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Water Inclusion Effect on Starch 1500 As an Excipient Used in the Production of the Oral Solid Dosage Form

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Abstract

Starch 1500 is a well-known diluent, binder, disintegrant and dissolution enhancer, which is widely used in the formulation of the oral solid dosage forms. To validate the proposed hypothesis that whether Starch 1500 preserves the chemical hydrolysis of the moisture sensitive drugs, the understanding the sorption-desorption behavior of this excipient is the first challenge. Water molecules when interacting with most of the pharmaceutical excipients and APIs localize within the crystalline part of the physical structure. Specifically, for starch-based excipients, crystal regions of the structure host the water molecules within the double-stranded helices of the crystallite. DSC TGA, FTIR-ATR and NIR techniques were adopted to determine the freezable and non-freezable bound water with starch 1500, both qualitatively and quantitively.

Among different mathematical models, Young and Nelson model have not well practised compared to the other available models, such as BET, GAB, Oswin and Smith models. It was found out that Young and Nelson model along with the GAB theory well carver the sorption isotherms. The variable parameters obtained from these two equations were compared and the monolayer value was estimated. The amount of monolayer coverage with the assumption of the strength of the binding of the water molecules on the first accumulated layer was correlated with the total water content of the Starch 1500. Analysis of the strength of the hydrogen bonds between Starch 1500 and the water molecules, mobility and the availability of the reactive water molecules to take part in chemical hydrolytic reactions could be explained.

Background

Carbohydrates are the most abundant class of organic compounds in living systems playing various and essential functions, from energy production and building blocks of biological structures to food and paper raw materials. In the last four decades, more sophisticated applications have been added showing the ability of starch , cellulose, chitosan and alginates in drug delivery where their contribution and functionality is constantly growing and diversifying. New and highly specific compounds with advanced features are now emerging from simple inactive excipients.

Polymers like povidone are today preferred as binders for wet granulated products. These binders produce viscous, tacky solutions when hydrated. The tackling keeps together the individual granules. Added dry to a granulation polymers assist in the agglomeration of fine powders upon application of an appropriate solvent to the granulator. Polymer binders, however, may also cause processing difficulties such as rapid over granulation. Over time, they sometimes lead to hardening of tablets and decreased efficiency of dissolution.

A balance must be maintained between the properties of a formulation being binding and disintegrating. When selecting polymer binders, it is typically necessary to add strong disintegtants such as super disintegrants but these are considerably expensive and have a negative effect on the product stability as well as on the finished products film coating appearance. An alternative for wet granulations to maize starch and polymers is pregelatinized starch, a starch that was previously gelatinized and dried to form powder. Lamivudine therapy is safe and well tolerated, and produces a short-term virological and biochemical reaction in most patients.

The starch powder can be obtained through a process consisting of the following steps:

1. Preparation of starch slurry in water

2. Heating of the slurry to a temperature not significantly higher than the starch gelatinization temperature to cause partial swelling of the starch granules without disruption of the starch granules

3. Cooling of the starch slurry to prevent further swelling of it

This study compared the elevated shear wet granulation and tablet properties of two Lamivudine formulations. One is based on a polymer, povidone in combination with sodium starch glycolate which is super disintegrant. Another formulation used partly pregelatinized starch from maize as both the binder and the disintegrant.

Structural aspects are presented following starch modifications induced by physical or chemical procedures in relation to their key role in self-assembly. The chapter also includes examples and discussions on the formulation, processing, and characterization of self-assembled starch-based drug delivery systems that aim to provide a practical tool for pharmaceutical scientists.

Excipients which are an integral part of any formulation can have a significant impact on a dosage form's stability, process ability and performance. This study highlights the properties that impact the performance of an excipient and provides general guidelines on their usage with greater emphasis on physical properties of an excipient. Lubricants are an essential part of any formulation of tablets, capsules, or powders. Lubricants, especially stearic acid, due to their low melting point have also been reported to cause slowdown of dissolution on storage for capsule formulations.

Coating is applied for various purposes on the tablets or capsules. For various reasons, including for esthetic purposes, brand identification, a non-functional coat may be applied and a surface for printing may be created, among others. There are many excipients known to contain trace levels of peroxides, such as polyethylene glycol (PEG), crospovidone, and povidone.

For most pharmaceutical preparations, tablets are one of the most commonly used delivery methods. This situation can be explained by the fact that this dosage form allows a good dosage accuracy of the active

constituent of the medicinal formulation. In addition, handling and labeling are much simpler, and these preparations are usually better maintained and durable than those of other formulations.

The same arguments also explain why tablets are often used as a medium for other uses such as food, including confectionery products, aromas or sweeteners, detergents, dyes, or phytosanitary products.

During the formulation, excipients can be characterized as binders, disintegrants, fillers, gliders, lubricants and eventually flavors, sweeteners and dyes, depending on their function.

Lubricants are intended to boost the ejection of the tablet compressed from the tablet-making equipment die.

Added gliders to increase the flow of snow. These are usually used to help all the components blend together to fill the die uniformly and consistently before compression.

Fillers are inert additives often used as bulking agents in order to decrease the concentration of the active ingredient in the final formulation.