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Turning Side Streams into Value: Technological Insights, Challenges and Practical Examples

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Abstract

The environmental impact of food production is immense, yet approximately 30% of all food produced is lost or wasted from farm to table. Food processing accounts for 35% of these losses, making it a critical stage in the value chain to address. These losses often occur in the form of so-called side streams such as e.g. cocoa hulls from cocoa roasting or wheat bran from flour milling. Side streams are often nutritionally valuable and economically underutilized but pose challenges such as a potential risk of biological or chemical contaminants. The aim of the presented work is to develop processing strategies to valorise side streams into valuable food ingredients and in a second step to produce desirable food products containing valorised side streams in substantial fractions (>20%). 14 side streams were selected based on their environmental impact and the amount generated. Detailed analyses were then conducted to assess the technofunctional, biological, chemical, and nutritional quality and challenges of these side streams such as biological and chemical contaminants as well as potential legal restrictions. Additionally, the feasibility of various upcycling processes was explored, including mechanical, thermal, biological, and chemical treatments, to enhance the side streams' suitability for further applications. Lastly, prototype food products were developed for the five side streams cocoa hulls, coffee spent ground, coffee silverskin, spent grain and barley rootlets with the aim of using substantial amounts of the side streams while achieving a desirable taste and texture of the food products. Results include (a) Classification and Potential Analysis: Overview of opportunities, limitations, and environmental impacts of valorizing side streams in food production, (b) Product Development & Evaluation: Assessment of 3 prototype products based on side streams (chocolate containing cocoa bean hulls, meat analogues containing barley rootlets and/or brewer’s spent grain, granola containing coffee spent ground and/or coffee silverskin. The results include the analyses of technological processability, sensory quality, safety, legal aspects and the environmental impact. (c) Practice-Oriented Decision Support: Provision of clearly structured decision trees that guide companies step by step from side stream to market-ready final product. The project highlights the strong potential of using valorised side streams in high quality end products, thus contributing to a more sustainable food system. Together, both presentations provide a practice-oriented basis for moving from technical feasibility to environmentally robust implementation.

Keywords: Side streams, valorisation, technology, food quality, food products

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