

B.8. VALORIZATION OF BREWING INDUSTRY WASTE WITHIN THE CIRCULAR ECONOMY FRAMEWORK

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Abstract. The brewing industry, a significant global producer with an annual output of approximately 1.86 billion hectoliters, generates substantial quantities of organic waste that present both environmental challenges and economic opportunities. This paper analyzes the

transition from traditional disposal methods, such as animal feed, toward advanced valorization strategies for the industry's primary byproducts: Brewers' Spent Grain (BSG), Brewers' Spent Yeast (BSY), spent hops, and pot ale. The study details the complex chemical composition of these waste streams, highlighting the presence of cellulose, proteins, beta-glucans, and polyphenols. The methodological approaches discussed for waste transformation include: biotechnological conversion - utilizing BSG and BSY as substrates for the production of enzymes, organic acids (lactic, citric), and functional food ingredients such as xylitol or pullulan; energy recovery - the processing of spent grain for biofuel and thermal energy production, as well as the application of pot ale in anaerobic digestion for biogas generation; pharmaceutical and environmental applications - extraction of bioactive compounds like xanthohumol from hops for antimicrobial purposes and the use of BSG as an adsorbent for heavy metal removal in wastewater treatment; emission management - the capture and purification of fermentation-derived CO₂ for reuse in carbonating beverages, effectively reducing the carbon footprint of production facilities. Acknowledgments: Institutional Project 020405 "Optimizing food processing technologies in the context of the circular bioeconomy and climate change", Bio-OpTehPAS, being implemented at the Technical University of Moldova.

Keywords: circular economy, Brewers' spent grain, valorization, biotechnology, sustainability, waste management.