Enhancing natural products extraction: using metabolomics for evaluating analytical methods

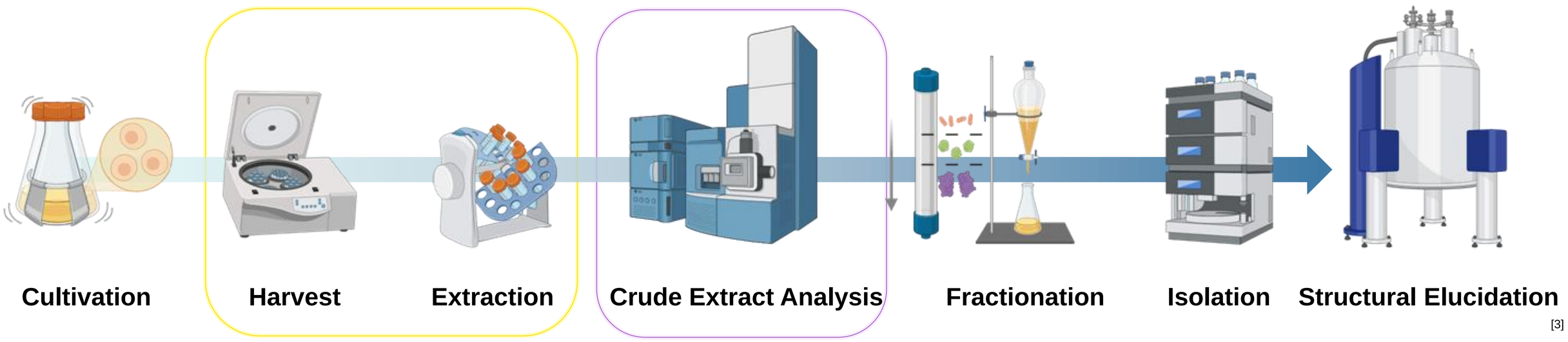
Elisa de Lannoy Guerra[1], Simon Cremers[2], Felix Penth[3], Daniela Becher[3], Ronald Garcia[2], Alexander Voltz[2], Sebastian Walesch[2], Chantal Bader[2], Daniel Krug[1,2], Rolf Müller[1,2]

[1] Universität des Saarlandes, Department of Pharmacy, Campus E8.1, 66123 Saarbrücken, Germany
[2] Department of Microbial Natural Products, Helmholtz-Institute for Pharmaceutical Research Saarland (HIPS), Helmholtz Centre for Infection Research (HZI) and Department of Pharmacy at Saarland University, Campus E8.1, 66123 Saarbrücken, Germany
[3] MyBiotech GmbH, Industriestraße 1b, 66802 Überherrn, Germany

Abstract

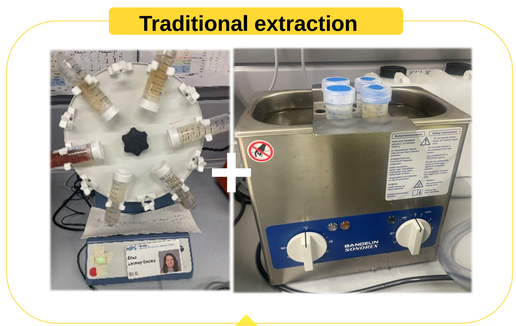
Microbial natural products are historically known for their role in antibiotic discovery and potential for other drugs development [1]. The success of isolating new microbial natural products depends not only on enhancing biotechnological cultivation techniques, but also on extraction and analytical methods [2]. From this perspective, alternative methods are being explored both to maximize the extraction efficiency of secondary metabolites and to achieve environmentally friendly processes. To assess if a greener technique can substitute or complement traditional approaches, we employ here a metabolomics-based approach for evaluating alternative methodologies from the natural products perspective. In this context, techniques that aim to diminish the quantity of solvent use, and therefore being eco-friendlier, were chosen for the current study. This poster outlines two experimental setups in which metabolomics is used to evaluate extraction and analytical analysis of bacterial crude extracts, respectively. To address the extraction process, a microreactor is being tested for facilitating the extraction of endometabolites by disrupting cells without the need of solvent use. For the analytical step, a supercritical fluid chromatography method – UltraPerformance Convergence Chromatography (UPC²) – coupled to mass spectrometry (MS) is compared to a conventional Ultra-High Performance Liquid Chromatography (UHPLC) coupled to mass spectrometry-system for analysing myxobacterial crude extracts.

MICROBIAL NATURAL PRODUCTS ANALYSIS WORKFLOW

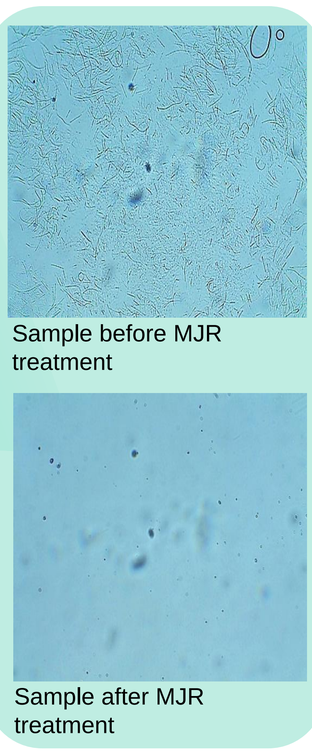


[3]

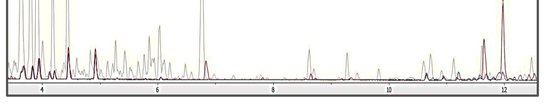
EXTRACTION EVALUATION



MicroJet Reactor (MJR) [4,5]

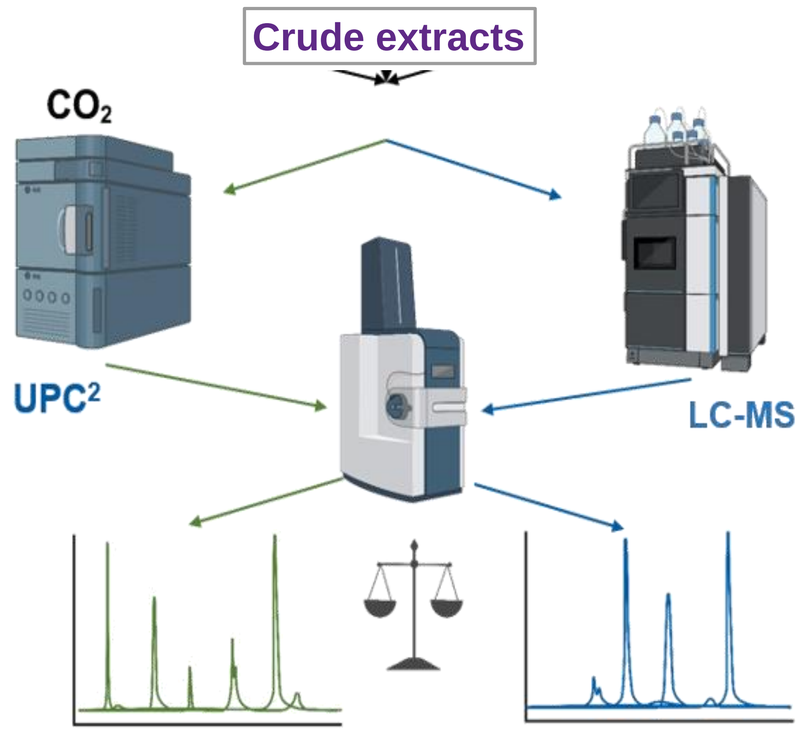


Microscope image at 40x magnification



LC-MS Chromatogram of crude extract samples with and without previous MJR treatment overlapped. In red: sample undergone MJR process, in gray: sample without MJR process.

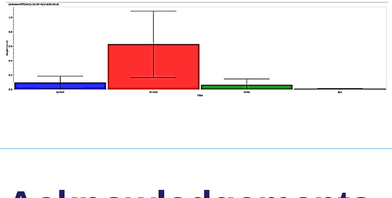
CRUDE EXTRACT ANALYSIS



METABOLOMICS DATA-ANALYSIS

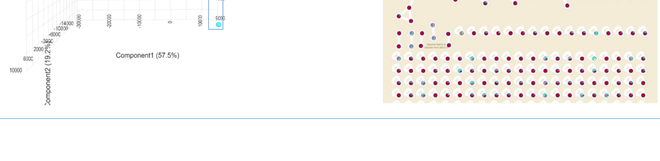
1: Analysis of chromatogram + m/z spectrogram

2. Identification of compounds (annotation)



3. Comparison of number of features

4. Group different features/ Statistical tools for visualization

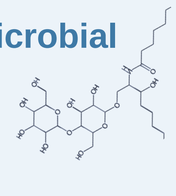


OUTCOME

Understanding when greener methods can enhance extraction and identification of natural products

Understanding which type of natural products supercritical fluid chromatography can highlight

To facilitate the discovery of a new microbial natural product



Ultimate goal

To find a new molecular structure with the potential to the development of novel antibiotic

Acknowledgements

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MARIE CURIE ACTIONS

References

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[5] **Baumstümmler, B., Türeli, A. E., Penth, F., Müller, D. & Krumbholz, R.**, 2020. *EP 3 938 088 B1*. European Patent Office