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Letter to Editor

MACERATION-VORTEX-TECHNIQUE (MVT), A RAPID AND NEW EXTRACTION METHOD IN PHYTO-PHARMACOLOGICAL SCREENING

MD. TOREQUL ISLAM[1,2,3]*, MÁRCIA FERNANDA CORREIA JARDIM PAZ[1,2], BAHARUL ISLAM[3], MARCUS VINÍCIUS OLIVEIRA BARROS DE ALENCAR[1,2], ANA AMÉLIA DE CARVALHO MELO-CAVALCANTE[1,2]

[1]Northeast Biotechnology Network (RENORBIO), Post-Graduation Program in Biotechnology, Federal University of Piauí, 64.049-550, Teresina, Brazil, [2]Department of Biochemistry and Pharmacology, Post-Graduation Program in Pharmaceutical Science, Federal University of Piauí, 64.049-550 Teresina, Brazil, [3]Department of Pharmacy, Southern University Bangladesh, 22-Shahid Mirza Lane (E), Academic Building-II, 1st Floor, 739/A, Mehedibag Road, Mehedibag-4000, Chittagong, Bangladesh
Email: rbiotufpi.br@gmail.com

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ABSTRACT

Extraction is a process of preparation of extracts from biological materials (plant/animal/microorganism) in the essence of drug discovery and development scienticism. This writing is aimed at proposing a new, rapid, economical and easy extraction method, Maceration-Vortex-Technique (MVT). For this 2-5 g of powdered materials is sucked into 5-10 ml of solvent recommended for extraction. A cleaned, small amber-colored glass bottle of 20-25 ml capacity is needed for this purpose. Powdered materials are mixed with the solvent, then followed by shaking vigorously; shaken for 1.5-2 h and vortexed for 5 min. The extract is collected by immediate filtration through filter paper (Whatmann no. 1) and allowed for concentration and/or solvent partitioning. The MVT allows a 3 h extraction of plant materials. A small amount of extraction material is needed along with a small quantity of solvent which is a marker for the economy of this extraction process. In conclusion, rapidity in the extraction process is the rapidity in the screening process of biological materials. The MVT may be one of the speediest and most economical extraction processes.

Keywords: Extraction, Maceration-Vortex-Technique, New method, Phyto-pharmacological screening

From the beginning, drug discovery and development is one of the major platforms in the scientific areas. Biological materials such as plants, animals, microorganisms and their parts as well as marine biologicals are the universal sources in this occasion. Extraction, a process of preparation of an extract of biological materials in the essence of drug discovery and development standpoint, is crucial prior to isolation, characterization, and pharmacological screenings. Purposes of standard extraction are 1) to attain therapeutically desired portions and 2) menstrum: to eliminate unwanted materials by treatment with selective solvent. It is to be mentioned that every extraction process is unique in its nature, whichever mainly depends on the type of biological materials to be extracted and the characteristics of the extracted substances.

There are a number of extraction methods, such as- maceration, infusion, percolation, digestion, decoction, continuous hot extraction, aqueous-alcoholic extraction by fermentation, counter current extraction, microwave assistance extraction, ultrasound extraction (sonication), supercritical fluid extraction and phytonic extraction with a hydrocarbon solvent. However, hydro distillation techniques (water distillation, steam, and water distillation), hydrolytic maceration followed by distillation, expression and effleurage (cold fat extraction), headspace trapping, solid phase micro-extraction, protoplast extraction, micro distillation, thermo-micro distillation and molecular distillation are commonly preferred for aromatic plants. It is noteworthy that successful determination of biologically active compounds depends on the type of solvents used and therefore an ideal solvent should have the following properties– low toxicity, ease of evaporation of solvent at low heat, promotion of rapid physiologic absorption of the extract, preservative action, inability to cause the extract to complex or dissociate and so on. Most preferably used solvents for the extraction are–water (anthocyanins, tannins, starches, saponins, terpenoids, polypeptides, lectins), ethanol (tannins, terpenoids, sterols, alkaloids, flavonols, polyphenols, polyacetylenes), methanol (anthocyanins, terpenoids, saponins, tannins, xanthophylines, totarol, quassinoids, flavones, lactones, phenones, polyphenols), chloroform (terpenoids, flavonoids), ether (alkaloids, coumarins, terpenoids, fatty acids) and acetone (phenol, flavonols).

Steps in the extraction process are size reduction, extraction, filtration, concentration, and drying. Plants and the plant-derived components are the major concerns to the drug scientists from the ancient [1]. World Health Organization (WHO) mentioned that about 25% of modern medicines are developed from plants sources, used traditionally thus leading to research and discover of 75% of herbal drugs nowadays. WHO (2012) recorded approximately over 21,000 plant species for their medicinal uses throughout the world. However, in this field of research, to everyone it is a pivotal knowledge that the method of drug obtaining; always is a time-consuming process as from the identification to marketed drug it requires 12-18 y. Noteworthy, it is a stepwise path-length, wherever every single step is time-consuming. The discovery of biosensors is a potentiating and encouraging chapter in this era, which may be incorporated to the rapidity of few other time-consuming steps namely identification and characterization of chemical moieties, pharmacological, toxicological and clinical studies of the biological samples [2]. However, prior to jumping those steps; extraction is the prime concern. A rapid, economical and ease of handling extraction may save valuable time of the drug scientists; which could be more helpful in the area of drug discovery and development, thereof from the essence, the method, MVT has been proposed.

Briefly, MVT is a two hours maceration technique followed by five min vortex with a small amount of solvent. After collection and drying of a biological sample (such as plant material: a whole plant or its parts), milling is done by using a suitable grinder (milling machine). Powdered materials (PM) can be preserved in an amber colored bottle for repeated use. Let's take a shake for the smallest particles to be settled down to the container. Only a small amount of powder (2-5 g), from the lower portion of the container, is sucked into 5-10 ml of solvent to be used for extraction. Solvent volume and amount of powder is a concern to the percentage of yield and sample concentrations for the investigation, recommended. A cleaned, small amber-colored glass bottle (20-25 ml capacity) may be suitable for this purpose. After mixing the powdered material with a solvent the tight sealed container is then vigorously shocked for 1.5-2 h. Shaking can be done manually or in an electronic shaker, which is then followed to vortex for 5 min a a rate of >2000 rpm.

Now the final extract should be obtained by immediate course filtration through a sterile cotton plug (CP) followed by filter paper (FP; Whatman no. 1). To determine the yield, dried CP and FP should be weighed before and after their application. Percentage yield and concentration calculation are given bellow–

$$\text{Yield (\%)} = \frac{E_b(PM+CP+FP) - E_a(PM+CP+FP)}{E_bPM} \times 100$$

Where, E_b: before extraction; E_a: after extraction; PM: powdered material; CP: cotton plug; FP: filter paper.

$$\text{Concentration} = \frac{\text{Yield}}{E_v}$$

Where, Ev: extraction volume.

For an overview about the overall MVT extraction, please see the fig. 1.

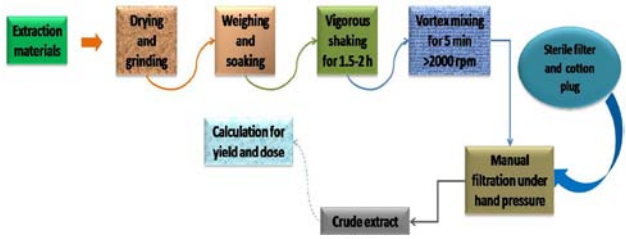

Fig. 1: Flowchart of overall MVT extraction process

[EM, after drying (shed/sun) and grinding (size reduction), is shaken in a suitable solvent in the glass bottle (amber) and followed by vigorous shaking for up to 2 h. For more better mixing vortex at 2000-3000 rpm for 5 min is appreciated, which was then followed by manual filtration under hand pressure with CP and Whatman FP. Finally, solvent evaporation is recommended by using a Rotary evaporator under reduced pressure or simply at ambient temperature].

In order to get fractionation and fraction yield; subsequent solvent (s) treatment should be followed to evaporation of solvent (s) by suitable method such as freeze drying, under reduced pressure in rotary evaporator and so on.

$$\text{Fraction yield (\%)} = \frac{F_d}{E_i} \times 100$$

Where, F_d: dried fraction; E_i: initial extract.

For an overview about the fractionation, have a look at the schematic fig. 2.

[The MVT extraction crude extract is now ready to be fractionated, where subsequently polarity-wise solvents are added to the original crude sample solution and shaken vigorously. To make sure of the two different solvent extracts a partitioning solvent is used. After elapsed time the partitioning solvent extract and fractional one are decanted out, leaving behind the original crude extract solution, which will undergo further one or more fractional separations.

Finally, the residue is returned to the container of crude extract. It is the time for solvent evaporation and yield determination of the fractions].

To increase the yield (%) we can follow the fig. 3 and 4.

[In this occasion, extraction materials are treated with a different solvent to get the different composition of crude extract. After evaporation of respective solvents, extracts are preserved in marked containers].

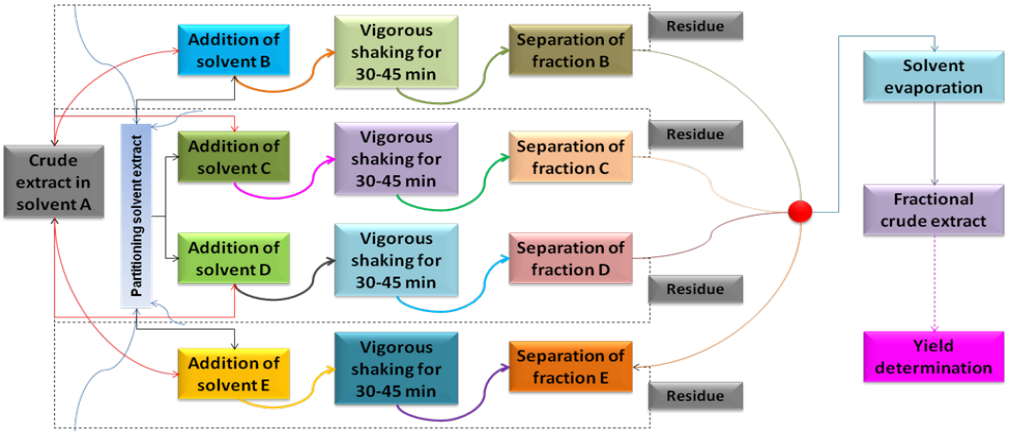

Fig. 2: Flowchart of general fractionation pathways after MVT extraction

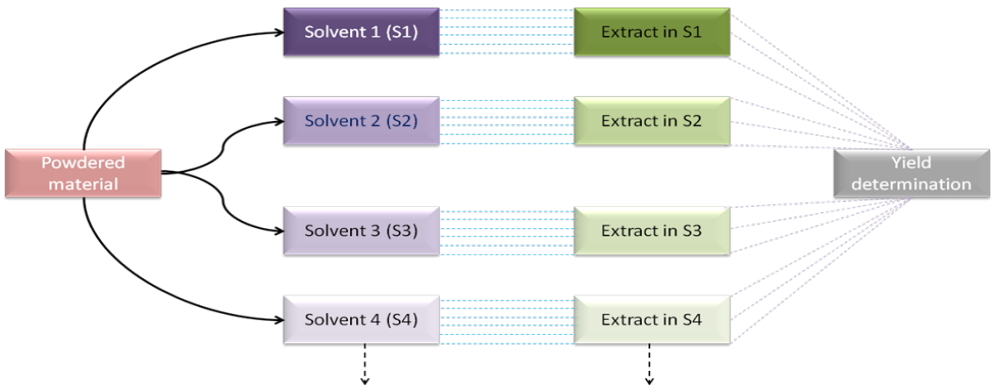

Fig. 3: Flowchart for extraction with individual solvent. [Polarity: S1>S2>S3>S4>----]

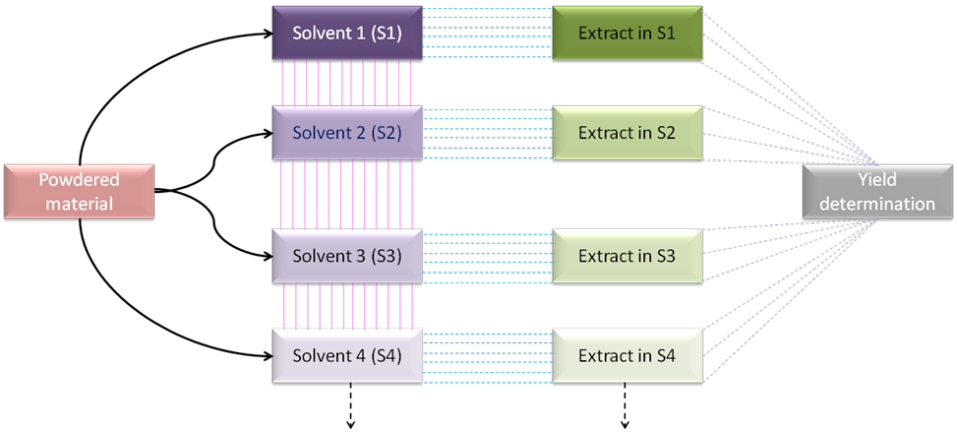

Fig. 4: Flowchart for serial extraction followed by polar to non-polar solvent (s), [Polarity: S1>S2>S3>S4>----]

[Here a series of treatment is followed by polar to non-polar or vice-versa. fractions obtained in this process are then subjected for solvent evaporation and yield determination.]

The essential features tell that MVT may be more economical and suitable for the extraction with a small amount of biological materials and solvent. The residue, after extraction and drying, permits re-use for large-scale extraction. The MVT may be a rapid method in preliminary phytochemical screening. The heat-labile/heat-sensitive, as well as essential oils, can be extracted by adapting suitable other existing methods. Otherwise, for more rapidity, it is possible to become accustomed with automatization; thus having a chance of modifying.

In conclusion, the discovery of new drug candidate(s) is always charming to the drug scientists, although it is a time-consuming task, as it requires a progression of steps in its journey. Every step is unique in its nature, essentially for elapsed time. However, scientists are always in touch to discover and share their valuable ideas to make more economical, rapidity, ease of usage and handling of the tools involved in this decent task. Biological materials, mainly the plants and their parts are the major sources of natural products-origin drugs, whichever till date participating as a sole source of active constituents for health-consumptions.

To be a bolus to the latter one phytopharmacological screening is crucial; in which extraction is considered as one of the most important primary steps to be proceeded on, practically. There are a number of extraction methods, which are extensively used in this area. Unfortunately, all of them may be considered as solvent as well as time-consuming. It is to be mentioned that the current MVT is a proposal, as still to be developed. Percentage yield is a major concern for any extraction, as the amount of coins extract is crucial for the further rolling to experimentation. Finally, the overall talks tell that MVT may be an important rapid and economical extraction method in the phyto-pharmaceological screening studies, studies, especially in drug discovery and development.

CONFLICT OF INTERESTS

There is no conflict of interest.

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