

placement, lack of scale on the heating element, reduction of energy consumption in 2–2,5 times, reduction of the time of the device's withdrawal into operating mode, reducing the material costs of manufacturing the apparatus.

TECHNICAL EQUIPMENT OF PRODUCTION LINE OF PECTIN PRODUCTS FROM RAW MATERIALS

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Statistical data concerning the development of the world economic activity give grounds for making the conclusion that the study the technological processes of obtaining pectic products will give the best results if you choose abroad citrus residues as raw material for the production of pectin. This is primarily due to high content of in these types of plant material, the degree of esterification (the use of pectin in food industry), as well as a large number of juice producing plants. However, the main advantage of the research is tropical citrus, in particular oranges and lemons.

In accordance with the chosen pectin-containing plant material for the development of hardware equipment of the line for the production of pectin products, it is necessary to select a scheme of technological process.

The basic processes of pectin production technology can be presented in the form of two schemes:

1. Preparation of raw materials → primary extraction (removal) of substances → purification → concentration → deposition → crushing → washing of the resulting substance → separation of fractions → buffering → re-grinding → drying → pectin powder → further use.

2. Preparation of raw materials → chemical extraction (extraction) of substances → separation of fractions → concentration (ultrafiltration) → purification (diafiltration) → drying or preservation of liquid pectin → further use.

In our opinion, the second scheme of obtaining pectin is preferable, because it is less energy-intensive and more productive than the previous one. In addition, this scheme reduces the duration of obtaining pectin, and has a minimum number of equipment involved in the production of high-performance products.

A great interest in considering the process of obtaining pectin products is the way of extraction. Extraction today is the most effective

method of obtaining pectin extract, which allows shorten the process time and completely provides extraction of pectic substances.

The extraction process for pectin-containing raw material occurs in one or more stages. Depending on the equipment, it may have one unit of equipment or several interconnected apparatuses (extractors). Regarding the type of reagent (water, acid, alkali, enzymes, etc.), the extractors have open, closed, semi-tight or sealed containers. Overall dimensions of the equipment are determined according to functional purpose and technical solution.

As we can see from the above, many extractors are used for the pectin extraction process. One of the features of each type of extractor is the passage time of the process, the presence of the working body and the type of extraction. The devices are equipped with a variety of turbulent elements and additional processes. One of the processes that allows intensify the process of extracting pectic substances is the mixing process. In the case of pectic substances extraction, the mixing process is used for the elimination of the phenomenon of forming the phase of distributing a solution of high concentration near the surface. It slows the mass transfer from the raw material to the solution. Mixing of the technological solution in the process of extraction occurs with the use of additional working units of the device – mixers and rotors of arbitrary shape. The analysis of various mixing elements, differing in form, size and area of application, shows that disk, blade and turbine mixers can be used for the intensification of pectic substances transition stage into the extractant solution. We have developed a plant for extracting pectic substances, in which a mixing element is set up similar to a shredder used in sweeping machines for mass catering establishments. Such a mixing element will simplify the design of the extraction plant by reducing the metal content. Also, in order to prevent the formation of a well for mixing viscous media, achieving greater uniformity and intensity of mixing, the structure of the stirring element is equipped with special partitions, which are additional blades.

Thus, the production of high-quality low cost pectic extracts requires the creation of not only modern technological processes and formulations, but also the selection and creation of modern hardware equipment for the production process that would meet all technological requirements regarding economy, convenience in service, reliability and environmental friendliness.