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Microwave hydrodiffusion and gravity model with a blend of high and low power microwave firing for improved yield of phenolics and flavonoids from oyster mushroom

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ABSTRACT

Oyster mushrooms are a globally important entity both commercially and therapeutically with immense food value. The work describes a successful application of a unique method of microwave hydrodiffusion and gravity combining optimal mix of high and low power microwave firing for the extraction of phenolics and flavonoids principles from oyster mushroom for the first time. Initial firing of microwaves at higher power level (510 W for 2 min and 340 W for 2 min) was applied followed by sustained microwave firing at 170 W till the completion of the extraction as indicated by physical oozing out of the aqueous extract. Such a combination of microwave firing in microwave hydrodiffusion and gravity (MHG) method (26 min) successfully produced two times more yield of extract with 57.7% ± 2.8 and 82.3% ± 3.7 more content of phenolics and flavonoids, respectively, when compared to 5 h Soxhlet extraction and that too with a better reproducibility. Mapping of individual phenolics/flavonoids were carried out and SEM images were studied for better understanding of the operational aspects. The research aims towards canvassing green technologies as in the near future only those technologies shall survive which are in tandem with environment.

1. Introduction

Oyster mushroom is one of the most popular edible mushrooms with high nutritional value and also can be easily cultivated from various agro-industrial residues with minimal effort. Recently these mushrooms have gained added advantage owing to their rapid use as functional foods due to their potential beneficial effects on human health which makes them a high priority commercial entity for the food industry (Corrêa et al., 2016). Apart from their nutritional richness in terms of presence of various phenolics/flavonoids and other antioxidants; oyster mushrooms also possess potent antinociceptive, antitumor, antioxidant, and immunological activities. A comprehensive review on the health promoting aspects of mushrooms and on the nutritional and therapeutics benefits of oyster mushroom in particular have been vividly crafted and published by Ma et al. and Correa et al. respectively (Corrêa et al., 2016; Ma et al., 2018).

Having said and understood about the therapeutic and commercial significance of oyster mushroom, it becomes need of the hour to adopt to green and sustainable extraction methods for large scale economical extraction of nutraceutical principles so that the growing demands of food industries can be met. In this regard, industries dealing with natural products as the source of raw material need to apply various solvents to accomplish the task of extract preparation (Kala et al., 2016). In such cases, contamination of finished product with trace residue of solvent used in the extraction process becomes a serious issue (Chemat et al., 2020). When dealing with plant derived extracts, at the production level it must be fully ensured that the finished product (dry extract) should be free from contamination particularly traces of any organic solvent which was used during the extraction process. Henceforth, an approach of microwave hydrodiffusion and gravity (MHG) was adopted which does not make use of any solvent and relies on extraction of contents from the ruptured cells and glands due to microwave heating. MHG basically is an innovative "upside down" extension of microwave assisted extraction system (Li et al., 2013). It combines microwave heating and earth's gravity at atmospheric pressure. This technique is best applicable for plant matrix which contains moisture (Bittar et al., 2013; Ciriminna

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