DEVELOPMENT OF AN ULTRASONIC SYSTEM TO INTENSIFY THE EXTRACTION PROCESS

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Extraction of biologically active substances is the most time-consuming stage of raw material processing. Traditional extraction methods often take hours, days or even weeks. The use of ultrasound can significantly expedite the extraction process, increase the yield and reduce the cost of the extracted substance, improve working conditions and increase its productivity.

The use of ultrasound has significant advantages over traditional raw material processing technologies. In particular, it provides deeper penetration of the solvent into the material with a cellular structure, reduces the processing time, provides a higher product yield and reproducibility, reduces solvent consumption, and increases the speed of the process. The equipment is low maintenance and less energy is used for processing; as a result, the process becomes more environmentally friendly and economically justified.

However, the development of ultrasonic equipment and technology is constrained by the low awareness of consumers about the effectiveness of ultrasonic exposure, and the lack of methodological recommendations that take into account the peculiarities of using ultrasonic technologies in small productions.

Far from being depleted, the possibilities of significantly increasing the efficiency of extraction technologies and devices through ultrasound. This reduces the need for chemical additives, and new principles of emitter design decrease the credibility of the inactivation of biologically active substances.

Piezoceramic materials are used increasingly in industry and household appliances nowadays. The piezoelectric element is an important link in electronics, mechanics, micro- and nanotechnologies (systems for intensifying biotechnological processes, etc.).

As a result of the project, theoretical positions of connection and coordination of oscillatory systems (components) of different physical nature (electromechanical, electrical, mechanical) for ultrasonic equipment have been created. The developed piezoelectric components of ultrasonic oscillatory systems have been studied through atomic force microscopy to determine the hidden micro defects at the initial stage of operation.

The authors have developed a technology for increasing the amplitude of resonant oscillations of a mobile ultrasonic system to intensify the extraction process by using the additional element method, which is used to optimize the main parameters of piezoelectric elements.

The practical point of view of the results can be beneficial for the food and pharmaceutical industry, the agricultural sector, and the instrument-making industry.

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Further research of the authors will be aimed at the optimal parameters for the concentration of extracts, choosing the optimal content of biologically active substances and micro- and macroelements in functional beverages.