An injection wedge includes a housing having a first face and a second face. A first tube extends through the housing and is coupled to a first nozzle on the first face of the housing. A second tube extends through the housing and is coupled to a second nozzle on the second face of the housing. The first face of the housing is opposite the second face of the housing. The first nozzle and the second nozzle are angled away from a vertical axis of the injection wedge. The first tube and the second tube are adapted to carry a fill material to the first nozzle and the second nozzle for injection into die pockets formed onto surfaces of a pair of rotary die drums.
INJECTION WEDGE FOR ROTARY DIE SYSTEM

FIELD OF THE INVENTION

[0001] The present invention generally relates to a rotary die system. More particularly, the present invention relates to an injection wedge for a rotary die system adapted to produce capsules wherein a fill material is uniformly-distributed therein.

BACKGROUND OF THE INVENTION

[0002] Soft gelatin capsules, also known as “softgels,” have been well known and widely used for many years. Softgels generally comprise an outer shell made primarily of gelatin, plasticizer, and water, and a fill material contained within the outer shell. The fill material may be selected from any of a number of substances that are compatible with the gelatin shell. Softgels are widely used in the pharmaceutical industry to administer various pharmaceutical, nutritional, and cosmetic products. They are particularly well-suited for delivering products that utilize a fat-soluble carrier; vitamin E and fish-oil extracts are common examples. Softgels are also commonly used to deliver rectal and vaginal suppositories, and preparations for ophthalmic or topical use. The cosmetic industry uses softgels as a package for various types of perfumes, oils, shampoos, skin creams, and other cosmetic preparations.

[0003] Softgels are available in a great variety of sizes and shapes, including spherical and round shapes, oval shapes, oblong shapes, tube shapes and other special types of shapes, such as squares and stars. The finished capsules or softgels also can be made in a variety of colors. Additionally, opacifiers may be added to the outer shell.

[0004] Softgels are typically made with a rotary dye system, an example of which is illustrated in FIG. 6. The rotary die system in FIG. 6 utilizes two rotary die drums 120 to advance a gelatin ribbon 140 under an injection wedge 110. As the drums 120 rotate, the gelatin ribbon passes under a single nozzle 152 at the bottom of the wedge 110. The nozzle 152 injects fill material (drugs, vitamins, etc.) into the space created by die pockets 130 on the surface of the drums 120; as the drum rotates, the die pockets 130 on each drum seal and cut-away the gelatin ribbon 140 to form a softgel in the shape of the die pocket having the fill material encapsulated therein.

[0005] The rotary dye system of FIG. 6 injects fill material into the center of the space created by the dye pockets. Some of the material is then distributed to one side of the softgel created, and the remainder is distributed to the other side. The material is not distributed evenly. More is distributed to one side than the other, and the odds that this will happen increase for softgels that are not spherical or obvoid. The softgels produced therefore tend to be deformed, asymmetrical, and not aesthetically pleasing. Many consumers discard deformed-looking softgels, especially those used for oral consumption, because they believe the product is defective for some reason (they assume, for example, that its seal has been compromised and it therefore leaks).

[0006] Excess fill material may be injected into die pockets of the rotary die drums to compensate for uneven filling. But, as more fill material is injected, more fill material is wasted; this is because the position of the injection nozzle relative to the die pockets on the surface the rotary die drums does not ensure accurate and efficient injection of the fill material, and waste is therefore inevitable.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] FIG. 1 illustrates a rotary die system according to an embodiment of the present invention;

[0009] FIG. 2 illustrates a cross-sectional view of an injection wedge according to an embodiment of the present invention;

[0010] FIG. 3 illustrates a front view of an injection wedge according to an embodiment of the present invention;

[0011] FIG. 4 illustrates a close-up cross-sectional view of an injection wedge according to an embodiment of the present invention;

[0012] FIG. 5 illustrates a side cross-sectional view of an injection wedge according to an embodiment of the present invention; and

[0013] FIG. 6 illustrates a rotary die system according to the prior art.

DETAILED DESCRIPTION OF THE INVENTION

[0014] FIG. 1 illustrates a rotary die system according to an embodiment of the present invention. The rotary die system 100 includes an injection wedge 110 having a first face 210 and a second face 220 (see FIG. 2). A first tube 150 extends through the housing of the injection wedge 110, and is coupled to a first nozzle 152 on the first face 210 of the injection wedge 110. A second tube 155 extends through the housing of the injection wedge 110, and is coupled to a second nozzle 157 on the second face 220 of the injection wedge 110. The first tube 150 and the second tube 155 are adapted to carry a fill material to the first nozzle 152 and the second nozzle 157 for injection. As illustrated in FIG. 2, the first face 210 of the injection wedge 110 is opposite the second face 220 of the injection wedge 110.

[0015] The rotary die system of the present invention can be used to encapsulate the same fill material as conventional rotary dye systems. Accordingly, the fill material may be any material known in the art for filling soft-gelatin capsules. Suitable fill material includes, for example, pharmaceutical compounds, nutritional compounds such as vitamins and herbal/homeopathic substances, soaps, oils, cosmetics, and dyes.

[0016] FIG. 4 illustrates a close-up cross-sectional view of an injection wedge according to an embodiment of the present invention. Preferably, the first nozzle 152 and the second nozzle 157 are positioned on the injection wedge 110 so that they are angled away from a vertical axis 410 of the injection wedge 110. Referring back to FIG. 1, a pair of rotary die drums 120 are provided, each having die pockets 130 formed on the surfaces thereof. A pair of rollers 160 may be provided with the rotary die system 100 to assist in advancing encapsulating ribbons 140, which are cast over
and stamped out by the die pockets 130 on the surfaces of the rotary die drums 120, to form the softgel. The encapsulating ribbons 140 may be made of any material known in the art to be suitable for encapsulating the fill material. In one embodiment, the encapsulating ribbons 140 may be made by providing molten gelatin from a spreader box, so that the molten gelatin flows and spreads onto a rotating casting drum, which is then fed to the roller 160, and then cast onto the rotary die drum 120, adapted to conform and line the die pockets on the surface of each rotary die drum 120 as it solidifies. However, any suitable method of providing the encapsulating ribbon 140 to the rotary die system 100 is acceptable.

[0017] When forming the softgels, the die pockets may be semi-spherical, so that when the rotary die drums 120 rotate, the die pockets on the surfaces of the opposing rotary die drums 120 align and match up to form an encapsulated spheroid (using the stamped out portions of the encapsulating ribbons 140 to form the outer shell). The first nozzle 152 and the second nozzle 157 are preferably arranged so that they inject the fill material uniformly and equally into the die pockets 130 as the rotary die drums 120 rotate so that each die pocket forming a half of the encapsulated spheroid receives the same and even portion. Moreover, the injection wedge 110 is preferably triangular-shaped, having a downward point directed to where the surfaces of the pair of rotary die drums 120 meet, so as to minimize any obstructions to the rotary die drums 120 as they rotate during operation.

[0018] Referring to FIG. 3, the first tube 150 and the second tube 155 may extend beyond the injection wedge 110. The first tube 150 and the second tube 155 may be coupled to a pump device or devices (not shown), which is in fluid connection with a tank or container (not shown) storing the fill material. The pump device(s) is preferably adapted to pump the fill material stored in the tank or container through the first and second tubes 150,155 in an even and uniform fashion so that the fill material injected from each of the nozzles 152, 157 is accurately disposed into the die pockets 130 of the rotary die drums 120 in equal and uniform amounts. Therefore, when the rotary die drums 120 rotate to seal and cut-away the encapsulated spheroid from the encapsulating ribbons 140, the fill material is evenly injected into the die pocket halves forming the encapsulated spheroid, thus resulting in a uniform distribution of the fill material within the encapsulated spheroid, which minimizes the chances of deformation.

[0019] FIG. 5 illustrates a side cross-sectional view of an injection wedge according to an embodiment of the present invention. The injection wedge 110 may be configured to have a plurality of nozzles 152, each coupled to the tube 150 supplying the fill material for injection. FIG. 5 illustrates only one side of the injection wedge 110 at the first face 210, and it is understood that the opposite second face 220 (not shown) may be similarly configured. In this configuration, by using a pair of rotary die drums 120 having die pockets 130 positioned corresponding to the positions of the plurality of nozzles 152, an even greater number of softgels may be manufactured at the same time with the rotary die system 100 utilizing the injection wedge 110 according to an embodiment of the present invention.

[0020] By utilizing the injection wedge 110 and the rotary die system 100 of the present invention, the softgels and capsules manufactured thereby maintain a more symmetrical quality, the fill material is more uniformly distributed therein, and they are more aesthetically pleasing to the consumer. Additionally, the injection wedge 110 and the rotary die system 100 of the present invention may be utilized to manufacture encapsulated spheroid projectiles containing a fill material of, for example, a colored fluid or liquid dye, particularly when utilizing semi-spherical die pockets 130 to form the encapsulated spheroids.

[0021] In a preferred embodiment, the injection wedge of the invention is used to make an encapsulated spheroid used as a projectile. Such projectiles are popularly used in recreation, as well as in law enforcement and military training, to simulate small-arms combat. They are also used by surveyors to mark structures such as trees or posts. Typically, the encapsulated spheroid projectiles (representing ammunition) are propelled by gas (air) utilizing guns and rifles having gas canisters containing for example, compressed air, nitrogen, or CO₂. These encapsulated spheroid projectiles, typically weighing about 12 grams and being 0.68 inches in diameter, are propelled at speeds of 300 feet per second (fps) and greater.

[0022] The shape and distribution of fill material in a softgel projectile is critical to its trajectory. Because of the high speeds at which it is propelled, any imbalance in the distribution of the fill material within the projectile, as well as any deformities in its overall shape, will adversely affect the trajectory and distance of the projectile. It is therefore advantageous to have an accurate, balanced, and symmetrically-encapsulated softgel projectile for use in surveying, recreation, or law enforcement/military training, and the injection wedge 110 and rotary die system 100 of the present invention are adapted to produce such an encapsulated spheroid projectile. These projectiles may be made with any ribbon and fill material known in the art to be suitable for such projectiles. The ribbon may be, for example, a thermoplastic linear polymer such as styrene having a thickness from about 0.005-0.040 inches; the fill material may comprise one or more of polyethylene glycol, gelatin, glycercine, starch, dye, sorbitol, and water, or any other ingredient found in softgel spheroid projectiles.

[0023] While the description above refers to particular embodiments of the present invention, it will be understood that many modifications may be made without departing from the spirit thereof. The accompanying claims are intended to cover such modifications as would fall within the true scope and spirit of the present invention. The presently disclosed embodiments are therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims, rather than the foregoing description, and all changes that come within the meaning and range of equivalency of the claims are therefore intended to be embraced therein.

What is claimed is:
1. An injection wedge, comprising:
a housing having a first face and a second face;
a first tube extending through the housing and coupled to a first nozzle on the first face of the housing; and
a second tube extending through the housing and coupled to a second nozzle on the second face of the housing,

wherein the first face of the housing is opposite the second face of the housing, the first nozzle and the second nozzle are angled away from a vertical axis of the injection wedge, and the first tube and the second tube are adapted to carry a fill material to the first nozzle and the second nozzle for injection into die pockets formed onto surfaces of a pair of rotary die drums.

2. The injection wedge according to claim 1, wherein the housing is triangular-shaped.

3. The injection wedge according to claim 1, wherein the fill material is a colored fluid.

4. The injection wedge according to claim 1, wherein the fill material is selected from the group consisting of a vitamin, a pharmaceutical, and a cosmetic.

5. The injection wedge according to claim 1, wherein the fill material is a viscous fluid.

6. The injection wedge according to claim 1, wherein the die pockets are semi-spherical die pockets.

7. A rotary die system, comprising:

an injection wedge having a first face and a second face;

a first tube extending through the injection wedge and coupled to a first nozzle on the first face of the injection wedge;

a second tube extending through the injection wedge and coupled to a second nozzle on the second face of the injection wedge, wherein the first face of the injection wedge is opposite the second face of the injection wedge, the first nozzle and the second nozzle are angled away from a vertical axis of the injection wedge, and the first tube and the second tube are adapted to carry a fill material to the first nozzle and the second nozzle for injection; and

a pair of rotary die drums having semi-spherical die pockets formed onto surfaces thereof, wherein the pair of rotary die drums are adapted to receive encapsulating ribbons at the surfaces of each rotary die drum, and the first nozzle and the second nozzle are adapted to inject the fill material uniformly into the semi-spherical die pockets of the rotary die drums to form an encapsulated spheroid.

8. The rotary die system according to claim 7, wherein the injection wedge is triangular-shaped.

9. The rotary die system according to claim 7, wherein the fill material is a colored fluid.

10. The rotary die system according to claim 7, wherein the fill material is selected from the group consisting of a vitamin, a pharmaceutical, and a cosmetic.

11. The rotary die system according to claim 7, wherein the fill material within the encapsulated spheroid is evenly distributed therein.

12. The rotary die system according to claim 7, wherein the fill material comprises a viscous fluid.

13. The rotary die system according to claim 7, wherein the encapsulating ribbons comprise a thermoplastic linear polymer.

14. The rotary die system according to claim 13, wherein the encapsulating ribbons have a thickness from about 0.005 to 0.040 inches.

15. The rotary die system according to claim 7, wherein the encapsulated spheroid is a projectile.

16. A method of producing an encapsulated spheroid, the method comprising:

providing a fill material to an injection wedge having a first face and a second face;

injecting the fill material from a first nozzle on the first face of the injection wedge and a second nozzle on the second face of the injection wedge, wherein the first face of the injection wedge is opposite the second face of the injection wedge, and the first nozzle and the second nozzle are angled away from a vertical axis of the injection wedge;

rotating a pair of rotary die drums having semi-spherical die pockets formed onto surfaces thereof, wherein the pair of rotary die drums are adapted to receive encapsulating ribbons at the surfaces of each rotary die drum, and the fill material is injected uniformly into the semi-spherical die pockets; and

sealing the fill material with the encapsulating ribbons;

and

cutting the encapsulated spheroid from the encapsulating ribbons.

17. The method according to claim 16, wherein the injection wedge is triangular-shaped.

18. The method according to claim 16, wherein the fill material is a colored fluid.

19. The method according to claim 16, wherein the fill material is selected from the group consisting of a vitamin, a pharmaceutical, and a cosmetic.

20. The method according to claim 16, wherein the fill material within the encapsulated spheroid is evenly distributed therein.

21. The method according to claim 16, wherein the fill material is a viscous fluid.

22. The method according to claim 16, wherein the encapsulating ribbons are a plastic material.

23. The method according to claim 16, wherein the encapsulating ribbons are a gelatin material.

24. The method according to claim 16, wherein the encapsulated spheroid is a projectile.

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