Studies on Extraction of Flavonoids from Leaves of *Artocarpus heterophyllus*

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ABSTRACT

Every component of the plant contains polyphenolic substances known as flavonoids. To prepare pharmaceuticals and carry out pharmacological actions, these are separated from the extraction process. Flavonoids from leaves of Artocarpus heterophyllus were increased for this study (Jack fruit). For the extraction of bioflavonoids during batch extraction, optimisation of physical and chemical parameters is necessary. The extraction of flavonoids is correlated with various solvents, solvent concentrations, time, and particle mesh sizes. The concentration of 72 mesh size was found to be 24 g/ml and the ideal batch extraction conditions for kaempferol were ethanol, 100% solvent, 24 hours. The concentration of rutin at 22 g/ml was found to be the best under the ideal conditions of methanol, 100% solvent, 36 hours, and 72 mesh size. The ideal conditions for quercetin were also determined to be ethanol, 80% solvent, 24 hours, and 72 mesh size concentrations, which resulted in a 26.5g/ml concentration.

Keyword: - *Jack fruit, Separation, Purification, Rutin, Quercetin, Kaempferol*

1. INTRODUCTION

Jack fruit, also known as Artocarpus heterophyllus, is a tropical plant that is a member of the Moraceae family [1]. This plant range in size from 45 to 52 cm depending on the species. This tree produce more than 150 fruits per year. This plant contains different phytochemicals like epicatechin, quercetin, kaempferol [2], gallic acid, rutin, glucosides, coumaric acid, saponins, ursolic acid, [3], terpenoids, gallic acid are present. These phytochemicals are played as medicinal properties for control of diseses. Hence, the extraction process for making drug material is isolated from the phytochemicals [4]. It is edible fruit and leaves are used as food fooder and shampoo product. Plant leaves are high in micronutrients, macronutrients, and bioactive substances. They have an average fat (0.52 %), carbohydrates (11.89 %), moisture content (81.45 %), ascorbic acid (102 mg), gallic acid (1818 mg), protein (19.67%), and ash (3.64%). Extracts from this leaves have been studied for their biological activities, including antidiabetic, hepatoprotection, anticancer [5], antidiarrheal, antimicrobial [6], and antioxidant. In this experimental process, we have to extract the higher concentration of flavanoids from these plant species by different methods. Flavonoids play a variety of biological activities in plants.Whenever we are getting high concentration of flavanoids in guava leaves extract then finally; we have to use this plant extract sample for the pharmacological activity studies. In this work we are studied about various flavonoids from this jack fruit leaves from extraction process with parameters. These flavonoids acts as biomedicine properties and used in preparation of drugs in pharmaceutical industry for control of disorders. Most of the plants contains these flavonoids and extracted with different solvents like polar solvents and non polaric solvents.

2. MATERIALS AND METHODS

2.1 Collection of plant materials

Jackfruit leaf are collected from Modinagar, Ghaziabad, Uttar Pradesh State. Leaves are separated from the plant, cleaned with water and dried under the sunlight. Finally, the leaves are grinded and converted into powdered form.

2.2 Chemicals

Potassium acetate, Distilled water, Ethanol, Methanol, Silica gel, Aluminium chloride

2.3 Plant extraction

1 gram powder (72 mesh) is taken in conical flask and add 25 ml of organic solvent (ethanol and methanol) in conical flask. The samples should be soaked for between 24 and 36 hours before being filtered via a funnel using Whatmann paper No. 1. The organic solvent from these filtered, extracted samples is evaporated at a specific temperature using heat (Methanol at 65 ^{o}C and Ethanol at 78 ^{o}C). Finally, plant extract was prepared for determination of bio flavonoids.

2.4 Determination of Flavonoids

Rutin: Take 1 ml of the extract and mix it with 1 ml of the Alcl 3 (2%) solution in a test tube. Take 30 minutes to incubate at room temperature. At 420 nm, a colorimeter was used to observe the reaction mixture. Using a calibration curve, the rutin was found.

Kaempferol: Add 1ml of methanol to 1ml of plant extract in a test tube. Take 30 minutes to incubate at room temperature. At 265 nm, a colorimeter was used to observe the reaction mixture. Using a calibration curve, the amount of kaempferol was ascertained.

Quercetin: 0.5 ml of plant extract sample, 1.5 ml of methanol, 0.1 ml of Alcl3 (10%), 0.1 ml of 1M potassium acetate, and 2.8 ml of distilled water are added to the test tube. Take 30 minutes to incubate at room temperature. Using a colorimeter, the reaction mixture could be seen at 415 nm [10]. Using a calibration curve, the quercetin was ascertained.

3. RESULTS AND DISCUSSION

In this study, flavonoids from Jack fruit leaves were extracted while optimising the extraction's parameters.

3.1 Different solvents

To obtain the highest output of bioflavonoids from Jackfruit leaves, a variety of organic solvents were employed. Ethanol was optimum for extraction of quercetin and kaempferol. These concentration were 11.5µg/ml (quercetin) and 13.5µg/ml (kaempferol). Methanol is best result for extraction of rutin [11] and it found be 12.0µg/ml. It was express in figure 1.

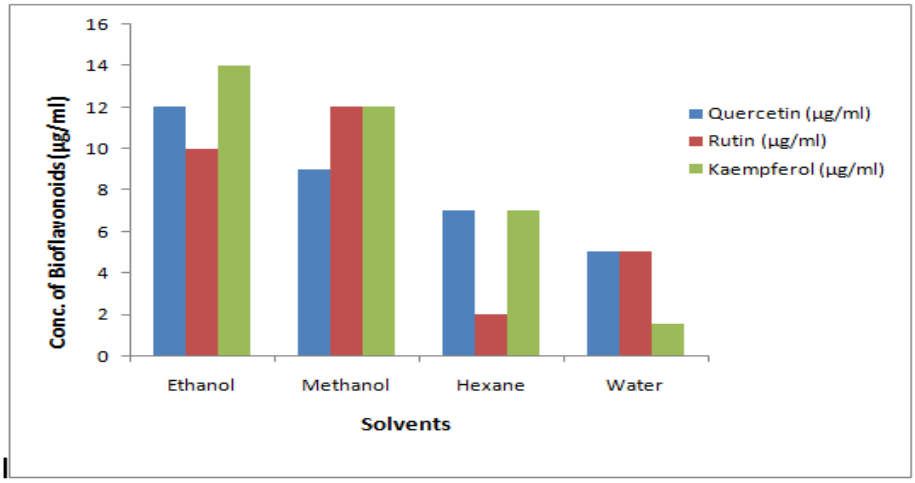

Fig -1: Effect of Different Solvent

3.2 Percentage solvent

In this process, percentage solvents are played a key role for extraction of flavonoids. 100% solvent is optimum for rutin (100% methanol) and kaempferol (100% ethanol) and these concentrations were 12.0µg/ml (rutin) and 13.5µg/ml (kaempferol). 80% ethanol solvent is found to be optimum for quercetin [12] and the concentration of flavonoids is 16.5µg/ml. It was express in figure 2.

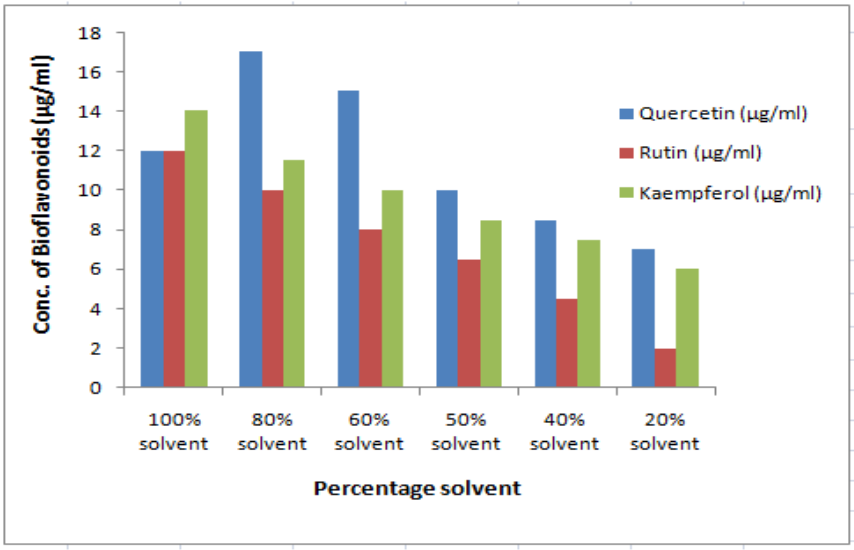

Fig -2: Effect of Percentage Solvent

3.3 Time

In this extraction process, flavonoids was found to be 23.5µg/ml at 24hrs for quercetin, 17.5 (µg/ml) at 36hr for rutin and 19µg/ml at 24hr for kaempferol. Here, 24hrs is a optimum for extraction of flavonoids from the quercetin and kaempferol and 36hr [13] is found to be optimum for rutin. It was express in figure 3.

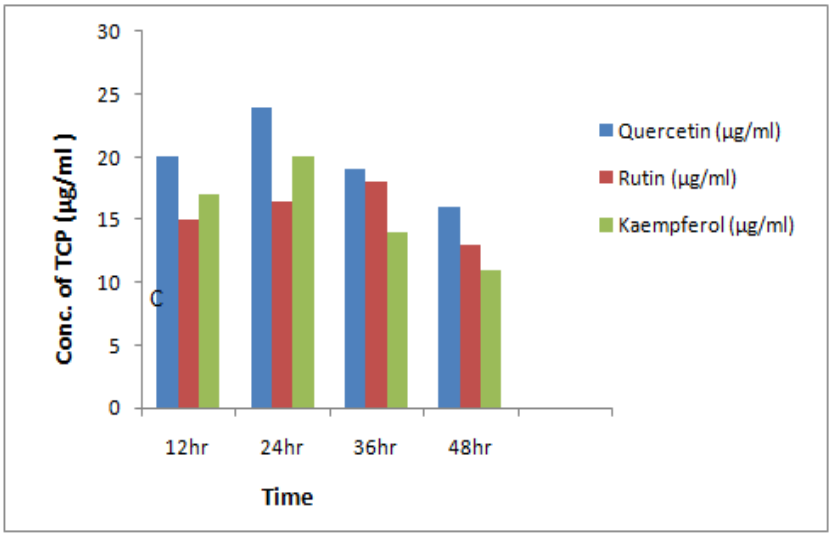

Fig -3: Effect of Time

3.4 Particle mesh size

A particle mesh size of 72 is ideal for extracting flavonoids in this extraction procedure. It was found to be 26.5 µg/ml of quercetin, 22µg/ml of rutin and 24µg/ml of kaempferol in leaves of this plant. It was shown in figure 4.

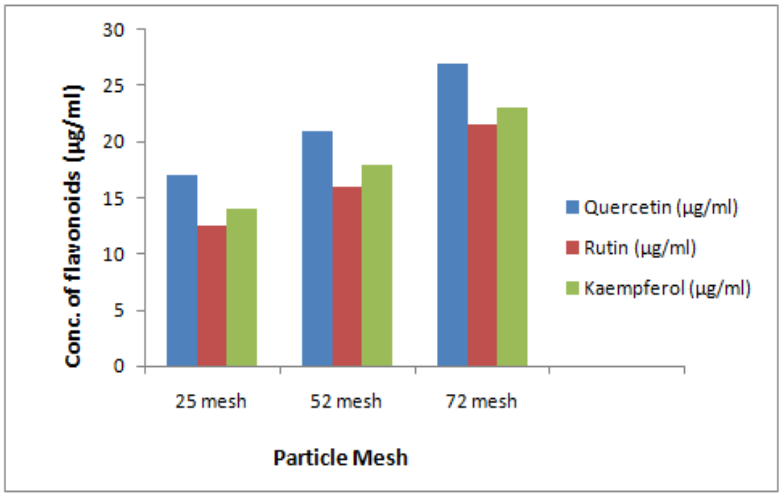

Fig -4: Effect of Particle mesh size

4. CONCLUSIONS

To extract bioflavonoids from the leaves of the jackfruit, the batch extraction procedure involves optimising physico-chemical parameters. The extraction of flavonoids is correlated with various solvents, solvent concentrations, time, and particle mesh sizes. The concentration of 72 mesh size was found to be 24 g/ml and the ideal batch extraction conditions for kaempferol were ethanol, 100% solvent, 24 hours. The concentration of rutin at 22 g/ml was found to be the best under the ideal conditions of methanol, 100% solvent, 36 hours, and 72 mesh size. The ideal conditions for quercetin were also determined to be ethanol, 80% solvent, 24 hours, and 72 mesh size concentrations, which resulted in a 26.5g/ml concentration.

5. REFERENCES

1. M. Kamaluddin, M. Ali and M.K. Bhuiyan. Effect of auxin on rooting of cuttings and growth of stecklings of jackfruit (Artocarpus heterophyllus lam.). Chittagong Univ. Stud. Sci. 20(1): 71-75(1997).
2. Roy, S.K., P.K. Royand and R.G. Brumfield, In vitro propagation and establishment of a new cultivar of jackfruit (Artocarpus heterophyllus lam.) bearing fruits twice yearly. Acta Hort., 429: 497-502 (1996).
3. R. Dayal and T.R. Seshadri. Colourless compounds of the roots of Artocarpus heterophyllus. Isolation of new compound artoflavone. Indian J Chem. 12: 895-896 (1974).
4. Chai-Ming Lu and Chun-Nan Lin. Two 2′, 4′, 6′-trioxygenated flavanones from Artocarpus heterophyllus. Natural Products Research Center 33(4): 909-911 (1993).
5. S.C. Fang, C.L. Hsu, G.C. Yen. Anti-inflammatory effects of phenolic compounds isolated from the fruits of Artocarpus heterophyllus. J Agric Food Chem. 56(12): 4463-4468 (2008).
6. Burci, L.M., Bezerra, C., Oliveira, M.De, Dalarmi, L., Zanin, M.W., Miguel, O.G., Fátima, J.D. and Dias, G. (2015). Determination of antioxidant, radical scavenging activity and total phenolic compounds of Artocarpus heterophyllus (Jackfruit) seeds extracts. Journal of Medicinal Plants Research, 8(40), 1013–1020.
7. Ilmi, H.M., Elya, B. and Handayani, R. (2020). Association Between Total Phenol and Flavonoid Contents In Artocarpus heterophyllus (Jackfruit) Bark and Leaf Extracts and Lipoxygenase Inhibition. International Journal of Applied Pharmaceutics, 12 (1), 252 – 256.

8. Moke, L.E., Ngbolua, K., Bongo, G.N., Messi, L.M., Noté, O.P., Mbing, J.N. and Mpiana, P.T. (2017). Artocarpus heterophyllus Lam. (Moraceae): Phytochemistry, Pharmacology and Future Directions, a mini-review. Journal of Advanced Botany and Zoology, 5(3), 1–8.
9. Purseglove P (1968) Tropical crops, vol 2. Dicotyledons Artocarpus heterophyllus Jackfruit vol 2. Longman, London, pp 384–386.
10. Rowe-Dutton P (1985) Artocarpus heterophyllus-Jackfruit. In: Garner JR, Chaudhury SA (eds) The propagation of tropical fruit trees. FAO/CAB, London, pp 269–290.
11. A. A. Sundarraj and T. V. Ranganathan. (2017). Physicochemical characterization of Jackfruit (Artocarpus integer (Thumb.).) Peel. Res. J. Pharm. Biol. Chem. Sci., vol. 8, no. 3, pp. 2285–2295.
12. Morelos-Flores, D. A., Montalvo-González, E., Chacón-López, M. A., Santacruz-Varela, A., Zamora-Gasga, V. M., Torres-García, G., & de Lourdes García-Magaña, M. (2022). Comparative Study of Four Jackfruit Genotypes: Morphology, Physiology and Physicochemical Characterization. Horticulturae, 8(11), 1010.
13. Alves, J. L. F., da Silva, J. C. G., Mumbach, G. D., Di Domenico, M., da Silva Filho, V. F., de Sena, R. F., ... & Marangoni, C. (2020). Insights into the bioenergy potential of jackfruit wastes considering their physicochemical properties, bioenergy indicators, combustion behaviors, and emission characteristics. Renewable Energy, 155, 1328-1338.
14. K. Anwar., A. Lutpi., A. Melinda., and S. Hadi. (2022). Extraction methods effect on antioxidant activity of ethanol extract of 'pasak bumi' (Eurycoma longifolia Jack.) root. IOP Conf. Ser. Earth Environ. Sci., vol. 976, no. 1.
15. Oreopoulou, A., Tsimogiannis, D., & Oreopoulou, V. (2019). Extraction of polyphenols from aromatic and medicinal plants: an overview of the methods and the effect of extraction parameters. Polyphenols in plants, 243-259.