Study of Extraction of Tannic Acid from Emblica Officinalis (Amla)

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Abstract— Traditional medicinal plants have stood up to the test of time and its active ingredients were used for preservatives and therapeutic medicine to the modern science. The fruits of terminalia chebula (baheda), terminalia ballerica (baheda), Emblica officinalis (Amla) were contains tannic acid among, it is one of the richest source of tannic acid. There are various methods for the extraction of tannic acid from Emblica Officinalis such as conventional batch extraction and novel extraction technique etc. This work represents impact of various experimental conditions such as temperature, solid loading and particle size on the extraction of phenol from dry fruits of Emblica officinalis. Extraction of tannic acid is performed with distilled water. Distilled water is found to be the best solvent from literature for tannic acid. Increase in temperature of process results into increase in solubility and diffusion coefficient because it destructed cellular structure of solid matrix. This study shows extraction rate is increased with increase in particle size, which is because of decrease in diffusion path length. With increase in solid loading suspension becomes more viscous. It is difficult for solvent molecules to diffuse inside solid matrix. Therefore, as the solid loading increases, % extraction of tannic acid decreases.

Key words: Active Ingredients, Tannic Acid, Emblica Officinalis, Diffusion Coefficient

I. INTRODUCTION

Tannic acid is an organic compound and mostly used in industries types of tannin, a kind of polyphenol. Its not an strong acid (pKa around 10), which result uncalculated phenol groups in the structure. These tannic acid chemical formula was generally given as C76H52O46, which comparable by means of decagalloyl glucose, but it is a mixture of polygalloyl quinic acid esters or glucoses along with quantity of galloyl moieties per molecule ranges between 2 to 12 which depends on the plant methods those are use on the way to extract the tannic acid. The fruit has comparatively larger concentration of asparagic acid & minerals. Alanine, 2-Aminoglutaric acid, Pyrrolidine-2-carboxylic acid, lysine and asparagic acid are 14.6%,29.6%, 8.1%, 5.3% and 5.4% respectively of the total asparagic acid. The soft delicate part of seed, dried and liberated from the nuts enclose: tannin, tannic acid 1.33%, rough cellulose 17.08%; gum 13.75%; c cellulose 17.08% and mineral material 4.12%. Amla natural product fiery debris contains copper, zinc, chromium (3, 4, 2.5 ppm) [1]. Emblica officinalis was one of mainly important fruit of tropics and subtropics. It contain large amount of vitamin C and other nutrients like polyphenols, pectin, iron calcium and phosphorus. Tannic acid is generally defined as polyphenolic compounds have high molecular weight (over 1000) and can from a complex with the protein.

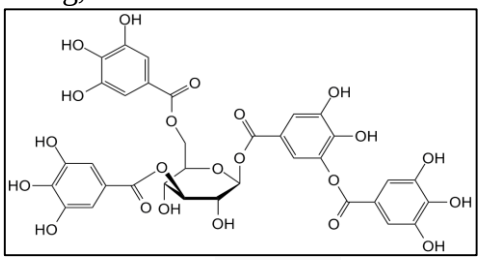

Fig. 1: Tannic acid

The main aim of this work is to study solid-liquid extraction of tannic acid. The soxhlet and continuous solvent (batch) extraction experiment were conducted to find the influence of the parameter [2].

II. MATERIALS AND METHODS

The Emblica Officinalis used in current work was purchased from herbal store (Pune, India). This distilled water used as solvents and UV-Visible double beam Spectrophotometer (UV-1800, Shimadzu Japan Model No. 2600) was used for analysis purpose. The following relation gives the percentage extraction of tannic acid [3].

$$\% \text{ Extraction of tannic acid at any time t} = \frac{A}{B} \times 100$$

A = tannic acid concentration at any time t in solvent.

B = tannic acid maximum concentration in solvent by Soxhlet extraction method.

III. EXPERIMENTAL SETUP

The investigation of the impact of different working parameters, for instance, effect of effect of temperature (60, 50, 40, 30°C), diameter of solid (0.600-0.850, 0.420-0.600, 0.106-0.420mm), influence of solid loading (0.3%, 0.5%, 0.67%) was carried out in this experimentation. The batch extraction method were done in completely perplexed 600 cm^2 borosilicate tube shaped glass vessel, outfitted with a three-cutting edge turbine impeller. Using a constant temperature bath, the stirrer was kept up at 500 rpm and experiments were carried out at 30°C (±1°C). The stirrer was kept up at 500 rpm utilizing a steady temperature shower. All investigations were directed at 30°C (±1°C) unless generally expressed.

IV. EXPERIMENTAL PROCEDURE

A. Hot Continuous Extraction (Soxhlet)

The goal of hot continuous extraction (soxhlet) was to decide most extreme recoverable substance of the solute in the crude material. Emblica officinalis (Amla) fruit grinded in mixer and isolated by sieving into an unequivocal size. The fragmentary extent chose for the trial was 0.6-0.850mm. Hot continuous extraction equipment through 400 cm^2 of distilled water and mass of 1.33 g of raw material (fruit powder) was placed thimble [4], and experimentation

performed for 24 h with distilled water. The equilibrium concentration of tannic acid at time 24 h was obtained 672.16 mg/L distilled water.

B. Batch Extraction

The aim of the conventional extraction experiments is used to estimate the percentage extraction of tannic acid and investigation of effect of the working parameters. *Emblica Officinalis* fruits powder grinded were taken 1g (0.600-0.850 mm) and brought into the extractor, outfitted with a mechanical agitator and it consist of 300 cm^2 solvent.

C. Analytical Methods

Powdered fruits of Emblica officinalis were subjected to analysis under ultra violet light after treatment with various chemical. These parameters were taken into account i.e., observation under maximum wave length U.V (276 nm) UV–Visible double beam Spectrophotometer (UV-1800, Shimadzu Japan Model No. 2600) with 4 cm quartz cuvettes.

V. Results and Discussion

A. Effect of Temperature

The rate of extraction of tannic acid is found to increases with expansion in temperature as shows in Fig. 2. The rate of extraction of tannic acid from fruit of Emblica Officinalis with distilled water as solvent which stirred at 500 rpm in an agitated vessel at temperature range from 30-60°C [5]. The initial rate of extraction of tannic acid is fast. The tannic acid yield increased with increasing the extraction temperature. This temperature decreases it enhanced solubility of the tannic acid in the extracting solvent decreased. This diffusion rate increases with increase temperature these causes increase in % extraction of tannic acid and mass transfer from the interior of plant particles into solution [6].

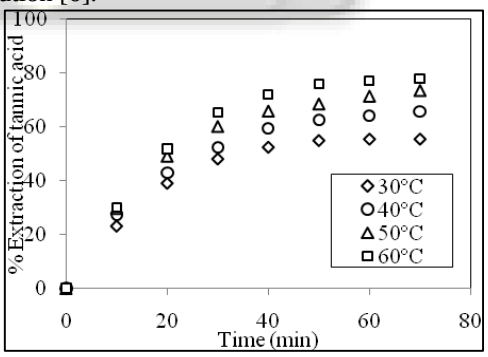

Fig.2. Effect of temperature on extraction of tannic acid [solvent: water, agitation speed: 500rpm and raw material (gm): volume of solvent (ml): 0.3%, diameter of solid: 0.60 ~ 0.85mm].

B. Influence of Solid Loading

Fig. 3 shows the result of sample loading on the tannic acid extraction with distilled water at 1000 rpm, and at temperature (60°C). The suspension of solid is seen to be thick in distilled water during extraction which moves smaller the surface range accessible for extraction with the expansion in solid loading. Following the suspension get to be thick it is troublesome for the solvent to diffuse inside the solid particle. During extraction solvent get diffused inside pore of solid particle it increases in size these effect on ability of the agitation decreases and viscosity increases with increase in loading. Consequently, it was found that extraction rate decreased with increase in solid loading [7]. The yield of tannic acid improves as the composition of solvent increases. During time of tannic acid production yield will reduces due to less amount of solvent for swelling of raw material and it also depend on solvent relative polarity [8].

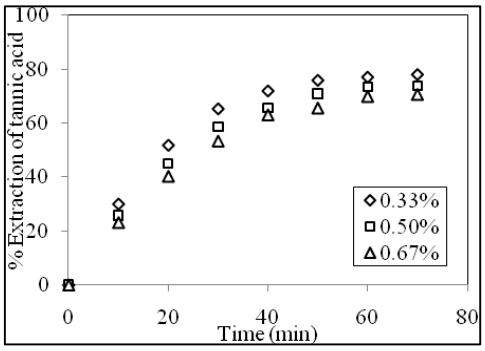

Fig. 3: Effect of solid loading on extraction of tannic acid [solvent: temperature 60°C, speed of agitation: 500 rpm, diameter of solid- 0.60 ~ 0.85mm].

C. Effect of Diameter of Solid

Fig. 4. demonstrates effect of size of a particle in the ranges such as: 0.600-0.850, 0.420-0.600 and 0.106-0.420 mm. Obviously, when the raw material such as Emblica officinalis fruit powder particle was reduced, the degree of rate of extraction for tannic acid increases. The rate extraction of tannic acid was possibly extended along with the fall in the particle size, this implies that the rate of transfer of the solvent into the solid mass of smaller particle size is relatively fast compared to the larger particle size [9].

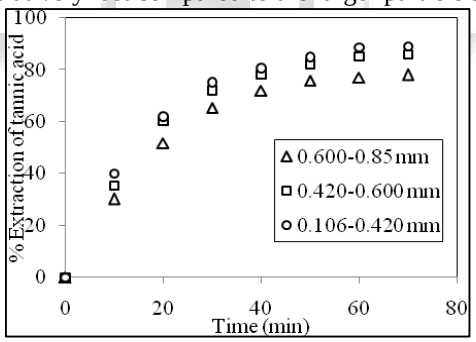

Fig. 4: Effect of diameter of particle on extraction of tannic acid [temperature: 60°C, speed of agitation: 1000 rpm and solid to solvent ratio in percentage: 0.3%]

It is likely in view of fall in the pore diffused way with reduction in the particle size. The effect of diameter of solid on the % yield of tannic acid extraction was explained at 60°C & the volume of distilled water per gram of raw material. Mass transfer rate and amount of extraction depends on the surface area. Particles of same mass with molecule size have higher surface region. So, Emblica officinalis fruit powders with smaller equivalent diameter are more efficient for tannic acid extraction [10]. It can also be stated from the Fig. 4. spreading for big sized particle has been shown by the kinetic increase in the graph [11], indicating resistance in internal diffusion to be most important through the complete extraction process. Pore diffusion affected by the particle size and increase in particle size improve pore diffusion [12].

VI. CONCLUSION

Extraction of tannic acid was performed with distilled water as a solvent. The effect of different parameter for example, temperature, diameter of solid and solid loading has been extensively examined. Due to the destruction of cellular structure of matrix, release of tannic acid takes place. This decrease in the particle size provides higher surface area for the extraction process and gives better extraction efficiency. As solid loading increases, solvent gets thick or saturated and it makes the solution more viscous. This extraction of tannic acid decreases because surface area available is less & makes more difficult for solvent to diffuse inside solid particle core and dissolve tannic acid.

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