

Bioactive Compounds Produced Using Agro-Industrial Waste Substrates: A Literature-Based Perspective on Sustainable Applications in the Bioeconomy

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Abstract: Microbial biosurfactants represent a class of eco-friendly surface-active compounds with diverse industrial applications, including bioremediation, agriculture, pharmaceuticals, and cosmetics. Scientific literature highlights the increasing potential of biosurfactants as sustainable alternatives to synthetic surfactants, due to their biodegradability, low toxicity, and functional versatility. Recent studies demonstrate that various microbial strains - particularly bacteria and yeasts - can efficiently produce biosurfactants using low-cost agro-industrial wastes, such as used vegetable oils, molasses, or dairy by-products, thereby aligning production with circular economy principles. According to the literature, the results support the integration of biosurfactant bioprocesses into sustainable value chains that enhance microbial biodiversity, reduce environmental impact, and foster innovation in the bioeconomy [1]. The valorization of waste through microbial biotechnology represents a strategic direction for sustainable development and resource-efficient biomanufacturing.

Keywords: biosurfactants; agro-industrial wastes; sustainability; circular bioeconomy.

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References

1. Miao, Y.; To, M.H.; Siddiqui, M.A.; Wang, H.; Lodens, S.; Chopra, S.S.; Kaur, G.; Roelants, S.L.K.W.; Lin, C.S.K. Sustainable biosurfactant production from secondary feedstock-recent advances, process optimization and perspectives, *Front. Chem.* **2024**, *12*, 1327113. doi: 10.3389/fchem.2024.1327113