



Metabolomic Analysis of Brewery Trub and Comparative Study of Production Matrices for Nutraceutical Valorization

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Project description (max 300 words)

Trub, the sediment produced during brewing, is a by-product rich in bioactive compounds that remains largely underutilized. In a circular economy perspective, this PhD project aims to valorize trub as a matrix for the sustainable recovery of nutraceutical substances, such as hop-derived α - and β -bitter acids and prenylated flavonoids. These compounds, known for their potential antioxidant and antimicrobial activities, will be extracted using environmentally friendly methods and characterized to assess their functional value. Advanced analytical techniques will be employed for the chemical characterization of trub extracts. High-resolution HPLC-HRMS and NMR spectroscopy will allow for the identification and quantification of key metabolites; in parallel, a metabolomics approach based on Feature-Based Molecular Networking (FBMN) will support the comparison of chemical profiles from trub collected at different industrial breweries. This multi-site comparative study will make it possible to identify a core set of shared bioactive metabolites, making trub a more stable and standardizable raw material regardless of its origin. The obtained trub extracts will be subjected to **in vitro** and cell-based biological assays to evaluate their health-promoting properties. In particular, antioxidant activity (TPC, FRAP, DPPH, and ABTS) and cytoprotective effects will be assessed, confirming the potential of trub as a safe and effective functional ingredient. The proposed objectives are structured over a three-year period, ensuring experimental feasibility. Extraction and analysis protocols will be optimized, a database of characteristic trub metabolites will be created, and the biological effects of the extracts will be validated. This integrated approach will lay the groundwork for future developments such as industrial scale-up and concrete nutraceutical applications, promoting the use of trub as a sustainable and readily available source of new functional ingredients.

The third mission activity will be carried out within the framework of the Agreement with the La Tenda Association and will focus on interactive meetings aimed at educating project participants and their families on the importance of prevention, healthy eating, and safe use of medicines, particularly antibiotics.

This objective will be achieved by implementing laboratory activities conducted by educators of the La Tenda Association in collaboration with the group coordinated by the proponent.

The project includes a 6-month internship at the research group of Prof. Dr. Nikolai Kuhnert of Jacobs Bremen University.



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REFERENCES

1. Silva KFC et al. 2024. *Unlocking hot trub's potential: a simple method for extracting bitter acids and xanthohumol*. J Sci Food Agric.
2. Costa FSF et al. 2021. *Reuse of hot trub as an active ingredient with antioxidant and antimicrobial potential*. Waste Biomass Valor.
3. Ziemah J et al. 2024. *Antibacterial activity potential of industrial food production waste extracts against pathogenic bacteria: comparative analysis and characterization*. Foods.
4. Dusek M et al. 2014. *Qualitative determination of β -acids and their transformation products in beer and hop using HR/AM-LC-MS/MS*. J Agric Food Chem.

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