost to the manufacturer and without having to add contaminants to the product.

Still further objects and features of this invention reside in the provision of a process for granulating denture cleansing compositions which is simple to carry out, is adaptable to compositions of various formulations, and which requires less floor space in a plant which therefore minimizes the need for plant expansion.

These, together with the various ancillary objects and features of this invention, which will become apparent as the following description proceeds, are attained by this process, preferred embodiments, of which have been illustrated in the accompanying drawings, by way of example only, wherein:

FIG. 1 is a front elevational view partly in section of an apparatus which will produce the granular denture cleaning composition in accordance with the process of this invention, parts, being broken away to show other parts in detail;
The sheet of material is then subjected to the grinding action of rotary blades, not seen, revolving about the axis of shaft 30 which is driven by motor 57. At first the sheet is broken into chips and flakes of the composition and then into smaller granular size particles within a desired range of sizes. The granules are able to pass through the holes in screen 32 whereas the larger size particles remain behind to be further broken down to the desired particle size.

After undergoing additional screening by screen 34, the particles of denture cleansing composition are classified by sorter 36 into granular product of the desired particle size and the oversized and undersized particles. Product passes from sorter 36 through outlet 42 into a suitable collection vessel, not shown. The oversized and undersized particles leave sorter 36 through outlet 38 and reenter the main flow stream through conduit 40 for further processing.

It will be appreciated that the described apparatus occupies a minimum of plant floor space. Furthermore, the process is one which requires relatively little handling by the operator in that powdered material is merely fed into hopper 12 and granular product is removed at outlet 42. Therefore, notwithstanding the maintenance of the apparatus and the control of the feed rate, piston pressure, etc. by turning the appropriate knob 58 or pushing the correct button 60 on control panel 62, the operative steps to be handled by personnel are limited to the barest minimum. Finally, the cost of equipment is nominal because it is paid back through the other savings to the manufacturer in a relatively short period of time.

Referring now to FIG. 5, there is seen a diagrammatical of another apparatus for preparing the granular denture cleansing composition by a modified form of the apparatus. In this embodiment, the several components of the composition are fed to the system in powdered form through a hopper 64 and into the main flow stream designated by reference numeral 66, comprising conduits 67, 68 and 70. Conduits 66 and 68 contain rotating screws, not seen, which thoroughly blend and homogenize the components of the mixture. The partially processed mixture then enters hopper 72 and falls onto rotating horizontal screw 74, disposed at the bottom of hopper 72, which extends into conduit 76 that communicates with conduit 78 containing rotating vertical screw 80. Horizontal screw 74 feeds the mixture to vertical screw 80 at a controlled rate, whereby vertical screw 80 precompresses and deaerates the mixture by sheave forces. Closely spaced revolving compresion rolls 82 under pressure applied by piston 84 force the material downwardly while the sheave compactly the mixture into a dense sheet of material 83. Subsequently, the sheet falls onto rotary blades 86 revolving in the direction of arrow 87 where it undergoes a preliminary chopping action which breaks the sheet into flakes and larger than granule size particles. These prebroken particles of material are more finely ground by a second set of rotary blades 88 rotating in the direction of arrow 89 in which operation granular sized particles are formed.

Screen 90 permits only the granular sized particles to pass through it and the flakes or larger particles remain behind to be further broken down. After undergoing a preliminary screening step by screen 92 the granular sized particles are ready to be classified by sorter 94 into granules of a size within a predetermined range of permissible sizes, i.e., the product, and granules which are oversized or undersized. Sorter 94 consists of screens 96 and 98, screen 96 having a mesh size which allows the maximum permissible size of granule particles to pass through it. Hence, only product of the desired maximum size can pass in the direction of arrow 99 from outlet 98 to collection vessel 100, the oversized and undersized particles moving in the direction of arrows 101 and 102 respectively, being recycled through conduits 103 and 104 into the main flow stream where they are eventually reprocessed. It has been found that better compression of the composition results in most cases when a percentage of recycle material is incorporated into the virgin product.

A granular denture cleansing composition prepared by the method of this invention is free flowing and dustless. It dis-
solves quickly in water to form an effervescing solution which will cleanse removable dentures soaking in the solution. One such composition that has been successfully prepared by this process consists of 21.50 percent by weight of tartaric acid, 34.14 percent by weight of sodium bicarbonate, 28.00 percent by weight of oxone (KHSO₅), 15.00 percent by weight of NaBO₃·H₂O₂, 0.10 percent by weight of the sodium salt of an alkyl benzene sulfonate, 1.25 percent by weight of a flavor mix consisting of 1.00 percent magnesium carbonate and 0.25 percent flavor oils, and 0.01 percent by weight of a red dye.

It will be appreciated that almost a limitless number of granular denture cleansing compositions can be prepared by utilization of agglomerate forces together with granulation operation in accordance with this invention. This procedure is cleaner and less costly than prior art methods of granulation, in addition to which it obviates the need for adding adulterants to the composition.

We claim:

1. A process for preparing a granular composition for cleaning dentures which composition effervesces and liberates oxygen upon dissolution in water comprising the steps of feeding the components of said composition through a cylinder containing a screw rotating therein for compressing and deaerating said components in powdered form, extruding said composition into a dense sheet of material, breaking said dense sheet of material into chips and flakes, grinding said chips and flakes by rotary blades into granules of approximately the desired particle size, and then sorting the granular product of desired particle size from oversized and undersized particles of said composition.

2. A process according to claim 1, wherein said components are extruded into said dense sheet of material by forcing said components between two closely spaced rolls which rotate under externally applied pressure in opposite directions from one another.

3. A process according to claim 1, including recycling said oversized and undersized particles of said composition.