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Sustainable Microbial Protein-Rich Biomass-Derived Ingredients

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Abstract

Protein- rich biomass fermentation is a scalable and economically competitive technology. It offers a promising solution for enhancing food security and reducing the carbon footprint of highly urbanized environment like Singapore. Building on our expertise in developing scalable cultivation and downstream processing approaches demonstrated in pilot scale to produce multiple microbial biomasses and biomass derived ingredients [1-3], we are currently focusing our efforts on feedstock sustainability through the utilization of regional agri-food side streams as feedstock for biomass fermentation under the Bezos Center for Sustainable Protein at the National University of Singapore (NUS). Our research transforms agri-food side streams like brewers spent grain (BSG) and palm kernel expeller (PKE) into high-value ingredients through a circular biorefinery approach. By optimizing hydrolysis, we successfully released over 70% of Carbon and Nitrogen, creating high-efficiency media for microbial fermentation. To date, our process has delivered impressive biomass yields (>0.4 g/g) and a microbial protein content of over 50% using our BSG hydrolysate without further supplementation. We have further refined these outputs into functional protein concentrates with a 65%protein purity, offering a scalable solution for sustainable urban nutrition.

References

[1] Singapore Patent Application No. 10202501283S. M. Weingarten, B. Balagurunathan, I. Bin Adam, S. T. Ngoh, L. Ji: Production of a protein-rich whole cell product as an alternative protein ingredient using red yeast *Rhodotorula toruloides*.

[2] Singapore Patent Application No. 10202501736X. M. Weingarten, B. Balagurunathan, S. R. Puniredd, Y. S/O Kanagasundaran, I. Bin Adam: Downstream processing of microbial biomass for novel products with enriched nutritional ingredients

[3] Technology Disclosure:Z2025-305 -*Kluyveromyces lactis* F32359: A high-yield yeast for sustainable protein and dairy alternative applications.