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Valorization of Spent Coffee Grounds Biomass for Synbiotic and Prebiotics Development for Functional Food Applications

Kumar Pankaj (ITMO University)
Scientific Supervisor – Candidate of Technical Sciences,Associate Professor,Boulkrane M.S.(ITMO University)

Introduction

This research aims to explore the use of Spent Coffee Grounds (SCG) biomass for isolating prebiotics and developing synbiotic ingredients with potential health benefits for human nutrition. Coffee is one of the most consumed beverages globally, second only to petroleum in commercial value. In 2021–2022, global coffee consumption reached 170.3 million 60- kilogram bags, with projections of 12 million tons by 2030. Spent coffee grounds (SCG), a by- product of coffee brewing, are generated in large quantities, with 18 million wet tons produced globally in 2021. SCG disposal poses environmental challenges, as landfilling risks spontaneous combustion and greenhouse gas emissions. However, SCG are rich in dietary fibers, polysaccharides, and oligosaccharides, making them a potential source of prebiotics that support gut health by promoting beneficial bacteria. Studies show that SCG-derived oligosaccharides resist gastric digestion and enhance short-chain fatty acid production, offering health benefits like improved lipid levels, blood glucose control, and weight management at lower doses compared to traditional prebiotics [1,2].

Main Part

1) Assess spent coffee grounds as a biomass source for prebiotic fibers and synbiotic formulations through compositional and functional analysis.
2) Optimize processing methods (enzymatic, chemical (eutectic solvents), physical) to convert spent coffee grounds biomass into bioactive prebiotic ingredients.
3) Characterize prebiotics from spent coffee grounds biomass, focusing on molecular composition, fermentability, and impact on gut microbiota.
4) Develop synbiotics by combining SCG biomass derived prebiotics with probiotics.
5) Investigate the health effects of SCG biomass-based prebiotics and synbiotics on gut microbiota through in vitro studies.

Conclusion

In future this research will focus on scalable methods to convert spent coffee grounds (SCG) biomass into synbiotic ingredients for functional foods. Advanced extraction and optimization techniques will enhance yield and quality, while long-term studies will assess their impact on gut microbiota and metabolic health. Industry collaboration will drive commercialization, promoting sustainability and reducing coffee waste globally.

References

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