

# How sustainable is sustainability? Recovery of bioactives from food processing waste

**D. Emide<sup>1\*</sup>, L. Periccioli<sup>1</sup>, G. Ceravolo<sup>1</sup>, S. De Benedetti<sup>1</sup>, C. Magni<sup>1</sup>, A. Scarafoni<sup>1</sup>**

<sup>1</sup>*DeFENS, Università degli Studi di Milano, via G. Celoria, 2, 20133 Milan, Italy*

\*[davide.emide@unimi.it](mailto:davide.emide@unimi.it)

The modern agri-food industry, crucial for global nutrition, generates significant by-products often considered waste, posing economic and environmental challenges. By-products are secondary products unintentionally obtained from the manufacturing process, while waste refers to inefficient activities that add no value. Waste is generated throughout the entire food lifecycle, from production to distribution [1]. They are frequently incinerated or sent to landfills, causing air, water, and soil pollution [2]. Agri-food waste can alternatively be used as animal feed, yet both waste and by-products contain valuable molecules for scientific research and sustainable solutions in a circular economy. Agri-food by-products contain compounds for biostimulation, green pesticides, and nutrition, requiring chemical-physical treatments to realize their potential. Therefore, revalorization of agri-food waste biomass creates high-value products and addresses waste accumulation [3], underscoring the importance of economical evaluation in this process.

Despite studies on pure isolated bioactive compounds, significant gaps persist in understanding their interactions with matrices, influenced by their supramolecular characteristics, which affect their behavior during isolation. Matrix effects impede the exploration of biological activities such as biodefense or biostimulation, stemming from molecular changes that occur during processing. Overcoming these challenges requires innovative biochemical strategies and enzymatic treatments.

The recovery of bioactives from food processing waste highlights critical challenges for the agri-food sector. Private and public companies in nutraceuticals, food packaging, and agriculture stand to benefit significantly from these innovations. Crucially, EU policies play a pivotal role in managing food waste and by-products, advancing a sustainable circular economy by reducing waste and optimizing resource efficiency [4].

## References, notes, and acknowledgements:

1. Kumar, K. et al. (2017) 'Food waste: a potential bioresource for extraction of nutraceuticals and bioactive compounds', *Bioresources and Bioprocessing*. Springer Science and Business Media Deutschland GmbH, 4, 1-14. doi: 10.1186/s40643-017-0148-6.
2. Socas-Rodríguez, B. et al. (2021) 'Food by-products and food wastes: are they safe enough for their valorization?', *Trends in Food Science and Technology*. Elsevier Ltd, 114, pp. 133–147. doi: 10.1016/j.tifs.2021.05.002.
3. Massironi, A.,(2023) 'Valorization of pumpkin seed hulls, cucurbitin extraction strategies and their comparative life cycle assessment', *Journal of Cleaner Production*, 427, p.139267. doi: 10.1016/j.jclepro.2023.139267.
4. Wunder, S. et al. (2018) 'Food waste prevention and valorisation: Relevant EU policy areas'. Report of the REFRESH project, D3.3 review of EU policy areas with relevant impact on food waste prevention and valorization.

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