PP-320 [Apitherapy]
Improving the nutritional and functional profile of coconut bee pollen through supercritical fluid extraction-based cell wall disruption

Anamika Sharma[1], Avinash Thakur[2], Vikas Nanda[1]
[1]Department of Food Engineering and Technology, Sant Longowal Institute of Engineering and Technology, Longowal, Sangrur, India
[2]Department of Chemical Engineering, Sant Longowal Institute of Engineering and Technology, Longowal, Sangrur, India

Background: Bee pollen is recognized as a nutrient-rich super food with bioactive compounds. However, its robust cell wall limits the bioavailability of these compounds, reducing its potential benefits. Elevating the degree of cell wall disruption can unlock bioactive compounds, improving the nutritional and functional properties of bee pollen.

Problem Description : The cell wall of bee pollen presents a challenge for bioavailability, restricting its use in functional food and nutraceutical formulations. Conventional methods of cell wall disruption often fall short of optimizing the release of bioactive compounds while maintaining nutritional integrity. Therefore, an efficient and eco-friendly method is needed to improve nutrient accessibility and techno-functional properties.

Methodology: Supercritical fluid extraction (SFE), a green and efficient cell wall disruption technique, was employed in this study. Response Surface Methodology (RSM) was used to optimize SFE parameters—pressure (400 bar), temperature (40°C), and time (40 min)—to achieve maximum wall disruption and enhanced functional properties. The optimized bee pollen samples (SCOP) were analyzed for compositional, thermal, and functional properties, as well as amino acid profiling and in vitro digestibility.

Results and CONCLUSION: The optimized SFE process significantly enhanced the nutritional composition of bee pollen, increasing crude protein (29.36%), lipids (11.43%), and carbohydrates (42.85%) compared to untreated bee pollen (UTP). Techno-functional properties such as solubility (43.69%), water-holding capacity (1.65g/g), oil-holding capacity (2.25g/g), emulsifying activity (62.58%), and emulsion stability (47.56%) improved substantially. Mineral analysis revealed elevated levels of essential macro and trace minerals, while amino acid profiling showed enrichment in essential (4.57mg/g) and non-essential amino acids (5.51mg/g). In vitro digestibility increased from 60.68% to 81.81%, confirming enhanced nutrient accessibility. The findings demonstrate the effectiveness of SFE in improving bee pollen's nutritional, functionality, and digestibility

Practical Application for Beekeepers: Beekeepers can leverage the findings of this study to increase the commercial value of bee pollen. By adopting supercritical fluid extraction technology, they can produce high-quality bee pollen with enhanced nutritional and functional properties. This optimized product can be marketed to functional food and nutraceutical industries. Additionally, the improved digestibility and versatility in food formulations make it more appealing to health-conscious consumers, creating opportunities for premium product offerings.