Research Article
ISSN: 0974-6943

V.Shankar ananth et al. / Journal of Pharmacy Research 2009, 2(11),1739-1741

Available online through
http://jprsolutions.info

Comparative studies of conventional extraction with microwave assisted extraction of some selected phytoconstituents

V.Shankar ananth*, K.K.Rajasekhar[1], Y.Sivaprasad[1],M.Rajagowtham[1] and P.Ravikiran[1]

**,1Department of Pharmaceutical Chemistry,Sri Padmavathi School of Pharmacy,Tiruchanoor,Tirupati-517503,A.P.,India.*

Received on: 20-08-2009; Accepted on:15-10-2009

ABSTRACT

The traditional techniques of solvent extraction of plant materials require long extraction time and have low efficiency. Moreover, many natural products are thermally unstable and may degrade during thermal extraction. Microwave assisted extraction technique is one of the novel techniques which have been developed for the extraction of phytoconstituents from plants in order to shorten the extraction time, decrease the solvent consumption, increase the extraction yield and enhance the quality of extracts.

Keywords: Soxhlet extraction, Microwave assisted extraction, Thin layer chromatography etc.

INTRODUCTION

Extraction[1] may be defined as the process of removal of desirable soluble components from a substance, leaving out those, which are not required, with the aid of solvents and standardized process. Plant tissues contain chemical substances some of which provide relief and treatment in a variety of diseased conditions. Extraction is the first important step for the recovery and purification of active ingredients of plant materials. The various conventional extraction processes including maceration, digestion, percolation and soxhlet extraction are available for the extraction of the phytoconstituents from plants. The main problems arise from the possibility of loss (or) contamination during sample preparation, the long time required for completion of the leaching step, and large solvent consumption. There are several novel techniques including ultrasound assisted extraction, microwave assisted extraction, supercritical fluid extraction and accelerated solvent extraction have been developed for the extraction of phytoconstituents from plants in order to shorten the extraction time, decrease the solvent consumption, increase the extraction yield and enhance the quality of extracts[2] .Further more, microwave assisted extraction helped achieve extraction yields higher or at least comparable with those achieved by traditional methods[3]. From the literature review, It is clearly understood that, the microwave assisted extraction was not compared with conventional method of extraction. Hence, the present study aimed to compare the conventional method and microwave assisted method of extraction of some selected phytoconstituents[4] .

MATERIALS AND METHODS:

Materials:

Black pepper powder, Rhubarb powder, Tea powder, Orange peel powder, and the reagents chemicals, such as rectified spirit, alcoholic potassium hydroxide solution, distilled water, concentarated hydrochloric acid, diethylether, anhydrous sodium sulphate, lead acetate solution, animal charcoal, dilute sulphuric acid, chloroform, methanol, petroleum ether, dilute acetic acid solution, alkaline copper sulphate, sodium hydroxide solution, sodium acetate, congo-red paper, 20%Hcl, conc.HNO_3, NH_4OH solution, Ethyl acetate, Kieselghur were the reagents and chemicals obtained from the department of pharmaceutical chemistry, pharmacognosy laboratory and used without further purification.

Equipments and glass wares used:

Laboratory scale microwave oven, Buchner funnel, Reflux condenser, Beaker, RB flask conical flask, separating funnel, watch glass, soxhlet extractor etc.

Methods:

The extraction of some selected phytoconstituents was done conventionally by the standard methods[5]. Then, the extraction was done by using microwave assisted method[6]. Here, the extraction was done for some selected phytoconstituents such as piperine from black pepper, Rheum emodin and Chrysophanol from rhubarb powder, caffeine from tea powder, Hesperidine from orange peel, and cystine from human hair.

i. **Extraction of Piperine from Black Pepper:**

1gm of powdered drug was treated with 20ml of ethanol in a beaker, then, the process of microwave assisted extraction was performed in a laboratory scale microwave oven which was equipped with a inboard thermometer, power control switch, time control switch, stirrer and water condenser at a temperature of 90°C for 2,4 and 6 minutes respectively. Then filter the solution & concentrate at 60°C. Cool & add 20ml of alcoholic potassium hydroxide solution & filter. Allow the solution for overnight. Then crystals of piperine was separated by filtration, air dried and collected. Then, the crystals of piperine was confirmed by performing TLC[7]. The R_F value of this piperine was compared with conventionally extracted piperine.

***Corresponding author.**
V.Shankarananth,
Department of Pharmaceutical Chemistry,
Sri Padmavathi School of pharmacy, Tiruchanoor,Tirupathi.
Tel.: + 91-9908391835
Telefax: +91-
E-mail: shankraja2004@rediffmail.com.

Table : 1.Comparison of R_F value of microwave assisted extracted phytoconstituents with standard.

S.No	Name of phytoconstituents	Matrix	TLC solvent system	R_F value	R_F value of standard
1	Piperine	Black pepper	Chloroform:Methanol (19:1)	0.692	0.70
2	Rheum emodin and chrysophanol	Rhubarb powder	Ethyl acetate: pet. Ether: water free formic acid(25:75:1)	0.63 and 0.93	0.61 and 0.92
3	Caffeine	Tea powder	Ethanol: isopropanol:xylene : chloroform (12.5: 12.5: 25:50)	0.93	0.95
4	Hesperidine	Orange peel	Butanol: acetic acid: water	0.75	0.65- 0.75
5	Cystine	Human hair	Iso propanol: formic acid: water (40:2:10)	0.27	0.26

ii. Extraction of Rheum emodin & Chrysophanol from Rhubarb Powder:

1gm of powdered rhubarb was mixed with 30ml of distilled water and 1ml of conc. Hcl for 30sec, 1min, & 2minutes in a microwave oven respectively. Then, cool it at room temperature and filter. The filtrate was then extracted with 20ml of solvent ether. The ether layer was separated and dried over anhydrous sodium sulphate and filter. The Rhubarb extract was separated and air dried. Then, the rhubarb extract was confirmed by TLC. The R_F value was compared with standard. The TLC study was performed by using standard procedure[8].

iii. Isolation of caffeine from tea powder:

50gms of tea leaves was boiled with 250ml of water in a 500ml beaker for by microwave oven 2 minutes. Then, the hot solution was filtered & the residue was washed with boiling water. Basic lead acetate solution was added to the filtrate with constant stirring until complete precipitate formed. Again the hot solution was filtered and dilute sulphuric acid was added till whole of lead is removed as lead sulphate. The lead sulphate was removed by filtration and then 0.5gm of animal charcoal was added to decolourise the filtrate and the solution was concentrated to half of its volume. The resulting solution was filtered and the caffeine was extracted from the filtrate by adding 75 ml of chloroform in 3 times (25ml each time) using a separating funnel. The chloroform was distilled off from the chloroform layer. Then, the residue was dissolved in a minimum amount of water, the resulting solution was cooled. Silky needles of caffeine separated out. The melting point of caffeine crystals was determined. The caffeine crystals were confirmed by performing TLC[9] and the chemical test.

iv. Isolation of hesperidine from orange peel:

The powdered orange peel (25gms) was refluxed with 100ml of petroleum ether by using microwave oven at 50°c for 2mts, 4mts and 6mts respectively. The contents were filtered while hot through a buchner funnel and the marc obtained was dried at room temperature. Then, the powder was extracted with 100ml of methanol by using microwave oven for 5mts, 10mts respectively. The contents were filtered while hot, and the marc was washed with 12.5ml of hot methanol. The washings were added to the filtrate, and then the combined filtrate was concentrated to syrupy mass. Hesperidine was crystallised from dilute acetic acid solution. Then, the melting point and TLC of hesperidine was determined and compared with the standard[10]. Then it was confirmed that, the hesperidine obtained (via) Micro wave assisted extraction was matched with the standard.

v. Isolation of cystine from human hair:

10 ml of concentrated hydrochloric acid was taken in a 250 ml round bottomed flask and heated on a water bath. 5 grams of thoroughly clean and dry hair in 5 equal instalments was added with thorough shaking after each addition. The contents were boiled using a microwave oven until a drop of the test sample no longer gives a violet colour with alkaline copper sulphate (20 mts). The hot solution was first partly neutralised with sodium hydroxide solution and then with excess of sodium acetate completely. The completely neutralised solution was tested with the help of a congo-red paper. The contents were allowed to stand overnight, Then the formed brown coloured precipitate was filtered using a buchner funnel. The precipitate was collected in a breaker and then boiled with15ml of 20% Hcl and filtered. The filtrate thus obtained was combined with the pervious one and decolorising carbon (1gm) was added, boiled & filtered while hot. Hot concentrated solution of sodium acetate was added to the hot clear filtrate. Then, the contents were cooled in an ice bath to separate the colourless crystals of cystine. Then, it was confirmed by physical state, TLC[11] and chemical test.

RESULTS AND DISCUSSION:

From the above methods, the Microwave assisted extraction of some phytoconstituents such as (piperine from black pepper, rheum emodin and chrysophanol from rhubarb powder caffeine from tea powder, hesperidine from orange peel & cystine from human hair) has proven to be effective compared to traditional extraction techniques because it was capable of yielding a desired quantity with 5 to 20minutes of extraction time. It was faster than the conventional extraction procedures. The time taken by the microwave extraction process was 40 times less than the conventional extraction such as soxhlet extraction. The separated phytoconstituents was confirmed by the standard procedures such as melting point determination, TLC, chemical tests etc. Then these were compared with the standard and the results were tabulated in table no:1. This technique is easy to use and the system is cheaper compare to other modern techniques such as super critical fluid extraction.

SUMMARY AND CONCLUSION:

Thermal technology dictates the quality, economics and environmental impact of any processing plant. From the above result, it would be concluded that the microwave assisted extraction technique is cheaper, less time and solvent consuming desired yield method when compared with conventional extraction methods. So, Microwave assisted extraction is a viable and feasible method for performing extractions of phytoconstituents.

ACKNOWLEDGEMENTS:

The authors are thankful to Smt.P.Sulochana,Correspondent,Sri Padmavathi school of Pharmacy,Tiruchanoor,Tirupati for providing

facilities to carry out this work.

REFERENCES:

1. Jain, N.K and Sharma S.N, A text book of professional pharmacy, (vallabh prakashan) Delhi, 4 , 1997,111-112.
2. Lijun, W. and weller. C.L., Recent advances in extraction of neutraceuticals from plants. Trends in food science and technology., 17, 2006, 303-305.
3. Simona M.Nemes and Valerie orsat., Screening the experimental domain for the microwave assisted extraction of secoisolariciresinol diglucoside from flaxseed prior to optimization procedures. Food Bioprocess technol.,2009,140-145.
4. Eskilson, C.S and Bjorklund. E., Analytical scale microwave assisted extraction. Journal of chromatography A., 902, 2000, 228-230, 232, 242-247.
5. O.P.Agarwal., Advanced practical organic chemistry .,12th edition, 2002,30-35.
6. Xinpeng Bai, Anjong qiu and Junjun guan., Microwave-assisted extraction of triterpenoids and its comparison with conventional extraction methods. Food. Technol biotechnol., 45(2), 2007,174-180.
7. Dr.C.K.Kokate., Practical Pharmacognosy.,8th edition,2005, 28-30.
8. Hai-Xia zhang and Man-cang Liu., Separation procedures for the pharmacologically active components of rhubarb. Journal of Chromatography B., vol:812,(1-2), 2004,175-181.
9. Muthanna J Mohammed and Firas A Al-bayati.,Isolation,Identification and purification of caffeine from Coffea arabica L. and Camellia sinensis L,a combination anti-bacterial study.IJGP.,vol:3(1), 2009,52-57.
10. Garg.A, Garg.S,Zaneveld.L.J.D and Singla.A.K.,Chemistry and pharmacology of the Citrus bioflavonoid hesperidine.Phytotherapy research., vol:15(8), 2001,655-659.
11. Jones.K, and Heathcote.J.G., The rapid resolution of naturally occur ring amino acids by thin layer chromatography.J.Chromatogr., 24, 1966,106-111.

Source of support: Nil, Conflict of interest: None Declared