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Research Article

MICROWAVE ASSISTED EXTRACTION OF MANGIFERIN FROM *MANGIFERA INDICA* L.

P. Venkatesh[*1], V. Soumya[1], K. Hariprasath[1], R. Hari Prasad[2]
[1]Department of Pharmaceutical chemistry, Sir C. R. Reddy College of Pharmaceutical Sciences, Eluru-534 007, Andhra Pradesh, India
[2]Department of Pharmaceutical Analysis, P.S.G College of Pharmacy, Coimbatore-641004, Tamil Nadu, India

*P. Venkatesh, Department of Pharmaceutical Chemistry, Sir C. R. Reddy College of Pharmaceutical Sciences, Eluru-534 007, Andhra Pradesh, India.
Email: venkat7pharma@rediffmail.com
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ABSTRACT
The aim of this work is to compare the extraction efficiencies of microwave and conventional isolation of mangiferin from *Mangifera indica* L. The parameters studied, which might affect the extraction efficiency were extraction time, solvent composition and microwave power. The conventional heating 21 h provided 5.23 % yield of mangiferin and by microwave heating at 210 W for 56 min, the yield was 6.868 %. Hence microwave assisted extraction has shown as the most effective technique for the isolation of mangiferin. The isolated compounds were found to be same as evidence by UV, IR, HPTLC, and ^{1}H NMR studies.

KEY WORDS- Microwave assisted extraction, mangiferin, *Mangifera indica* L, UV, HPTLC, ^{1}H NMR

INTRODUCTION

In recent years, new extraction techniques have been developed to reduce the volume of solvent needed for extraction (or to eliminate its use entirely), to reduce extraction and extract clean-up times and to improve the reproducibility of compound recovery. These recent extraction techniques include accelerated solvent extraction (ASE), supercritical fluid extraction (SFE), solid-phase micro extraction (SPME), extraction with supercritical or subcritical water, and microwave-assisted extraction (MAE). Most of these methods have similarity regard to solvent volume, extraction time and extraction efficiency. The use of SFE or ASE, however, requires greater financial investment, and the presence of water in samples can cause blockages in both techniques[1-3]. Microwave-assisted extraction gains increasing interest as an advantageous method for the extraction of natural products. MAE has been employed for the extraction of pollutants such as polynuclear aromatic hydrocarbons[4], phenols in soil samples[5], and natural products such as silymarin from milk thistle seeds[6], essential oils from plant materials[7], ginsenosides from ginseng root[8], and saponins from chickpea[9].

Mangiferin, a xanthone glucoside, is an active phytochemical present in various plants including *Mangifera indica* L., *Anemarrhena asphodeloides Bunge* rhizome. Mangiferin is the major component (10 %) of *Mangifera indica* L. (mango) which belongs to the family Anacardiaceae, which grows in tropical and subtropical regions and widely used in folk medicine for various therapeutic indications [10]. Mangiferin has been reported to possess antioxidant[11], antitumor, immunomodulatory, antiHIV[12], antiviral[13], inhibit bowel

carcinogenesis[14], anti diabetic[15], vascular modulatory activity[16], anti-bone resorption[17], arthritis, hepatitis, mental disorders[18], cardioprotective[19], hypolipidemic[20], chemopreventive[21], and anti-inflammatory[22].
In the present paper we report the feasibility of MAE for the isolation of mangiferin from *Mangifera indica* with a short duration providing its excellent yield when compared to conventional extraction technique.

MATERIALS & METHODS

Plant Materials

The leaves of *Mangifera indica* L. were collected from Nilgiri, Tamil nadu and authenticated by Dr. S. Rajan, Medicinal Plants Survey and Collection Unit, Government Arts College, Ootacamund, Tamil Nadu, India, where a voucher specimen was preserved for further reference.

Equipments

Catalyst Scientific Microwave Oven with variable power output ranging between 140 W and 700 W; Soxhlet apparatus, and Buchi Rotovapor.

Conventional Extraction Technique

The shade dried and powdered plant material of *Mangifera indica* leaves were defatted with petroleum ether (60-80°C). Defatted powdered leaves (10 g) were extracted by Soxhlet with 50 ml of ethanol for 21 h and concentrated under reduced pressure to yield semisolid mass[7]. The semisolid mass was defatted repeatedly and finally dissolved in ethanol at room temperature. It yields an amorphous white powder and after repeated recrystallization of the powder in ethyl acetate, pale yellow needle –shaped crystals of mangiferin were obtained. The crystals were completely dried and weighed The TLC, HPTLC, melting point, UV, IR and ^{1}H NMR were determined.

Microwave Assisted Extraction

Defatted powdered leaves of *Mangifera indica* (10 g) were also extracted with a 50 ml of ethanol using microwave power at 210 W intensity for 56 min. The semisolid mass was defatted repeatedly and finally dissolved in ethanol at room temperature. It yields an amorphous white powder and after repeated recrystallization of the powder in ethyl acetate, pale yellow needle –shaped crystals of mangiferin were obtained. The crystals were completely dried and weighed The TLC, HPTLC, melting point, UV, IR and ^{1}H NMR were determined.

RESULTS & DISCUSSION

The conventional isolation of mangiferin from *Mangifera indica* involves 21 h of Soxhlet extraction using ethanol. Using the same amount of ethanol a microwave extraction method was developed. A satisfactory isolation was possible at 140 to 210 W intensities. However yields higher than the conventional method were obtained only at 210 W intensity and heating for a duration of 45 to 65 min. At 210 W intensity and 56 min heating the highest yield of 6.868 % was obtained hence, saving of around 20 h and increase in the yield of 31.3 % was obtained by following the microwave method when compared to conventional extraction.
The melting point of conventional and microwave isolated compounds ranges between 292-295^0 C. The UV spectrum of standard solution of mangiferin obtained by conventional procedure showed λ_{max} of 365, 314, 267,241 nm with absorbance 0.496, 0.635, 1.008, 1.079 and by microwave method the same solution showed λ_{max} of 365, 315, 257, 240 nm with absorbance 0.536, 0.685, 1.393, and 1.190 respectively. Under the same conditions HPTLC separation of mangiferin for both conventional and microwave method yields a single spot of R_f value 0.62 and 0.63 respectively. The IR and ^{1}H NMR data's of mangiferin isolated by both methods are shown in table-1

CONCLUSION

The present demonstrates the feasibility of microwave assisted extraction (MAE) for isolation of mangiferin from *Mangifera indica*. The data and comparison results illustrate that the microwave extraction is a rapid

method, with less solvent consumption, good recovery, and easy to be controlled automatically in comparison with the Soxhlet extraction.

REFERENCES

1. Buchholz KD, Pawliszyn J. Optimization of solid-phase microextraction conditions for determination of phenols. Anal Chem 1994; 66:160–167.
2. Hawthorne SB, Miller DJ. Direct comparison of Soxhlet and low-temperature and high-temperature supercritical CO2 extraction efficiencies of organics from environmental solids. Anal Chem 1994; 66:4005–4012.
3. Heemken OP, Theobald N, Wenclawiak BW. Comparison of ASE and SFE with Soxhlet, sonication, and methanolic saponification extractions for the determination of organic micropollutants in marine particulate matter. Anal Chem 1997; 69:2171–2180.
4. Tomaniova M, Hajslova J, Pavelkajr Kocourek V, Holadova K, Klimova I. Microwave assisted solvent extraction- A new method for isolatio of polynucler aromatic hydrocarbons from plants. J Chromatogr A 1998; 827:21-29.
5. Egizabal A, Zuloaga O, Extrebarria N, Fernandez LA, madariaga JM. Comparison of microwave assisted extraction and soxhlet extraction for phenols in soil samples using experimental design, Analyst 1998; 123:1679-1684.
6. Xin W, Xianzhe Z, Chenghai L. Optimization of microwave-assisted extraction of silymarin from milk thistle seeds**.** Int J Agric & Biol Eng 2008; 1:75-81.
7. Lucchesi ME, Chemat F, Smadja J. Solvent –free microwave extraction of essential oil from aromatic herbs; comparison with conventional hydro-distillation. J Chromatogr A 2004; 1043:323-327.
8. Shu YY, Ko M, Chang YS. Microwave-assisted extraction of ginsenosides from ginseng root. Microchem J 2003; 74:131–139.
9. Kerem Z, German-Shashoua H, Yarden O. Microwave-assisted extraction of bioactive saponins from chickpea (*Cicer arietinum* L). J Sci Food Agri 2005; 85:406–412.
10. Muruganandan S, Srinivasan K, Gupta S, Lal J. Effect of mangiferin on hyperglycemia and artherogenicity in streptozotocin diabetic rats. J Ethanopharmacol 2005; 97:497-501.
11. Sanchez GM, Re L, Giuliani A, Nunez-Selles AJ, Davison GP, Leon-Fernandez OS. Protective effects of *Mangifera indica* L. extract, mangiferin and selected antioxidants against TPA-induced biomolecules oxidation and peritoneal macrophage activation in mice. Pharmacol Res 2000; 42:565–573.
12. Guha S, Ghosal S, Chattopadhyay U. Antitumor, immunomodulatory and anti-HIV effect of mangiferin, a naturally occurring glucosylxanthone. Chemotherap 1996; 42:443–451.
13. Zheng MS, Lu ZY. Antiviral effect of mangiferin and isomangiferin on herpes simplex virus. Chinese Med J 1990; 103:160–165.
14. Yoshimi N, Matsunaga K, et *al.* The inhibitory effects of mangiferin, a naturally occurring glucosylxanthone, in bowel carcinogenesis of male F344 rats. Cancer Lett 2001; 163:163-170.
15. Miura T, Ichiki H, *et al.* Antidiabetic activity of a xanthone compound, mangiferin, Phytomed 2001; 8:85–87.
16. E. Beltran Y, Alvarez FE, *et al.* Salaices. Eur J Pharmacol 2004; 499:297.
17. Li H, Miyahara T, *et al.* The effect of Kampo formulae on bone resorption in vitro and in vivo. I. Active constituents of Tsu-kan-gan. Biol Pharm Bull 1998; 21:1322–1326.
18. Ghosal S, Rao G, Saravanan V, Misra N, Rana D. A plausible chemical mechanism of the bioactivities of mangiferin. Ind J Chem 1996; 35:561–566
19. Prabhu S, Mallika J, Sabitha KE, Devi CSS. Cardioprotective effect of mangiferin on isoproterenol induced myocardial infarction in rats. Ind J Exp Biol 2006; 44:209–215.

20. Prabhu Sukumaran Nair CS, Shyamala Devi. Efficacy of mangiferin on serum and heart tissue lipids in rats subjected to isoproterenol induced cardiotoxicity. Toxicol 2006; 228 :135–139
21. Peramaiyan R, Ganapathy E, Venkatraman M, Dhanapal S. Chemopreventive efficacy of mangiferin against benzo(*a*)pyrene induced lung carcinogenesis in experimental animals. Environ Toxicol Pharmacol 2008; 26:278–282.
22. Garrido G, Gonzalez D, *et al.* In vivo and in vitro anti-inflammatory activity of *Mangifera indica* L. extract (VIMANG). Pharmacol Res 2004; 50:143.

Table- 1: IR And ^{1}H-NMR of Mangiferin

Spectral and chromatographic data	Conventional method	Microwave method
IR (cm^{-1})	3365 (OH), 2916 (CH), 1651 (C=O), 1253 (C-OH)	3355 (OH), 2916 (CH), 1651 (C=O), 1253 (C-OH)
^{1}H-NMR (500 MHz, $CDCl_3$)	13.76 (s, 1H, 1-OH), 10.55 (s, 2H, 6, 7-OH), 9.86 (s, 1H, 3-OH), 7.38 (s, 1H, 8H), 6.37 (s, 1H, 4H).	13.74 (s, 1H, 1-OH), 10.56 (s, 2H, 6, 7-OH), 9.89 (s, 1H, 3-OH), 7.36 (s, 1H, 8H), 6.35 (s, 1H, 4H).

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