



Pharmaceutical Excipients as Alternative Solvents for Green Microwave Extraction of Herbs

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Abstract

A suitable method for the preparation of herbal extracts plays an important role in the development of herbal products, which are practically ready for commercialization. Various conventional methods for herbal extractions, such as Soxhlet extraction, heat reflux, and maceration, are process-intensive and expensive in terms of energy, time, and required huge volume of organic solvents. In addition, most organic solvents used for herbal extraction in laboratory research are toxic and therefore not suitable for large scale application in herbal product industries. Therefore, the innovative extraction methods are focused on green technologies that are friendly to the environment and humans, and also reduce the cost of production. Recently, microwave extraction with alternative green solvents has been proposed as a feasible alternative approach for improving both the extraction efficiency and safety profile of herbal products. In this regard, various pharmaceutical excipients, such as the excipients in the formulations of cream, lotion, dermal patch, and pastille, have been successfully used as alternative green solvents for the development of herbal products using the green microwave extraction. For example, the excipients involved in a cream base, i.e, isopropyl myristate and cetyl alcohol, have been used as alternative solvents for extraction of α -mangostin from mangosteen (*Garcinia mangostana* L., Clusiaceae) pericarp powders to produce 2.0% w/w α -mangostin extracts, which can be used directly for the formulation of anti-acne creams and oral-ulcer gels without the step of solvent evaporation [1]. The excipients of pastilles, namely glycerin and a eutectic mixture of sucrose and citric acid, have been used for the extraction of [6]-gingerol from ginger (*Zingiber officinale* Roscoe, Zingiberaceae) powders to obtain 1.7% w/w [6]-gingerol extracts for the formulation of anti-emetic pastilles [2]. A plasticizer used in the formulation of a natural-based dermal film, such as propylene glycol, has been used as an alternative solvent for the preparation of 1% w/v phenylbutenoid extract from Cassumunar ginger (*Zingiber cassumunar* Roxb, Zingiberaceae) powders for the development of analgesic and anti-inflammatory dermal patch [3]. These approaches are not only free from toxic organic solvents, but also reduce the cost of production by skipping the step of solvent evaporation in the process of preparing the herbal extracts.

Keywords: Green Extraction, Microwave Extraction, Pharmaceutical excipient, α -Mangostin, [6]-Gingerol, Phenylbutenoid

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