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A COMPARATIVE ANALYSIS OF EFFECT OF SOLVENT AND EXTRACTION TECHNIQUE ON RECOVERY OF BIOACTIVE COMPOUNDS FROM DIFFERENT PLANT PARTS OF *PINDA CONCENENSIS*

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ABSTRACT

Extraction procedure is an important step in analysis of bioactive compounds in terms of quality and quantity.Different methods of extractions have been used for the extraction and recovery of bioactive compounds from aromatic plants to obtained higher yield and to save solvent consumption. In present study conventional methods like maceration and soxhlet extraction were compared with modern methods like Ultra-sound Assisted extraction (UAE) and Microwave Assisted Extraction (MAE) using different solvents and for different time period for recovery of bioactive compounds from *Pinda concanensis*. A range of solvents from nonpolar (petroleum ether) to polar (methanol) was used for different time period. Obtained results demonstrated that the MAE method is the best one for recovering the maximum amount of bioactive compounds.In MAE extraction time was condensed, less solvent was used and quantity of extracted compounds was increased.

Keywords: *Pinda concanensis*, Extraction methods, bioactive compounds.

INTRODUCTION

Medicinal plants are currently in considerable significance view due to their special attributes as a large source of therapeutic phytochemicals that may lead to the development of novel drugs (Azwanida NN 2015). The beneficial medicinal effects of plant materials typically result from the presence of bioactive compounds and combination of these secondary products (Tonthubthimthong *et al.,* 2001). Biologically active components such as alkaloids, steroids, tannins, glycosides, volatile oils, fixed oils, resins, phenols and flavonoids are synthesized in different plant parts. In present scenario synthetic drugs are widely used, long term use causes health problems or side effects, which leads to the search for novel bioactive compounds, mainly among plant kingdom, which may provide unique chemical components with unique mode of action (Ankita Gupta *et al.,* 2012). In phytochemical investigation extraction is important step as it effects on quantity and yield of the compounds. Conventionally mining of bioactive compounds is usually performed using maceration, soxhlet and simple distillation techniques. Now days non-conventional methods microwave assisted extraction (MAE) and ultrasound assisted extraction (UAE) methods can be used for extraction. UAE involves use of high intensity, high frequency sound waves and their interaction with materials which can be effectively useful as it does not require any complex instrument and is relatively low cost. It can be easily used for large and small scale. The technique is based on acoustic cavitation due to ultrasonic effects leads to quicker diffusion of solutes into solvent (Cares *et. al*., 2009). MAE is simple, ecofriendly and economical technique for extraction of bioactive components from plants (Hemwimon *et al.,* 2007). Microwave possesses electric and magnetic fields which are responsible for dipolar rotation and ionic conduction simultaneously causes heating. Components of sample absorbs microwave energy, depending upon dielectric constants of solvents (Ahuja and Diehl, 2006) which leads to instant heating, which causes evaporation of residual moisture in the solid, creates pressure on cell wall. Increase vapour pressure breaks cell wall and releases components into solvents (Kothari *et al.,* 2009). The conventional methods which have been used since decades are time consuming and required relatively large quantities of solvents. Extraction using non-conventional methods such as microwave assisted extraction (MAE) and ultrasound assisted extraction (UAE) can results in increase in yield in short time and less solvent (Hizaji *et al.,* 2013, Evans, 2008). So in present work a small attempt was taken to compare non-conventional and conventional methods of extraction.

Pinda concanensis commonly known as 'Kokanpinda' has been used for study belongs to family Apiaceae and an endemic to Western Ghats of Maharashtra. Local people utilizing different parts of plant for oil, alternative to spices, flavoring agents and tubers as food. Many members of family Apiaceae used as food, flavoring agents also for medical purpose as they contains array of bioactive compounds mainly phenolics, flavonoids, saponins, terpenes, coumarins etc. (Heywood VH 1971).

Pinda concanensis is seasonal perennial geotrophic herb. Stem reduced, branched, leaves are compound pinnate with typical umbel inflorescence. The previous investigations shown that plant extracts were showing antioxidant, antifungal properties with novel bioactive compounds.

(Shimpale *et al.,* 2018). On this backdrop efforts were made to find out significant method for maximum recovery of bioactive compounds by using *Pinda concanensis* as experimental material.

MATERIALS AND METHODS

Collection of plant material

Pinda concanensis (Dalzell) P.K. Mukh and Constance was collected from Northern-western Ghats in the Nashik district, Maharashtra during August to October 2019 and 2020. Plant material cleaned and dried in shade at room temperature. The dried material finely powdered and used for extraction.

Methods of Extraction

For extraction 1gm of powdered plant material of root, leaves and seeds were extracted with 50ml of different solvents such as Petroleum ether, chloroform, acetone and methanol for different duration. Then extracts were filtered and concentrated to dryness. The weight of dry extracts was noted.

1. Maceration: Plant material was blended with different solvents and kept on shaker for different periods (12, 24 and 48 h) at room temperature.

2. Soxhlet method: Extraction was carried out by using soxhlet apparatus for 2, 14 and 24 hours.

3. Ultrasound Assisted extraction method: Plant material soaked in different solvents and sonicated by using ultrasonic bath at 20 KHz at 40°C for 20, 40 and 60 min.

4. Microwave Assisted Extraction method: Plant material was mixed with different solvents and irradiated with microwaves with some modification in method of Pan *et al.,* for 2,4 and 6 min. The irradiation achieved as 45 sec. power on followed by 30sec. power off and then by 15 sec. power on. After each irradiation of 60 sec. sample was cooled.

The extracts were filtered immediately and concentrated.

RESULTS AND DISCUSSION

1. Cold extraction method or maceration

The extractive values from 1gm of *Pinda concanensis* root, seeds and leaves is summarized in Fig. 1. The four different solvents petroleum ether, chloroform, acetone and methanol were used for extraction for 12, 24 &48 hrs. period. The extractive values were differing in contest with solvent type and period of extraction. The highest extractive values were produced in methanol at 24hrs (93.66mg/gm) for seed sample, while lowest in petroleum ether (21mg/gm).

As seen in Fig.1, there was correlation between increases in extractive values with increase in time for almost all samples. But in case of petroleum ether extractive value increases from 12hrs to 24hrs then it remains almost constant. While in case of methanol maximum extractive value obtained at 24 hrs then it was decreased. So we can conclude that the optimal extraction time depends upon solvent type. This can be well explained by Ficks second law of diffusion, which states that the final equilibrium will be achieved between solute concentration in plant matrix and in the bulk solution (solvent) after a certain time. It means excessive extraction time is not useful to extract more compounds but it may leads to oxidation of compounds due to exposure of light and oxygen(Chan *et al.,* 2009)

2. Soxhlet extraction

For soxhlet extraction method highest extractive values obtained at 24 hrs period for all solvent and all plant parts. Like maceration in soxhlet extraction also solvent type and extraction time have effect on extractive value Methanol is most effective organic solvent yielded highest extractive values for root, seeds and leaves (108.34, 120.34 and 143mg/gm) at 24 hrs. While lowest extractive value obtained in petroleum ether solvent (21,30.67,31.34mg). There was a correlation reported between extractive value and period of extraction. As time period increases there was increase in extractive value.

3. Ultrasound Assisted extraction

In UAE, as in conventional technique, the type of solvent and extraction period have effect on extraction. UAE uses ultrasonic wave energy in the extraction. Ultrasound induces micro cavities in solvents leads to improved solvent penetration, hydration, swelling, disruptor of membrane increases dissolution and diffusion of solutes, also heat generate in this process increases efficiency of extraction (Zang *et al.,* 2018). It can be applicable for extraction of thermolabile and an unstable compound also as it requires low solvent, energy, temperature and time. The highest extractive values were reported in methanolic solvent for root, leaves, seeds (64, 85.67, 93mg/gm). In chloroform and acetone extractive values obtained were all most same which were more than petroleum ether and lower than methanol. In polar as well as in non-polar solvents the highest extractive amount obtained at 60min. period. When time increases (from 10 min. to 60min.) the extractive values increases in all solvents. The extractive values obtained in UAE were comparable to conventional methods like soxhlet extraction and more than maceration.

4. Microwave Assisted extraction

MAE produced highest amount of extract as compare to remaining methods. Methanol gave highest optimized extractive value at 4 min (142,155,139 mg/gm) for roots, leaves and seeds, while remaining solvents showed increase in extractive value as time period increases. In petroleum ether higher extractive values obtained at 6 min.(43,41,51 mg) The longer exposure causes increase in extractive value but further increase in irradiation may leads to no improvement in extractive value or may cause fall in yield due to risk of degradation by heating (Rafiee *et al.,* 2011). In non-polar solvents extractive values were low as compare to polar solvents because non polar solvents remained transparent to microwave due to low dielectric constant and dissipation factor in comparison to polar

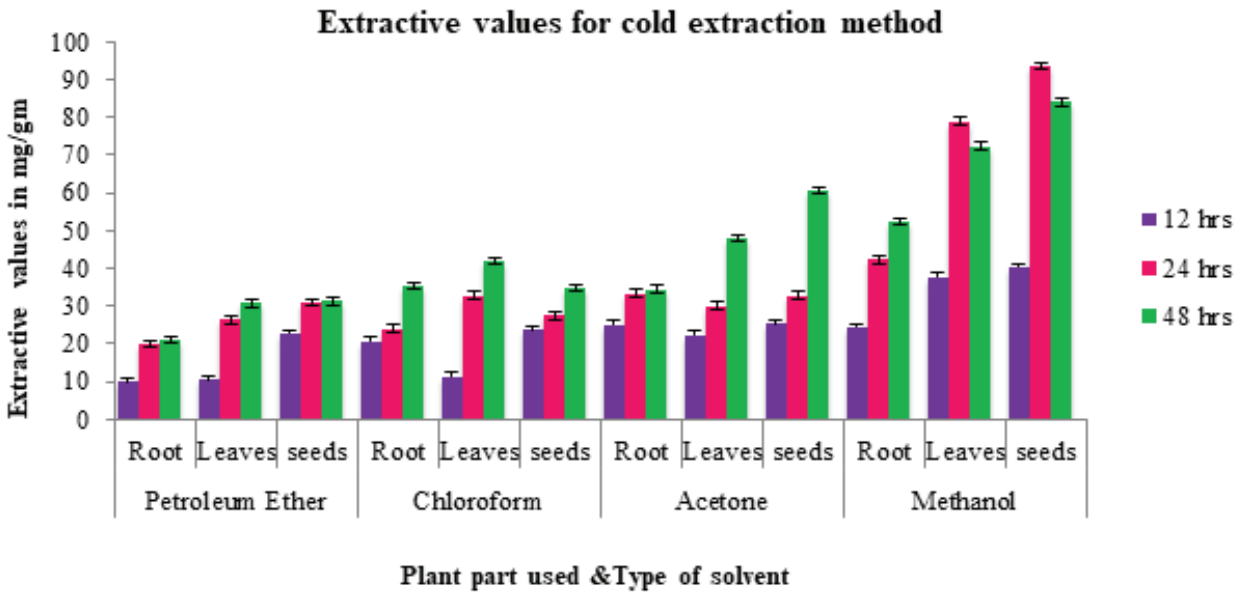

Figure 1: Extractive values for cold extraction method or maceration in mg/gm

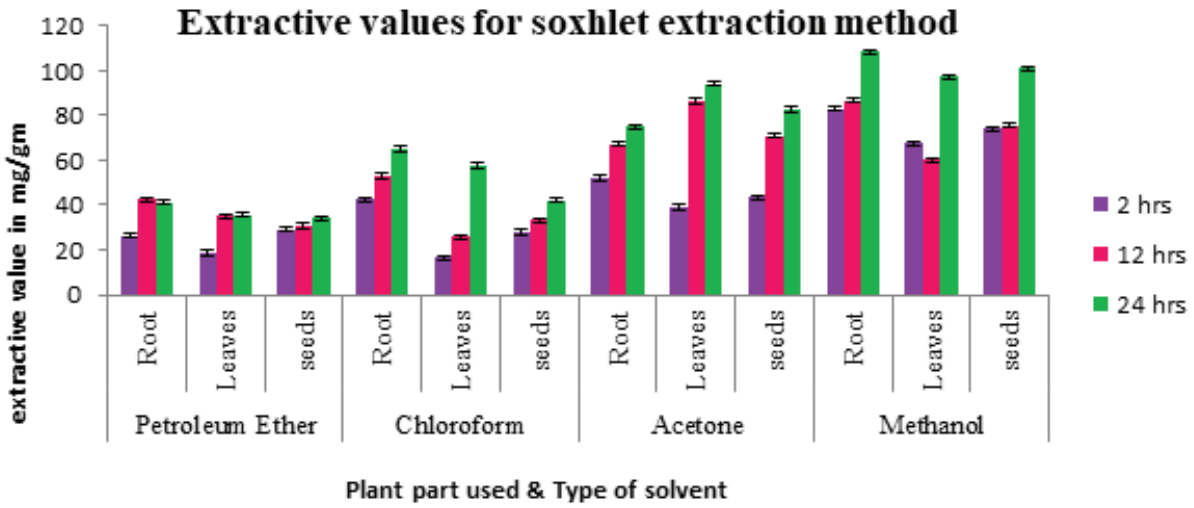

Figure 2: Extractive values for soxhlet extraction in mg/gm

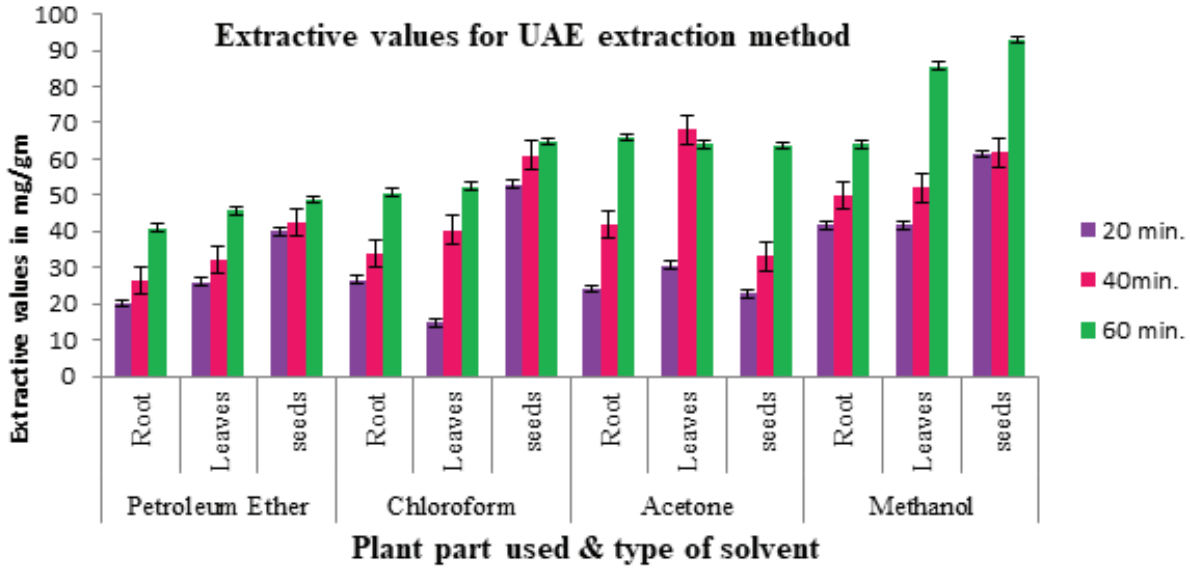

Figure 3: Extractive values for Ultrasound assisted extraction in mg/gm

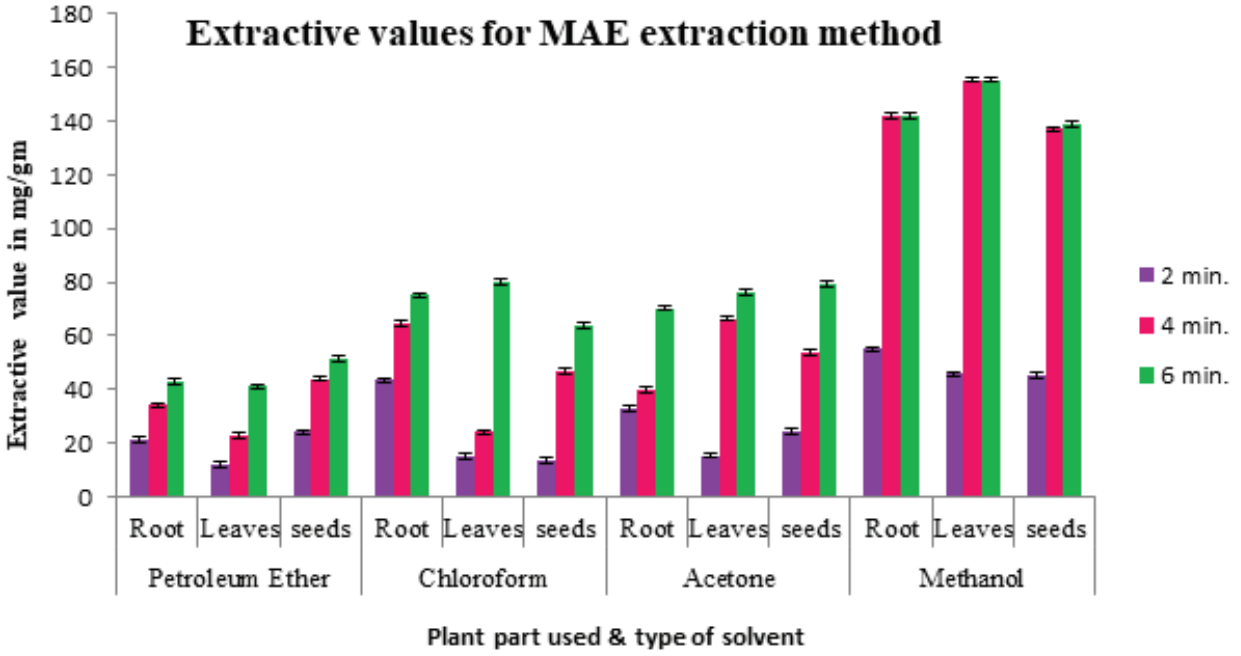

Figure 4: Extractive values for microwave assisted extraction in mg/gm

solvents (Mandal *et al.,* 2007) In case of methanol due to high dielectric constant and greater capacity of dissolving bioactive compounds shows maximum extractive value (B. Zhang *et al.,* 2008). Methanol was most effective organic solvent producing highest extraction yield and petroleum ether gave the lowest yield in extracting bioactive compounds by these methods. Furthermore increase in extraction time increases the extractive value. Within conventional methods soxhlet method had highest yield of extracts while maceration method had lowest. In Non-conventional methods yield of extracts was high and comparable to results of soxhlet method. In non-conventional methods high extractive values obtained within few minutes but conventional methods required several hrs. Therefore UAE and MAE were proved most effective technique for extraction of bioactive compounds

CONCLUSION

Obtained results proves the importance of non-conventional methods like UAE and MAE over conventional methods in recovery of bioactive compounds as highest extractive values, reduced time, high extraction efficiency, less efforts compared to other extraction techniques.

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