INFLUENCE OF BIOCATALYTIC PROCESSING OF OILSEED RAW MATERIALS ON THE EFFICIENCY OF VEGETABLE OIL EXTRACTION

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Rising demand for vegetable oils, as well as present-day requirements to improve their quality and safety, prompt the need for new strategies to increase target product yields not involving the use of potentially hazardous solvents and high-cost technologies.

Since oilseeds belong to a complex biological system, this paves the way for increasing the degree of oil extraction through the influence of hydrolases on the structure of raw materials, which is aimed at disrupting the association of lipid globules with cell wall components. To maximize the oil extraction from the cell, it is imperative to destroy the cell wall, disintegrate the cluster of reserve substances and the membrane system. The structure of the oilseed's cell walls is based on a complex of cellulose, hemicellulose, and pectin substances. The pectin hydrolysis by pectinases causes the wall to swell, as the bonding link between other polymers is removed from its structure. To achieve even deeper destruction of cell walls, it is reasonable to add cellulases and hemicellulases to the hydrolase complex. The most challenging aspect of oil extraction technology is to overcome protein-lipid interactions in the cell membrane system, as well as the bonds between proteins and lipids released from spherosomes upon disintegration of their membranes. Hydrolysis by endo-type proteases, which break down protein into large fragments, is more preferable for disintegrating localized clusters of reserve protein and destabilizing membranes.

Consequently, to develop an effective biocatalytic technology for vegetable oil production that maximizes target product yield, it is required to use an enzyme complex comprising the widest range of hydrolases, namely pectinase, cellulase, hemicellulase, and protease.

This study suggests an improved method for preparing sunflower seed meats for pressing by treating it with a complex of enzyme agents such as Alcalase 2.4 L FG and Viscozyme L. To analyze the collected data and optimize the parameters, the response surface methodology was chosen based on the central composite rotational design.

The research has revealed the feasibility of using a hydrolase complex to prepare sunflower seed meats for oil extraction with the aim to increase the efficiency of the pressing process. A mathematical model has been designed to predict the oil yield based on the parameters of biocatalytic raw material treatment. Reasonable intervals of their values were established for each of the predictors and the optimal parameters were calculated to obtain the maximum oil yield.

These findings will provide grounds for the development of a new resource-saving technology for the integrated processing of oilseed raw materials.