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β -galactosidase Containing Innovative Drug Delivery System

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1. Introduction

β -Galactosidases of various origins belong to families of glycosyl hydrolases produced by almost every living organism. The lack or decreased production of this digestive enzyme in the human small intestine results in the inability to properly break down and assimilate milk containing products. Even though these dairy foods play an important role in gastronomy in many parts of the world, so an irregularity during their metabolism can lead to deterioration in the quality of life [1]. The prevalence of the lactose intolerance is more than 60% amongst the human population, causing different health problems of various severity [2]. Enzyme type active ingredients are usually sensitive to pH, moisture, pressure and temperature as well as to the applied excipients occurring during manufacture, therefore they may lose their effectiveness before or during oral administration [3]. Nowadays, besides many different physicochemical and pharmacological properties of the active ingredients and excipients, the developer of a pharmaceutical formulation must consider several factors during the formulation process so that the patient would cooperate. One of the innovative solutions in paediatrics and geriatrics may be the use of medicated drinking straws. In our study we developed a lactase enzyme containing drinking straw. The application of this innovative medical formula was simulated and the effects of the different circumstances like liquid temperature and flow rate was measured.

2. Materials and methods

The particles were produced with two different technological methods. Extrusion-spheronization

technique was used to produce particles with a homogeneous (matrix) structure. The agglomerates made by layering process have heterogeneous, layered structure (*Figure 2*).

5 grams of prepared lactase-containing particulates were weighted into the polypropylene drinking straws and the samples were sealed by a custom-made straw-closing machine.

The dissolution study was performed using a specially developed peristaltic pump simulating the use of a straw (*Figure 1*). The kinetic characterization of the curves obtained by simulating the sip was studied with a Weibull distribution function.

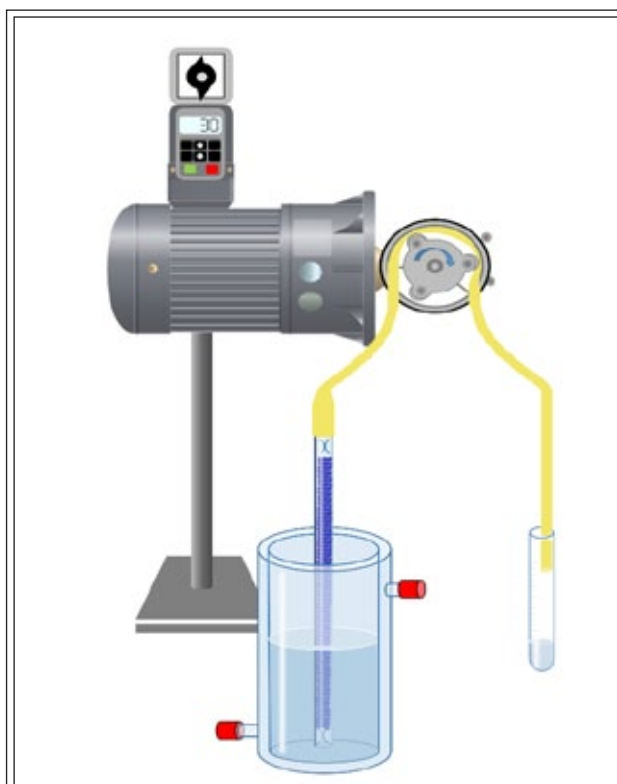


Figure 1 The apparatus for simulating the sipping of liquid through the straw

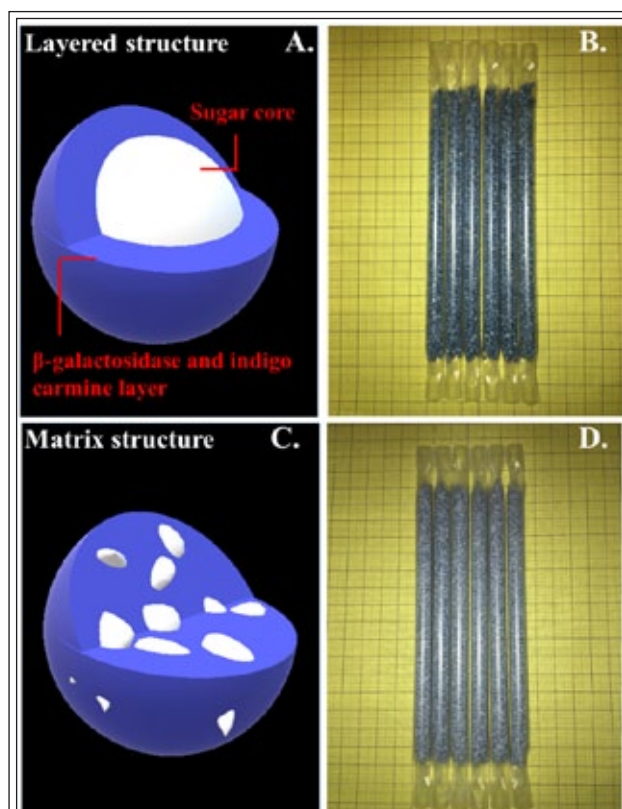


Figure 2 Photograph of the produced straws filled with the various particles (layered structure A.,B. and the matrix structure C.,D.).

3. Results

Comparing the particulates produced by the two methods, it can be concluded that the layered structured particulates being more spherical, flowed better and achieved a slightly lower Hausner Ratio compared to the matrix structured particulates. The latter, while being considerably less spherical still flowed exceptionally well and their compressibility was at almost the same rate as the layered pellets'. Both types of investigated samples were larger than a typical pharmaceutical pellet with their projected area was about 8,0 and 6,6 mm², respectively. Both types of particles disintegrated in less than 3 minutes. These dimensions were deemed acceptable to load the material into plastic drinking straws, and carry out the dissolution tests.

No large discrepancy can be observed between

the two different types of particulates (matrix, layered) in the disintegration test. The dissolution profile of lactase and indigo carmine had a similar shape in case of both heterogeneous and homogeneous particles.

In both case of the two ingredients, the applied setting parameters had a significant effect on the release profile. The sign of the main effect of the two independent variables is negative.

4. Conclusions

Lactase containing, rapid disintegration agglomerates by two techniques commonly used in the pharmaceutical industry were prepared successfully in this study. The study highlights that even in the case of a simple dosage form favored in pediatrics, we need to consider more factors during admission in order to get the desired effect of the medicine

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