

1

3,524,756

PROCESS OF COATING TABLETS WITH ALTERNATE TACKY AND NON-TACKY LAYERS

Charles A. Signorino, King of Prussia, and Thomas E. Jamison, Philadelphia, Pa., assignors to Colorcon Incorporated, West Point, Pa., a corporation of Pennsylvania

No Drawing. Filed May 29, 1967, Ser. No. 642,190

Int. Cl. B44d 1/14

U.S. Cl. 117—72

13 Claims

ABSTRACT OF THE DISCLOSURE

Process of coating tablets with alternate layers of liquid suspension of tacky material and aqueous suspension of non-tacky material wherein the tacky material is shellac, zein or gum arabic and the non-tacky material is sugar.

BACKGROUND OF THE INVENTION

One of the most important problems in the pharmaceutical industry has been the preparation of dosage forms which are safe and do not disintegrate or change while on the shelf, and which disintegrate as planned in the stomach or intestines when taken by the patient. Among the most popular and useful dosage forms being prepared today are coated tablets.

Tablets are commonly coated with a layer of sugar, but even when the sugar solution contains opaque color pigments, the compressed tablet core requires sub-coating with sucrose and dusting powders to get a rounded form. The tablet core also requires a coating or layer of sealant to protect the core against moisture.

Compressed tablet cores may be sealed against moisture by coating them directly with a film such as with methyl cellulose. However, such direct film coating requires elaborate spray and exhaust systems. This is true of most of the useful synthetic polymers, since they are not adapted to coating by ladling into a coating pan containing the tablet cores and then rotating the pan.

Shellac is widely used as a sealing coating on tablet cores, and also as a finish coating, if it does not matter that the tablets have a mottled or uneven appearance. Shellac has the advantages of being an excellent moisture barrier, and of being adaptable to being applied to the tablet cores by ladling onto the tablet cores in a rotatable coating pan.

However, shellac has several disadvantages. The shellac coats after the first one do not distribute color well. Moreover, the shellac film is not smooth because the subsequent layers of shellac activate those already deposited and cause a picking between tablets that transfers the shellac from one tablet to another and gives an orange peel effect and a general unevenness in color as well as pin holes in the film layer.

Another disadvantage of shellac coatings on tablets is the tendency of the shellac to polymerize upon standing on the shelf. This causes the disintegration time of the tablet to be extended so that the tablet may not disintegrate in the stomach as intended, or in the intestines, but may pass through the body without disintegrating at all.

SUMMARY OF THE INVENTION

Accordingly, it is an object of this invention to provide a process for coating tablets with film so as to seal the tablet core against moisture and to overcome the problems of tackiness, mottling, unevenness of film coating and color, disintegration or change in characteristics while the tablets are on the shelf, and failure of the tablets to disintegrate in the body.

2

It is another object to provide a process for coating tablets with shellac that eliminates the tacking and intercoat picking problems usually associated with the application of shellac layers to pharmaceutical tablets.

It is another object to provide a tablet coating process which takes less time than conventional processes.

It is another object to provide a tablet which is sealed against moisture and has an even coating of film and color.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The process of the invention permits ladling an anhydrous suspension, such as a shellac suspension, directly on tablet cores rolling in a coating pan.

In accordance with the process, compressed tablet cores are screened to remove dust, and are deposited in a rotatable coating pan. A sufficient quantity of a shellac color suspension is applied to thoroughly wet the tumbling tablet cores. After the suspension is uniformly distributed about the cores for about 1 minute, warm air is applied to the tablets while they are still rolling until the tablet cores start to break loose from each other and become less tacky. The warm air is applied to the rolling tablets for about 4 minutes. Then the pan is stopped and is intermittently jogged every minute for about 10 minutes. The jogging comprises rotating the coating pan for 1/2 revolution so as not to let the coated cores sit in the pan and adhere to each other.

After about 10 minutes of this jogging, this first coating is sufficiently dry to take a second coating. This second coating may be another coating, one-half the volume, of the shellac suspension if a double sealing layer of shellac is desired. The second shellac layer is more tacky than the first shellac layer, but this tackiness is not a serious problem.

Instead of applying a second coating of shellac immediately, it is preferred to apply sugar syrup as the second coating. The sugar coating may be applied by ladling plain sugar syrup into the coating pan onto the tablet cores and rolling the sugar layer dry in about 5 minutes.

Instead of plain sugar syrup, a sugar suspension of 10 to 25 pound cut, preferably a 16-22 pound cut, of sucrose syrup is formed into a sugar suspension by adding 1 to 5 percent by weight of a shellac suspension. By "10 to 25 pound cut sucrose syrup" is meant 10 to 25 pounds of sugar dissolved in one gallon of water. This sugar suspension containing the small amount of shellac suspension has the advantage of etching or softening the previous shellac layer slightly to form a better or more secure bond of the sugar coating to the shellac coating. Since the shellac suspension is colored, its addition to the sugar suspension gives color to the sugar suspension and therefore the sugar coating aids in adding color instead of just forming a colorless base for the next color application.

The sugar suspension aids in developing the color of the tablet more rapidly. The sugar layer adheres well to the first layer of shellac and provides a flat, non-tacky surface for a third coating layer which may be of shellac.

After the sugar is dried in the second coating layer, a layer of shellac is applied to form the third coating layer. This third layer is applied by ladling a sufficient amount of shellac suspension onto the tablet cores to wet them completely, then rolling the tablet cores until they break free from each other, then jogging the coating pan every minute for about 10 minutes to dry the tablet cores.

This procedure of applying alternate coating layers of shellac and sugar may be continued until the desired full color of the tablet is achieved.

Advantageously, the anhydrous suspension may comprise a shellac coating suspension including, by weight,

3

30 parts of 4 pound cut shellac (4 pounds of shellac dissolved in a gallon of alcohol), 3 parts of slip and levelling agents, 25 parts of pigment solids, and ethyl alcohol, denatured. Also, the shellac suspension may include 2 parts of polyvinyl-pyrrolidone. The slip and levelling agents may be in the range of about 0-6 parts, the pigment solids 10-30 parts, and the polyvinylpyrrolidone 0-5 parts.

The slip agents are included in the shellac suspension in order to chemically reduce the tacking of the shellac so that the tablet cores slip by instead of picking. The slip agents may include cetyl alcohol, glycol monostearate, and talc.

The levelling agents are included in order to help spread the shellac suspension evenly over the tablet cores. The levelling agents may include sorbitan monooleate, and sorbitan monostearate. Acetylated monoglyceride may be included in the shellac coating suspension as both a levelling and a slip agent.

The polyvinylpyrrolidone is included in the shellac suspension to reduce the tendency of the shellac to polymerize and to modify the shellac film to help stabilize it.

The pigment solids may include all the FD & C and D & C lakes, soluble and insoluble dyes, opacifiers, titanium dioxide, calcium carbonate, silica, iron oxides and channel black formulated to desired color.

For example, to obtain a tablet having a dark cherry red color, the pigment solids include FD & C Red No. 3, FD & C Violet No. 1, talc and titanium dioxide.

The alcohol may be a specially denatured alcohol such as 3A ethyl alcohol, denatured, and it is used in sufficient quantity to give a viscosity of the shellac suspension of 15 to 30 seconds in a No. 3 Zahn cup at 25° C.

The sugar syrup may comprise, by weight, 14 parts of sucrose, and 6 parts of water. If desired, 1 part of the shellac suspension may be added to the sugar syrup to produce the sugar suspension.

In practicing the process of the invention, 14 pounds of 3 grain scored placebos are loaded into a 16 inch spherical coating pan. Then 175 milliliters of the shellac suspension are ladled over the rolling tablet cores and after the suspension is thoroughly distributed, air at 100° F. is directed onto the tablet cores to dry them to the extent that they separate from each other. Then the coating pan is jogged for ½ revolution every minute for about 10 minutes while still directing the air onto the tablets to further dry the tablets.

If a second sealing coat is necessary before the aqueous coating can be applied, then 60 milliliters of the shellac suspension may be diluted with 20 milliliters of 3A ethyl alcohol and ladled onto the tablets in the coating pan. This diluted shellac suspension may be used so as not to get too much shellac on the tablet core, and to spread the diluted shellac suspension uniformly over all the tablets since the diluted suspension is thinner and easier flowing.

Next, 50 milliliters of the sugar suspension is added and is allowed to distribute evenly and is dried with air in about 4 minutes. This step can follow the first shellac coating directly if a good first coat is applied or the cores are not excessively sensitive to moisture.

Then 80 milliliters of the shellac suspension diluted by alcohol in the ratio of 3 parts of the shellac suspension to 1 part of alcohol is added and forms a coating over the sugar coating. This shellac coating is dried with air. A good flat, non-tacky, uniform layer of colored shellac is obtained and this may complete the tablet coating if desired.

If additional coating is desired, after about 12 minutes, 45 milliliters of the sugar suspension is added and is dried with cool air. Then 80 milliliters of the 3 to 1 diluted shellac suspension is added and the tablets are rolled dry with air without picking. A good uniform film of shellac and color is observed on the tablets.

Then 15 milliliters of the shellac suspension diluted with 15 milliliters of alcohol are added after about 10

4

minutes to get a more complete shellac finishing layer and to get a polished finish rather than a flat coating on the outside of the tablet. A very thin film is obtained so as to avoid any picking between tablets.

After standing 20 days, such coated tablets disintegrate in 5 minutes in simulated gastric fluid. After six months in storage the disintegration time was still 5 minutes in simulated gastric fluid.

To further illustrate the invention, the following examples of specific shellac suspensions will make obvious to one skilled in the art the practice of the invention.

Example 1

Ingredients:	Amounts
4 pound cut bleached shellac -----	11 pounds, 14 ounces.
Cetyl alcohol -----	3½ ounces.
Isopropyl alcohol -----	4 pounds, 2½ ounces.
Sorbitan monooleate -----	5 ounces.
Sorbitan trioleate -----	5 ounces.
FD & Yellow No. 5 Lake -----	2 pounds, 13 ounces.
FD & Blue No. 1 Lake -----	15¼ ounces.
Titanium dioxide -----	9 pounds, 9 ounces.
Talc -----	2 pounds, 8½ ounces.
Polyvinylpyrrolidone -----	3 ounces,

The tablets are coated by alternately applying a layer of a shellac suspension and a layer of sugar suspension to the tablet cores, drying one layer before applying the next layer. The suspensions are applied by ladling them onto the tablet cores being rotated in a coating pan, and this procedure is repeated as often as necessary to obtain the desired coloring and depth of film coating.

Example 2

Ingredients:	Amounts
4 pound cut bleached shellac -----	11 pounds, 14 ounces.
Cetyl alcohol -----	3½ ounces.
Isopropyl alcohol -----	5 pounds, 6½ ounces.
Sorbitan monooleate -----	5 ounces.
Sorbitan trioleate -----	5 ounces.
FD & C Yellow No. 5 Lake -----	2 pounds, 15¼ ounces.
Titanium dioxide -----	1 pound, 2 ½ ounces.
Talc -----	1 pound, 13¼ ounces.
Polyvinylpyrrolidone -----	7½ ounces.

The shellac suspension of Example 2 is applied to the tablet cores in the same manner as previously described.

Other examples of specific shellac suspensions are as follows.

Example 3

Ingredients:	Amounts
4 pound cut bleached shellac -----	4 pounds, 6½ ounces.
Cetyl alcohol -----	1¼ ounces.
Isopropyl alcohol -----	1 pound, ¼ ounce.
Sorbitan monooleate -----	2 ounces.
Sorbitan trioleate -----	2 ounces.
Titanium dioxide -----	1 pound.
FD & C Red No. 2 Lake -----	6 ounces.
Talc -----	10 ounces.
Polyvinylpyrrolidone -----	4 ounces.

Example 4

Ingredients:	Amounts
4 pound cut unbleached shellac -----	5 pounds, 12 ounces.
Sorbitan monooleate -----	6½ ounces.
Acetylated monoglyceride -----	¾ ounce.
Polyvinylpyrrolidone -----	4½ ounces.
FD & C Violet No. 1 Lake -----	12½ ounces.
Titanium dioxide -----	1 pound, 10½ ounces.
Talc -----	10 ounces.
Ethyl alcohol, denatured -----	1 pound.

5

In practicing this invention, the tacky substance which forms a coating layer on the tablet cores may be shellac or other natural polymeric materials of similar properties such as zein, or gum arabic. The non-tacky substance may be sucrose or other sugars that dry under normal coating procedures.

The word "tablets" as used herein includes any discrete solids such as pellets, pills, candy, and other forms.

The advantages of the invention are numerous. The sugar coating layer provides a good flat non-tacky base for the uniform spreading of a shellac layer which is applied thereto. The flat non-tacky finish of the sugar layer lessens the incidence of tablet-to-tablet picking, thereby avoiding the orange peel effect of uneven color distribution. Also, the sugar coatings aid in disintegrating the film coatings of the tablet after the tablet has been swallowed by a patient.

The color development of the tablet cores coated in accordance with the invention is more rapid and mottle free than conventional tablets because the shellac films or layers build up uniformly without being redistributed through picking. Without the intervening sugar layers, the shellac layers would build unevenly because of picking between tablets.

Also, the use of sugar coating layers between applications of the shellac suspension makes the coating operation much more simple. The attention of the coating operator is not as critical since dusting is unnecessary, and each new application of shellac goes on the tablet core with the ease of the first application.

What is claimed is:

1. A process of coating tablets comprising applying a liquid suspension to the tablets to form a first tacky layer, drying the first tacky layer, applying an aqueous suspension of sugar to the dried tacky layer to form a non-tacky layer, drying the non-tacky layer, applying said liquid suspension to the dried non-tacky layer to form a second tacky layer, and drying the second tacky layer, said tacky layers consisting essentially of shellac, zein, or gum arabic.

2. The process of claim 1 wherein, in parts by weight, the shellac suspension comprises about 30 parts of 4 pound cut unbleached shellac, 3 parts of slip and levelling agents, 25 parts of pigment solids, and a sufficient quantity of ethyl alcohol, denatured, to give a viscosity of the shellac suspension of 15-30 seconds in a No. 3 Zahn cup at 25° C., and the sugar suspension comprises 14 parts of sucrose and 6 parts of water.

3. The process of claim 2 wherein the shellac suspension also includes about 2 parts of polyvinylpyrrolidone.

4. The process of claim 2 wherein the sugar suspension also includes 1 part of said shellac suspension for each 20 parts of sucrose and water.

5. The process of claim 1 wherein the shellac suspension includes the following ingredients in the following ratios by weight: 5 pounds 12 ounces of 4 pound cut unbleached shellac, 6½ ounces sorbitan monooleate, ¾ ounce acetylated monoglyceride, 4½ ounces of polyvinylpyrrolidone, 12½ ounces FD & C Violet No. 1 Lake, 1 pound 10½ ounces titanium dioxide, 10 ounces of talc, and 1 pound of ethyl alcohol, denatured.

6. The process of claim 1 wherein the shellac suspension includes the following ingredients in the following ratios by weight: 11 pounds 14 ounces of 4 pound cut bleached shellac, 3½ ounces cetyl alcohol, 4 pounds 2½ ounces isopropyl alcohol, 5 ounces sorbitan monooleate,

6

5 ounces sorbitan trioleate, 2 pounds 13 ounces FD & C Yellow No. 5 Lake, 15¾ ounces FD & C Blue No. 1 Lake, 9 pounds 9 ounces titanium dioxide, 2 pounds 8½ ounces talc, and 3 ounces polyvinylpyrrolidone.

7. The process of claim 1 wherein the shellac suspension includes the following ingredients in the following ratios by weight: 11 pounds 14 ounces of 4 pound cut bleached shellac, 3½ ounces cetyl alcohol, 5 pounds 6½ ounces isopropyl alcohol, 5 ounces sorbitan monooleate, 5 ounces sorbitan trioleate, 2 pounds 15¾ ounces FD & C Yellow No. 5 Lake, 1 pound 2½ ounces titanium dioxide, 1 pound 13¼ ounces talc, and 7½ ounces polyvinylpyrrolidone.

8. The process of claim 1 wherein the shellac suspension includes the following ingredients in the following ratios by weight: 4 pounds 6½ ounces of 4 pound cut bleached shellac, 1¼ ounces cetyl alcohol, 1 pound ¼ ounce isopropyl alcohol, 2 ounces sorbitan monooleate, 2 ounces sorbitan trioleate, 1 pound FD & C Red No. 2 Lake, 6 ounces titanium dioxide, 10 ounces talc, and 4 ounces polyvinylpyrrolidone.

9. The process of claim 1 wherein the shellac is colored with a coloring agent.

10. The process of claim 9 wherein the coloring agent is FD & C and D & C lakes, soluble and insoluble dyes, iron oxides, channel black or opacifiers.

11. A method of coating tablet cores comprising forming a suspension of liquid non-aqueous material, forming a suspension of aqueous material, rolling the tablet cores in a coating pan, ladling the liquid non-aqueous suspension onto the rolling tablet cores to form a first coating layer, drying the coating layer, ladling the aqueous suspension onto the rolling cores to form a second coating layer, drying the second coating layer, ladling the liquid non-aqueous suspension onto the rolling cores to form a third coating layer, and drying the third coating layer, said liquid non-aqueous material consisting essentially of shellac, zein, or gum arabic, said aqueous suspension consisting essentially of sugar.

12. The method of claim 11 wherein the tablet cores are screened to remove dust before being rolled in the coating pan.

13. The method of claim 11 wherein warm air is applied to the rolling tablet cores being coated with the first coating layer for about 4 minutes until the cores break loose from each other, and then the pan is jogged intermittently for about 10 minutes until the first coating layer is dry.

References Cited

UNITED STATES PATENTS

2,865,810	12/1958	Sanders	117-12 X
2,881,085	4/1959	Endicott et al.	
2,982,234	5/1961	Ackley et al.	117-12 X
3,097,144	7/1963	Banker	117-72 X
3,159,544	12/1964	Heffernan et al.	117-12 X
3,383,236	5/1968	Brindamour.	
3,420,931	1/1969	Davm et al.	117-72 X
3,427,182	2/1969	Zingerman	117-72

WILLIAM D. MARTIN, Primary Examiner

R. HUSACK, Assistant Examiner

U.S. Cl. X.R.

99-134; 117-81, 84, 91, 100, 109; 424-33, 34, 35, 36