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## EXTRACȚIA CU ULTRASUNETE A SUBSTANȚELOR BIOLOGIC ACTIVE DIN SEMINȚELE DE TOMATE ȘI ARDEI

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**Rezumat.** *S-a cercetat procesul de extracție a substanțelor biologic active (SBA) din semințele de tomate și ardei sub acțiunea cavitației ultrasonore în solventul alcool-apă în dependență de puterea câmpului ultrasonor, durata tratării, concentrația masică a amestecului solid-solvent. Tratarea semințelor din tomate și ardei în câmp cavitațional ultrasonor asigură reducerea duratei de extracție a substanțelor biologic active până la 8-10 ori, temperaturii – de la 95 la 50-55 °C și creșterea procentuală a SBA până la 9 -12%. Extracția substanțelor biologic active în dependență de amplitudinea oscilațiilor traductorului ultrasonor este maximă în intervalul de 15-25 μm. La durata de tratare mai mare de 30 min începe majorarea procentuală de extracție a SBA din semințele, după tratarea de peste 60 min volumul extras se stabilizează.*

**Cuvinte cheie:** *cavitația ultrasonoră, extracție, substanțe biologic active, semințe de tomate, semințe de ardei, glicozide steroidice*

## ULTRASOUND-ASSISTED EXTRACTION OF BIOLOGICALLY ACTIVE SUBSTANCES FROM TOMATO AND PEPPER SEEDS

**Abstract.** *The process of extraction of biologically active substances (BAS) from tomato and pepper seeds under the action of ultrasonic cavitation in the solvent ethanol-water as a function of the ultrasonic field power, the duration of ultrasonic treatment, and the mass concentration of the solid phase - solvent was studied. The ultrasonic treatment of tomato and pepper seeds allows one to reduce the duration of the extraction of biologically active substances by a factor of 8-10, to lower the process temperature from 95 to 50-55 °C, and to increase the percentage of biologically active substance in the end product up to 9-12%. The maximal extraction of biologically active substances was obtained for the values of the ultrasonic amplitude within the range of 15-25 μm. For the duration of treatment greater than 30 min the increasing of the yield of biologically active substances from tomato and pepper seeds was observed. For the duration greater than 60 min the yield dependence saturates.*

**Keywords:** *ultrasonic cavitation, extraction, biologically active substances, tomato seeds, pepper seeds, steroid glycosides*

### Introduction

Nowadays the necessity of development of clean production processes and recovery of valuable substances from wastes becomes the focus of attention [1]. During industrial processing of vegetable raw materials for production of vegetable and fruit juices, tomato paste, and wines, a great amount of solid wastes is produced, which contain a considerable amount of useful components. It is recommended to treat such wastes as by-products or raw materials for further processing with the aim of recovery

from wastes of various biologically active substances (BAS) with their subsequent utilization as food components or pharmaceuticals [2].

Tomato and pepper seeds contain biologically active substances belonging to the group of steroid glycosides (SGs). It was shown that SGs exhibit antitumor and anti-inflammatory properties [3], reduce the blood cholesterol, reveal antioxidant properties, suppress activity of phytopathogenic fungi, microorganisms, and viruses, and can stimulate plant growth [4]. It was also found out that tomatoside – a SG extracted from tomato (*Lycopersicon esculentum* Mill.) seeds exhibits antiviral activity exceeding the action of interferon samples [5], and preparation Pacovirin on its basis was proposed. It was recently shown that SGs from pepper seeds (capsicosides) prevent accumulation of lipids in adipocytes [6-8] and capsicoside G from pepper seeds may have potential in the treatment of obesity.

## **Results and discussion**

Ultrasound (US) installations for generation of ultrasonic cavitation were developed. The devices for registration of the principal parameters of the treatment were designed and manufactured. The installation for ultrasonic treatment of tomato and pepper seeds comprises an ultrasonic unit with the power of 400 W and regulated amplitude up to 40  $\mu\text{m}$ , and it is supplied with a cooling system. It also allows one to regulate the temperature.

The process of extraction of biologically active substances (BAS) from tomato and pepper seeds under the action of ultrasonic cavitation in the solvent 70% ethanol–30% water as a function of the ultrasonic field power was studied. The whole and powdered seeds were used. The duration of ultrasonic treatment was within 180 min; the mass concentration of the solid phase – solvent mixture of 1:10 was used.

The ultrasonic treatment of tomato and pepper seeds allows one to reduce the duration of the extraction of biologically active substances by a factor of 8-10, to lower the temperature from 95 to 50-55 °C, and to increase the percentage of biologically active substance in the end product up to 9-12%. The maximal extraction of biologically active substances was obtained for the values of the ultrasonic amplitude within the range of 15-25  $\mu\text{m}$ . For the duration of treatment greater than 30 min the increasing of the yield of biologically active substances from tomato and pepper seeds was observed. For the duration greater than 60 min the yield dependence saturates.

The quality of the extracted BAS was evaluated using IR spectra of the samples in the wavelength range of 4000-650  $\text{cm}^{-1}$ . The IR spectra of BAS extracted by

ultrasound method and by traditional procedure were virtually identical. Therefore, the US treatment does not lead to a negative destruction of BAS. The chemical composition of the BAS extracted from tomato and pepper seeds remains unchanged, and the extracted BAS can be used in pharmacy and cosmetics.

## Conclusions

1. US cavitation treatment of the whole and powdered tomato and pepper seeds in the ethanol-water solvent (70%) improves the process of extraction of steroidal glycosides (tomatoside and capsicoside).

2. The action of cavitation considerably increases the porosity of the seeds and their surface destruction. This intensifies the release of BAS into the solvent.

3. The ultrasound-assisted extraction of BAS from the tomato and pepper seeds at a temperature of 55 °C does not induce the variation of the chemical composition of the extracted compounds.

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