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Methodology for Sustainable Solvent Extraction and Analysis of Chia Seed Oil and Precipitated Protein from Meal

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Introduction: Seed of the Chia plant (*Salvia hispanica* L.) has been ascribed a “Superfood” status due to its remarkable nutritional profile, which includes high levels of omega-3 fatty acids, dietary fiber, antioxidants, and proteins (Zare et al., 2024). These attributes have propelled chia seeds into the spotlight as a valuable ingredient in both food and nutraceutical industries. Although the extraction of the seed for oil remains the most wildly used industrial application, more research is now done into the valorisation of waste from this process including for its protein, mucilage among others (Nevara et al., 2023; Sharma & Kaur, 2025). Traditional extraction methods for chia seed oil are mainly based on cold pressing, and alternative solvent extraction, especially with n-hexane, is also commonly employed. However, in consideration of more environmentally friendly solvents and processes, there is a growing need to develop sustainable methodologies that reduce environmental impact while maintaining or enhancing product quality (Masoodi et al., 2022; Prasad et al., 2022). The methodology for this study aims to evaluate the effect of sustainable solvent (i.e. 2-Methyltetrahydrofuran) in comparison with conventional solvent (i.e. n-Hexane) on the quantity and quality of extracts of seed oil from chia (0/18 Accession Grown in Omsk), and subsequent precipitated protein from its meal.

Main Part (Objectives):

1. To evaluate the relative effect of green solvent-based extraction method for obtaining high-quality chia seed oil with minimal environmental impact;
2. To investigate the precipitation and recovery of protein from the residual meal after oil extraction of the eco-friendly approaches (*in objective 1*)
3. To evaluate the physicochemical properties, nutritional composition, and functional characteristics of both the extracted oil and precipitated protein.

The study will employ advanced analytical techniques such as gas chromatography-mass spectrometry (GC-MS) for lipid profiling and Fourier-transform infrared spectroscopy (FTIR) for protein characterization.

Conclusion: The result from this study would help demonstrates the effect of utilizing novel sustainable solvent (i.e. 2-Methyltetrahydrofuran) on the extraction and improving quality of analysed seed oil of chia and protein from its meal, while offering a promising alternative to current industrial methods. This will help also reduces the ecological footprint in association with valorisation of food waste. Furthermore, there is potential that extracts could have improved bioactivity of therapeutic importance. These results could play crucial for various industrial applications, including food, pharmaceuticals, and cosmetics. Thus, the findings will contribute to the advancement of sustainable practices in the food and biotechnology industries, while also solidifying the efficient utilization of chia seeds as a valuable nutritional resource.

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