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Separation and Purification of Rapeseed Polyphenols

Roksolana Fromel¹, Andrej Rondoš^{1,2}, Ján Janošovský¹

¹*Centrum výskumu a vývoja, s. r. o., Trnavská cesta 1033/7, Leopoldov, Slovakia*

²*Department of Laboratory Medicine, Trnava University, Univerzitné nám. 1, Trnava, Slovakia*

e-mail: jan.janosovsky@cvav.eu

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Polyphenols are valuable natural compounds with **increasing demand in food and cosmetics** due to their **natural bioactive** properties. Rapeseed meal (RSM), a major agri-industrial by-product of rapeseed processing, represents an abundant and underutilized source of phenolic compounds. Analysis of rapeseed meal produced within Envien Group showed that the total concentration of phenolic compounds was approximately 400 mg/kg, dominated by **sinapic acid**. This contribution focuses on the valorization of rapeseed meal through the development of efficient separation and purification technologies for polyphenol recovery, in line with sustainability and circular economy principles.

Our work investigates **rapeseed meal-derived feedstocks** as source of polyphenols. Sinapic acid accounts for more than 85 % of all quantified phenolic acids in rapeseed meal, with minor contributions from protocatechuic, 4-hydroxybenzoic, and ferulic acids (ca. 10 % combined). The proposed pilot process integrates solvent extraction, membrane filtration for protein-containing streams, and adsorption on polymeric resins followed by ethanol desorption. Systematic adsorbent screening, and equilibrium and kinetic studies were performed to support process optimization and scalability. For powder production, vacuum drying as well as lyophilization were tested. The examined polyphenol applications cover skincare cosmetics and natural preservatives in food.

Pilot-scale experiments confirm the feasibility of scaling up polyphenol recovery while maintaining compatibility with existing rapeseed meal and protein isolate processing lines. Overall, the developed process enables the production of high-value rapeseed-derived polyphenol extracts and supports the **integration of circular bioeconomy** and creation of new supply chains with focus on material sustainability.

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