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Tablet Shrouding Process Optimization with the Addition of Extended Fin to Improve Product Quality and Production Efficiency

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Abstract: In general, tablets are solid dose forms containing therapeutic substances, with or without fillers. Tablet compression is achieved by applying high pressure on powder (bulk) granules through a steel mold. The core tablet to be coated must meet certain standards because it will be moved and slammed repeatedly throughout the coating process. The extended fin is an additional fin that functions when the product is inserted into the coating pan and rotated, preventing the product from coming into direct contact with the coating pan wall during the coating process, resulting in friction and reactions that occur during the film coating process. For this reason, an expanded fin is inserted to reduce friction between the product and the pan coating machine's wall. The addition of the extended fin decreases friction between the drug and the machine wall, preventing the product coating process from reacting due to excessive friction with the machine wall. Additionally, the results of smoothness, glossiness, and color solidity are excellent. This resolves the issues that have previously lowered the proportion of production output.

Keywords: Extended Fin, Coating Film, Drug Defect

Introduction

In general, tablets are solid preparations consisting of ingredients with or without fillers. According to the manufacturing method, tablets can be classified into printed tablets and compression tablets. Molded tablets are made by pressing a mass of powder under low pressure into a molded hole. Compression tablets are made by applying high pressure to the bulk of the powder using a steel mold (Basu et al., 2013). Tablets can be made in different sizes, shapes, and surface markings depending on the mold design (DG POM, 1995). The main composition of the tablet is the iron contained in it, while the additional ingredients often used in tablet manufacturing are fillers, crushers, dressing agents, binding agents, flavoring agents, and other additives (Mohmood, 2023; Ramesh, 2023; Samina, 2023; Shabankare, 2023; Kabeel, 2022). The tablet core to be coated must meet certain requirements, because during the coating process there will be continuous movement and slamming of the tablet core for some time (Hussan et al., 2012). The fragility of the core tablet should be as minimal as possible. High fragility will lead to the formation of fine and coarse particles that can stick to the tablet surface during the coating process, the sticking itself will cause defects on the coated tablet surface (Attia, 2022; Winter, 2022; Ishaq, 2021; Cheng, 2020; Khan, 2020). In order to be resistant to falling during the coating process, the core tablets must have sufficient resistance and hardness in the coating pan that rotates continuously during the process. In this coating process, the drug will automatically experience friction with the wall of the coating pan, and it is inevitable that undesirable things will occur due to this friction, such as undesirable discoloration of the coated tablets due to friction (Agrawal, 2020; Saha, 2020; Shaikh, 2019; Johnson, 2018; Tang, 2018). Based on the problems that occur, it is important to conduct research on how to overcome the risk of drug defects in the film coating process (Rajab et al., 2017).

Methodology

Drugs are substances intended for use in establishing a diagnosis, preventing, reducing, eliminating, curing diseases or symptoms of diseases, injuries or physical and spiritual disorders in humans or animals, beautifying the body or parts of the human body (Rowe et al., 2009). The effectiveness of the drug depends on the dose and the sensitivity of the body's organs. Each person has different sensitivities and biochemical needs. However, in general, doses for infants, children, adults, and the elderly can be categorized (Yunarto, 2014).

As a technological advancement, coating formulas and process optimization using scientific methods have taken over from traditional coating methods. The coating process involves consistently applying and drying the coating formulation onto the drug surface to form a uniform coating. Parameter control is a very important process for a coating. A

poorly developed coating process can cause various defects in tablets such as chipping, erosion, twisting, color variation from tablet to tablet, low solubility, aesthetics and product stability. Several things to ensure the final quality of the product such as moisture content, surface roughness, gloss, coating efficiency, coating uniformity, color uniformity and disintegration time (Seo, 2020).

Film Coating Machine is a pharmaceutical device that functions to coat a product in the form of tablets or caplets using a spray process (advanced technology process) or manually. On this occasion I will share a little experience about the pan coating machine which is still used in drug factories (Schweizer & Kistler, 2012).

The Film Coating Machine was created using the latest technology for coating using a spray gun. The result is through a one-stage process which is a combination of the liquid mixing process, pumped through a spray gun with certain temperatures and conditions (Larasati et al., 2017). Briefly, the Film Coating Machine process can be explained that the required air volume is generally taken from the work area, then passed through the initial filter (Pre Filter), medium filter, hepa filter and finally Exchanger (heating source). Before entering the product chamber, the tablets/caplets to be coated/coated are weighed/checked as needed and then enter the product chamber. Clean air is passed through ducting to the top, thus agglomeration will occur in the presence of a binding agent used for coating/coating (Gulo & Siregar, 2021).

Coating System Workflow

It is important to note that film coating machines on the market today have the following 5 main parts:

1. Air chimney: the hot air that dries the coated powder leaves the system through this section. At this point, there is a significant drop in temperature.
2. Electrical control system; it controls all electrical and electronic components. These may include heating elements, motors, electrical switches, and others.
3. Film coating machine; this is where the tablet coating and drying takes place. The system is integrated with a modern control system to ensure accuracy and efficiency.
4. Coating preparation tank: this is where you will prepare the coating substrate. The system's pump will then direct it to the spraying nozzle in the film coating machine.
5. Clean air circulation: receives air from the external environment. It induces the right amount of heat into the air, before blowing it over the coated tablet.

In summary as shown in the figure below (Hidayat et al., 2014).

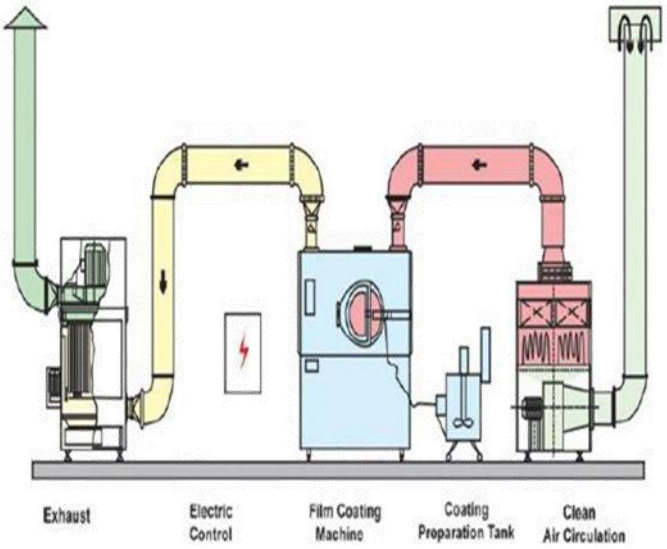

Figure 1. Schematic of Coating System Workflow

The way the extended fin works is as an additional fin that functions when the product has been put into the coating pan and rotated, then during the coating process it is impossible for the product to be in direct contact with the coating pan wall and friction will occur and cause a reaction that occurs during the film coating process. For this reason, an extended fin is installed to reduce the frictional force that occurs between the product and the wall of the coating pan machine.

Figure 2. Extended Fin

Result and Discussion

After conducting several tests, the following results were obtained:

Table 1. Test Result Data

Treatment	Rotary Speed	Results Acceptance Criteria		
		Smooth	Shiny	Color
Non Extended	3.5 Rpm	Rough	Dull	Not Solid
Extended Fin	3.5 Rpm	Rough	Dull	Solid
Non Extended	4 Rpm	Smooth	Shiny	Not Solid
Extended Fin	4 Rpm	Smooth	Shiny	Solid
Non Extended	4,5 Rpm	Gripis	Shiny	Not Solid
Extended Fin	4,5 Rpmp	Gripis	Shiny	Not Solid

Smoothness: the product is said to be not smooth if the spray looks rough like orange peel.
Glossiness: the product is said to be glossy if it looks shiny and not dull.
Color solidity: the color is said to be solid if the color of all parts is the same / solid color, there are no defects or stripes in the product.

In this case, the so-called poor smoothness means that the coating product results look rough spray and the physical shape also looks less good, if the good results mean that the product results look smooth spray and good physical shape. In terms of glossy results, poor results mean that the product cannot be shiny well or is rather dull, if the good results the product looks shiny clean and not dull. In terms of color, poor results show that the color of the product is not as desired or other colors arise that damage the original appearance of the product, if the good results the product looks according to the original appearance of the sprayed or solid color.

Conclusion

From the results of research on the effect of adding extended fins on the film coating process, it can be concluded that the results of coatings carried out without using extended fins get unsatisfactory coating results, and this will also harm the company because it reduces the percentage of product sales. Satisfactory coating results are obtained during the coating process with the treatment of adding an extended fin with a setting of 4 Rpm, because in terms of smoothness, glossiness, and color get good results and sell well in the market.

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