

New high-protein feed components obtained by valorization of waste biomass

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Abstract

The consequences and dangers of the continued growth of the global population are attracting more and more attention from the scientific community. As the population increases, there is a growing need to provide adequate amounts of food in a way that does not endanger the environment. This goal can be achieved through the sustainable management of natural resources, including the rational management of biomass crops used in agri-food processing.

In response to growing challenges, in 2015 the United Nations General Assembly adopted the United Nations Resolution for Sustainable Development 2030. According to this document, the realization of sustainable development goals can be achieved, for instance, through the implementation of the concept of a circular economy, which according to the premise aims to create a production process without generating waste. Managing waste and giving it new functionality is a benefit both for the manufacturer (the possibility of increasing the financial turnover of the company) and for the consumer (the availability of a new full-value product). The answer to this challenge is, for example, the concept of coupling processing with valorization of generated waste biomass.

The purpose of the work was to develop methods of increasing the feed value of selected food industry by-products: beet pulp and rapeseed meal by enriching them with microbial protein. Pulp, as a waste biomass, is severely depleted in nutrients and, due to its high water content, highly susceptible to the growth of undesirable microflora. Their rapid management is therefore required. Rapeseed meal, as a post-production biomass with limited use in animal nutrition, can also become a protein-enriched product with greater digestibility after appropriate processing and modification of its content.

The scope of work carried out included: selection of conventional and unconventional yeast strains capable of growth in the obtained hydrolysates of biomass of sugar beet pulp and rapeseed meal; selection of conditions for conducting hydrolysis of biomass of sugar beet pulp and rapeseed meal using varying concentrations of enzyme preparations and varying degrees of hydration of the medium; carrying out processes of simultaneous hydrolysis of plant biomass and multiplication of yeast cells; evaluating the efficiency of the conducted processes by controlling the hydrolysis process and the degree of liquefaction of biomass, measuring the sugar content, controlling the efficiency of yeast multiplication, measuring the increase in protein content, determining the crude fiber content and analyzing the amino acid profile of a selected component obtained on the base of rapeseed meal.

The developed processing conditions allowed for efficient yeast growth in both rapeseed meal and sugar beet pulp hydrolysates, as well as an increase in protein content by 2-3% (w/w) while reducing crude fiber content - a parameter that limits digestibility and availability of nutritional compounds. For the processes carried out with rapeseed meal, an improvement in the amino acid profile of the obtained feed component was noted, as well as the transformation of bioactive compounds from the isoflavone group into derivatives with higher nutritional value. Research on the use of fresh sugar beet pulp and rapeseed meal were extended to the processes of scaling up to a fractionally technical scale at an industrial facility - the Dobrzelin Sugar Factory.