STUDY ON THE DRYING OF APPLE PECTIN

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Introduction. The use of dryers is diverse - in the production of food products, the production of multi-tonne products of microbiological synthesis. The main advantage of using dryers for the manufacture of pharmaceutical substances is compliance with GMP requirements and the availability of validation documents. Such dryers are manufactured by such companies as GEA Niro Atomiae and Anhydro (Denmark) [1]. Dried products with promising raw materials are a good choice for restaurant business, especially fast food such as bistros and cafes. Consumers of these types of products are power structures, food concentrate production, special contingent (geologists, athletes, astronauts), etc. Spray drying, as well as freeze drying, is the most common method of obtaining microbiological synthesis products from native solutions, as it ensures drying of liquids within a few seconds [2]. Specifically, spray dryers are used to produce dry bacterial preparations, antibiotics, vaccines and other pharmaceutical products. This type of apparatus was first used in the early twentieth century to dry milk and blood. The principle of their operation is the fine spraying of solutions to be dried using spray discs or nozzles when the aerosol comes into contact with hot air in a special chamber [3]. This method of drying is based on the vacuum extraction of moisture from the material that is in a frozen state; in this case, the ice turns into a gas state, bypassing the liquid state [4]. A new promising type of lyophilic dryers is considered, in which Peltier thermoelectric elements are used for sublimation and desublimation. The principle of operation is described and basic information about spray-sublimation dryers for the preparation of powdered pharmaceutical substances for inhalation of dry powdered substances and their needleless intradermal injection is given. It is known that freeze dryers are used in production facilities for drying serums, antibiotics, enzymes, and food products.

In [5], industrial freeze dryers of non-periodic action are used for freezing the material to be dried, freezing (sublimation) of the frozen material in a vacuum, connecting the sublimation chambers and sterilising the equipment. Paper [6] describes the drying of paste-like thermolabile materials, which is a complex technological and heat and mass transfer problem. Drying is carried out in the following devices: chamber, cabinet, pneumatic gas, spray, vacuum roll, freeze-drying, belt, drum dryers, carousel type, and in a vibrating fluidised bed. It is proposed to carry out drying in a fluidised bed. The drying process is analysed by the so-called "shrinkage" phenomenon, which is the cause of cracks. This is considered to be the cause of complete destruction, since the development of the volume-stress state of the dried material above the maximum permissible for this material is observed.The object of the study is to investigate the operating modes of the experimental fluidised bed unit: fluidisation, fountain mode, removal of the dried material from the apparatus.

The aim is to determine the dependence of the moisture content of exhaust air on the moisture content of apple pulp (pectin) in the experimental fluidised bed unit.

Materials and methods. Fig. 1 shows the experimental fluidised bed setup. Loading device 1 is fed with wet pectin, which then enters the compartment with a grid 3.

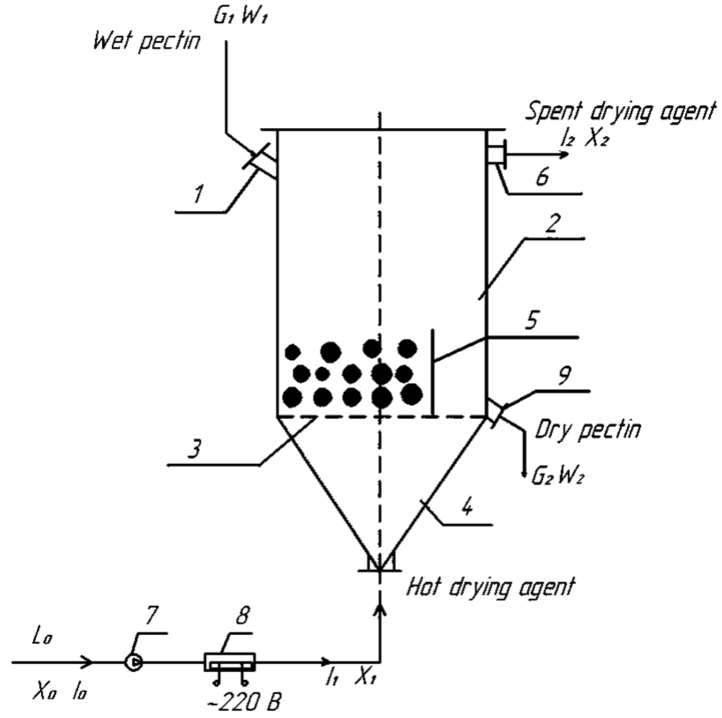

Fig. 1. Experimental setup: 1 - loading device, 2 - upper chamber, 3 - grate, 4 - lower chamber, 5 - unloading partition, 6 - outlet connection, 7 - fan, 8 - heater, 9 - unloading device.

A fan 7 and a heater 8 are installed under the lower chamber 4. Hot drying agent is supplied from the lower chamber 4, which dries the pectin (apple pulp). The spent drying agent for pectin is fed directly into the outlet 7, which allows us to calculate the moisture content of the pectin after drying. First of all, the dried pectin is then fed through the discharge partition 5 into the discharge device 6, where the finished dried pectin is already available.

Results and discussion. The following quantities were measured during the experiment: wet material and removed moisture capacity (G1 and GW), air humidity (X0), and air moisture content at the dryer outlet X2 [6].

Performance on wet material:

$$G_1 = G_2 \frac{100-\omega_2}{100-\omega_1} \ .$$

Performance by moisture removed:

$$G_B = G_1 - G_2 \, .$$

Air humidity:

$$X_0 = 0{,}622 \frac{\varphi_0 P_0}{B-\varphi_0 P_0} \, .$$

The moisture content of the air at the dryer outlet:

$$X_2 = \frac{1000 t_2 - I_1 + \Delta \cdot x_1}{\Delta - 1{,}97 \cdot 10^3 t_2 - 2493 \cdot 10^3} \, .$$

Fig. 2 shows the results of the experiment and a graph of the moisture content of the air at the outlet of the dryer [6].

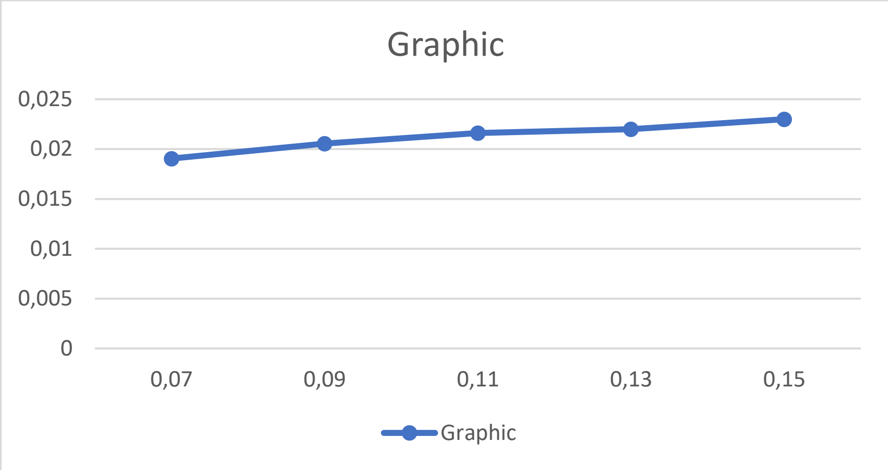

Fig. 2. Graph of the moisture content of the air at the dryer outlet: $X_2 = 0,05W_1 - 0,0156$ – dependence of the air moisture content at the dryer outlet on the initial pectin moisture content.

Table 1 shows the result of my calculation of the moisture content of the material.

Table 1. Comparison of moisture content between experimental and calculated values.

№ experiment	W_1 ,%	φ_2 ex	φ_2 ex, kg/kg	X_2, kg/g sol
1	15	0,15	0,0244	0,023
2	13	0,14	0,023	0,022
3	11	0,135	0,022	0,0216
4	9	0,13	0,021	0,02056
5	7	0,125	0,02	0,01905

Conclusion. The influence of the drying process on the functional and physicochemical properties of pectin was investigated, which made it possible to obtain the highest quality product at minimal cost.

References:

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