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THE PHARMA REVIEW (SEPTEMBER 2009)

**Microwave-Assisted Extraction – A Promising Extraction Technique for Natural Products**

Manish Devgun, Arun Nanda and S. H. Ansari

**Abstract:** Since the last decade, there is enhanced interest for the use of Microwaves for the extraction of the constituents from plant material. The traditional techniques like maceration, percolation, decoction, etc., are time- and solvent- consuming. This review brings into prominence the importance of novel methods of extraction for delivering high quality product. The microwave-assisted extraction (MAE) technique is a promising technique which is highlighted by increased extraction yield, decreased time and solvent consumption; moreover the reproducibility is better. A brief theoretical background of the principles involved and the types of instruments used has been presented. The main parameters like microwave power, extraction time, solvents, temperature and matrix characteristics, etc., which influence the MAE have been discussed. The application of optimization techniques, such as Factorial Design, to MAE has been highlighted, with examples. The potential applications of this technique and its performance vis-à-vis that of classical techniques have been elucidated.

**Introduction**

The history of herbal medicine is as old as human civilization. The widespread use of herbal remedies and healthcare preparations, as those described in ancient texts such as the Vedas and the Bible, and obtained from the commonly used traditional herbs and medicinal plants, has been traced to the occurrence of natural products with medicinal properties. World Health Organization (W.H.O.) currently encourages, recommends and promotes traditional/herbal remedies in National Health Care Programmes because such drugs are easily available at low cost, are comparatively safe and the people have faith in such remedies.

Plants synthesize a tremendous number of so called secondary metabolites, in addition to compounds that are necessary for the growth and reproduction such as carbohydrates, proteins and lipids. As our understanding of chemistry and other natural sciences has increased, the active chemical compounds of the plants have been successfully isolated and identified. Extraction of crude drugs can be done by various processes depending on the physical nature of the drug and chemical properties of the constituents present in it. Various traditional methods used for the extraction of drugs include Infusion, Decoction, Digestion, Maceration and Percolation. Out of these Maceration and Percolation are of particular importance and most Pharmacopoeias refer to these processes for the extraction of crude drugs. The conventional extraction processes are time consuming, e.g., maceration done for 2-7 days; involve bulk amount of solvents and ultimately there might be thermal decomposition of the target molecule like in the case of Soxhlet extraction.<sup>6</sup> The demand for new extraction techniques has encouraged the development of alternative extraction techniques such as Ultrasonic Assisted Extraction (UAE), Microwave Assisted Extraction (MAE), Supercritical Fluid Extraction (SCF) and Accelerated Solvent Extraction (ASE). These techniques have enabled automation, shortened extraction time and reduced organic solvent consumption.

Microwave-assisted extraction (MAE) is a relatively new extraction technique, which utilizes microwave energy to heat the solvent and the sample to increase the mass transfer rate of the solutes from the sample matrix into the solvent. Many reports have been published on the application of microwaves for extracting Pesticide/Insecticide residues and Herbicides from the samples. MAE technique has also been used to extract contaminants present in the environmental samples. The usage of microwaves for extracting phyto-constituents is still in infancy. This paper deals with the MAE of phyto-constituents and the factors which considerably influence the extraction. The theory behind microwaves and the heating mechanism is also discussed. The principles behind the extraction process are elucidated. In order to optimize the extraction procedure various techniques are also stated. In nutshell, this paper presents the epitome of success of MAE technique in the medicinal plant research.

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## PHCOG REV. : Review Article

# *Pterocarpus marsupium* Roxb. - A Comprehensive Review

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### ABSTRACT

The *Pterocarpus marsupium* belong to family Fabaceae and is widely distributed in central, western and southern regions of India. The role of *Pterocarpus marsupium* as anti-diabetic has been very well established. Its extract has been prepared using many methods like infusion, maceration, decoction and percolation. Several chemical constituents like pterostilbene, (-)-epicatechin, pterosupin, marsupsin, etc., have been identified and isolated. *Pterocarpus marsupium* extract also shows promising results in cataract and hypertriglyceridaemia. This plant also finds its use as cardiogenic and hepatoprotective agent. Studies have also been reported to demonstrate its ability as a specific COX- 2 inhibitor. The present review explores its description, traditional uses, extraction methods, chemical constituents, pharmacological activity and commercial importance so that its potential as a multipurpose medicinal agent can be understood and appreciated.

**KEY WORDS:** Extraction methods, Pharmacological activities, *Pterocarpus marsupium*.

**Abbreviations:** COX- 2: cyclooxygenase- 2, LDL: low density lipoprotein, VLDL: very low density lipoprotein, HDL: high density lipoprotein, PGE<sub>2</sub>: prostaglandin E<sub>2</sub>

### INTRODUCTION

Plants are indispensable to man for his life. All phyta of plants viz. Thallophyta, Bryophyta, Pteridophyta and Spermatophyta, contain species that yield official and unofficial products of medicinal importance. The history of herbal medicine is as old as human civilization. The wealth of India is stored in the enormous natural flora which has been gifted to her. Endowed with a wide diversity of agro-climatic conditions, India is virtually herbarium of the world. The importance of medicinal and aromatic plants has been emphasized from time to time. It is believed that the drugs of natural origin shall play an important role in healthcare particularly in the rural areas of India (1). *Pterocarpus marsupium* Roxb is grown in deciduous and evergreen forests of central, western and southern regions of India. It is found mostly in the states of Gujrat, Madhya Pradesh, Bihar and Orissa (2-3).

### TAXONOMICAL CLASSIFICATION

Domain	: Eukaryota
Kingdom	: Plantae
Subkingdom	: Viridiplantae
Phylum	: Magnoliophyta
Subphylum	: Euphyllophytina
Infraphylum	: Radiatopsis
Class	: Magnoliopsida
Subclass	: Rosidae
Superorder	: Fabanae
Order	: Fabales
Family	: Fabaceae
Genus	: <i>Pterocarpus</i>
Species	: <i>marsupium</i> (4).

### BOTANICAL DESCRIPTION

It is of moderate size to large tree. The height ranges from 15 to 30 meters. The stem is stout and crooked with widely

spreading branches. The bark is thick and dark brown to grey in colour. Leaves are compound and imparipinnate. Leaflets are 5-7, coriaceous, oblong, obtuse, emarginated or even bilobed at the apex and glabrous on both surfaces. The petioles are round, smooth and waved from leaflet to leaflet, 5 or 6 inches long and there are no stipules. Panicles are terminal and very large; ramifications are bifarious, like the leaves. Peduncles and pedicels are round and a little downy. Bracts are small, caduceous, solitary below each division and subdivision of the panicle. The flowers are very numerous, white, with a small tinge of yellow. Vexillum is with a long, slender claw, very broad; sides reflexed, waved, curled and veined; keel is two petted, adhering slightly for a little way near the middle, waved, etc., same as the vexillum. Stamens are 10, united near the base, but soon dividing into two parcels of 5 each; anthers are globose and 2-lobed. Ovary is oblong, pedicelled, hairy, generally 2-celled; cells are transverse and 1-seeded. Style is ascending. The legume, which is borne on a long petiole, is three-fourths orbicular, the upper remainder, which extends from the pedicel to the remainder of the style, is straight, the whole surrounded with a waved, veiny, downy, membranous wing, swelled, rugose, woody in the center, where the seed is lodged and not opening; generally one but sometimes 2-celled. Seeds are single and reniform (3, 5).

### DESCRIPTION OF DRUG

Drug consists of heartwood of *Pterocarpus marsupium*. It consists of irregular pieces of variable size and thickness. It is golden yellowish- brown in colour with darker streaks. It is very hard and brittle. In water it gives yellow coloured solution with blue fluorescence. Transverse section shows alternating bands of larger and smaller polygonal cells consisting of tracheids, fibre tracheids, xylem parenchyma and transversed by xylem rays. Xylem vessels are throughout distributed.

## Ultrasonic Assisted Extraction A Promising Extraction Tool for Medicinal Plant Research

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Since the last decade, there is enhanced interest for the use of Ultrasound for the extraction of the constituents from plant material. The traditional techniques like maceration, percolation, decoction, etc., are time- and solvent-consuming, and thermolabile constituents are difficult to extract using such conventional methods. This review brings into prominence the importance of extraction for delivering high quality product. The Ultrasonic Assisted Extraction (UAE) technique is a promising technique which is highlighted by increased extraction yield, decreased time and solvent consumption; moreover the thermolabile constituents can be safely extracted. UAE also offers some peculiar advantages, such as inhibiting the extraction of protein and pectin, which improve the sensory quality of the tea beverage. A brief theoretical background of the principles involved and the types of instruments used has been presented. The main parameters like ultrasonic intensity, extraction time, solvent nature and volume, temperature, ultrasonic pulsation and matrix characteristics, etc., which influence the UAE have been discussed. The application of optimization techniques, such as Factorial Design, to UAE has been highlighted, with examples. The potential applications of this technique and its performance vis-à-vis that of classical techniques have been elucidated.

**Keywords:** Extraction, Conventional methods, Ultrasound, Ultrasonic bath and probe, Optimization.

### Introduction

The history of herbal medicine is as old as human civilization. The widespread use of herbal remedies and healthcare preparations, as those described in ancient texts such as the Vedas and the Bible, and obtained from the commonly used traditional herbs and medicinal plants, has been traced to the occurrence of natural products with medicinal properties. The use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health, has been widely observed. Furthermore, an increasing reliance on the use of medicinal plants in the industrialized societies has been traced to the extraction and development of several drugs chemotherapeutics from these plants as well as from traditionally used herbal remedies<sup>1</sup>.

World Health Organization (W.H.O.) currently encourages, recommends and promotes traditional/herbal remedies in National Health Care Programmes because such drugs are easily available at low cost, are comparatively safe and the people have faith in such remedies. The W.H.O. assembly in a number of resolutions emphasized the need to ensure quality control of medicinal plant products by using modern techniques and applying suitable standards. For pharmaceutical purposes, the quality of medicinal plant material must be as high as that of other medicinal preparations<sup>2</sup>.

Plants (in addition to compounds that are necessary for the growth and reproduction such as carbohydrates, proteins and lipids) synthesize a tremendous number of so called secondary metabolites, which do not appear to be

**REVIEW ARTICLE**

## Recent Techniques for Extraction of Natural Products

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### ABSTRACT:

In recent years there has been increasing interest in the usage of herbal/alternative medicine for the treatment of the illness. The Extraction of the active constituents from the plant material is the crucial first step to achieve desired effect. In this article, various extraction techniques like older methods, conventional methods and the non-conventional methods have been reviewed. The advantages and the limitations of the various techniques have been discussed. The traditional techniques like maceration, percolation, decoction, etc., are time- and solvent- consuming. The principle behind the extraction techniques such as Microwave- assisted extraction, Ultrasonic- assisted extraction has also been reviewed. This review brings into prominence the importance of novel methods of extraction for delivering high quality product.

**KEYWORDS:** Extraction, Microwave, Ultrasonic and Supercritical.

### INTRODUCTION:

Plants have, at one time, supplied virtually all cultures with food, clothing, shelter and medicine. It is estimated that approximately 10-15 % of the roughly 300,000 species of higher plants have a history of use in traditional medicinal. By contrast, only 1 % of plant species have a history of food use.<sup>1</sup> Most of the crude drugs are obtained from plants only a small number comes from animal and mineral origins. Drugs obtained from the plants consist of entire plants or their parts. In recent years, investigation of natural products has produced large number of potential drugs and many of them are used for several other purposes in various industries. Drugs from natural origin are being used suitably in confectionaries, food industries and beverages; as spices and condiments and for other purposes as technical products. The medicinal importance of plants in the treatment of human ailments is immense and has been so since the dawn of civilization.<sup>2</sup> The use of traditional medicine and medicinal plants in most developing countries, as a normative basis for the maintenance of good health, has been widely observed. Furthermore, an increasing reliance on the use of medicinal plants in the industrialized societies has been traced to the extraction and development of several drugs chemotherapeutics from these plants as well as from traditionally used herbal remedies.<sup>3</sup>

World Health Organization (W.H.O.) currently encourages, recommends and promotes traditional/herbal remedies in National Health Care Programmes because such drugs are easily available at low cost, are comparatively safe and the people have faith in such remedies. The W.H.O. assembly in a number of resolutions emphasized the need to ensure quality control of medicinal plant products by using modern techniques and applying suitable standards. For pharmaceuticals purposes, the quality of medicinal plant material must be as high as that of other medicinal preparations.<sup>4</sup>

Plants (in addition to compounds that are necessary for the growth and reproduction such as carbohydrates, proteins and lipids) synthesize a tremendous number of so called secondary metabolites, which do not appear to be strictly necessary for the survival. Often these secondary metabolites are produced as a response to external stimuli, e.g., infection or nutritional or climatic changes, and they may be accumulated in only certain parts of the plants.<sup>5</sup> Indigenous cultures have learnt to exploit the properties of secondary metabolites in many ways, e.g., specific plants or parts of them have been used as poisons, analgesics, stimulants, preservatives, colorants, tanning agents for tanning leather, etc.<sup>6</sup> As our understanding of chemistry and other natural sciences has increased, the active chemical compounds of these traditionally used plants have been successfully isolated and identified. Nowadays, instead of using, e.g., pastes or crude extract prepared from plant material, the tendency is to use pure compounds, irrespective of the intended use be analgesia or for coloring

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