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METHOD DEVELOPMENT FOR EVALUATION OF PERCENTAGE YIELD FROM *Spinacia Oleracea.*

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ABSTRACT

Spinach (Spinacia oleracea L.) is a rich dietary source of health-promoting compounds responsible for their wide range of biological and functional properties. Different extractions (ultrasonication, pressurized liquid extraction), isolation (column, semi-preparative or Droplet counter-current chromatography) and analytical such as HPLC, UPLC, LC-ESI-MS/MS, NMR techniques have been used for the separation, identification and quantification of flavonoids from spinach. Extraction has been a fundamental technique used for chemical components extraction and then use the extract for formulation. Article emphasizes on principles of common organic techniques, including solvent extraction for the isolation and identification of components from spinach leaves. Article includes processing plant material to isolate and identify the pigments, using the solvents (Magnesium Sulphate: Alumina: Acetone) and (Hexane: Methanol).

Quantitative extraction research analysis reported in this article includes variable extraction method, and then to calculate and assess a suitable extraction method which gives maximum yield but depending upon the conditions such as varieties, growing season or cultivation practices extraction method could vary.

KEYWORDS: Extraction, Spinach, Green Chemistry, Percentage yield, Separation Science, Maceration.

INTRODUCTION

Spinach (Spinacia oleracea) one of the most important antioxidative vegetables, usually consumed after boiling either fresh or frozen leaves. Prior literature reports address extraction from spinach, which is a leafy vegetable, with a fascinating past holds a significant place in history. However it's worth noting that spinach traces its roots back to Persia. This vegetable is packed with nutrients, like vitamins, minerals (iron) phytochemicals and bioactive compounds. When it comes to extracting these components from spinach or any plant material the commonly used method is solvent extraction—a fundamental approach [2].

The purpose of the current research is to utilize previous reports and use the data for extraction with solvents of the beneficial effects of consumption of spinach leaves or spinach extracts to yield a process which is more effective for spinach leaves extraction. Current research work focuses on the extraction and identification of the

same. The main goal of this research is to develop and identify a suitable method to yield maximum extract out of spinach [5,6].

MATERIAL AND METHOD

Material

All the standard chemicals used were acquired from Merck Pharmaceutics and Spinach was obtained from local market for solvent extraction and solvents were used without additional purification.

Method

(A) Sample Preparation - Spinach leaves were cleaned by washing the leaves with tap water once and then with distill water twice

(B) Drying the leaves- Shade drying of leaves for a period of 7 days until they are dried, and then grounded into a fine powder. This increases the surface area and facilitates the extraction process.

(C) Solvent extraction of plant pigments

i. Extraction with $MgSO_4$, Acetone and Alumina

Fresh spinach was combined with anhydrous Magnesium Sulfate and Alumina. The mixture was ground in a mortar and pestle until a light green powder was obtained (5–10 minutes). The light green solid was transferred to a beaker containing acetone. This mixture was allowed to stand for 7 days and was kept sealed.

Fig 1- Spinach leaves extraction (Dried leaves+ MgSO4+Alumina+Acetone)

ii. Spinach leaves - Extraction with Hexane: Methanol in 3 different proportion (8:2) (5:5) (2:8)

Suitable solvent was chosen based on literature review in ratio Hexane: Methanol (8:2), (5:5) and (2:8) on the type of compounds to be extracted, dried spinach leaves is then mixed with the chosen solvent by maceration process. This mixture is allowed to stand for 7 days, and then filtered to obtain liquid extract.

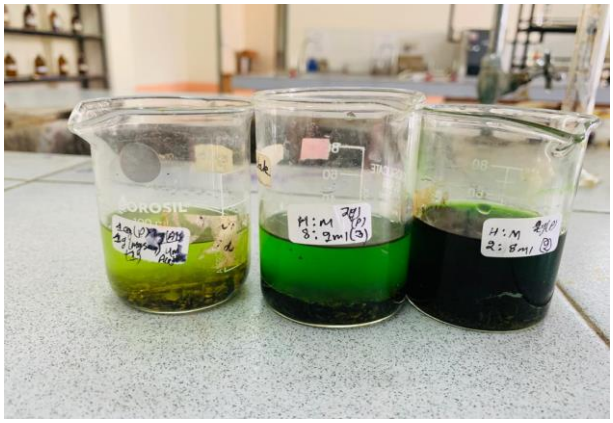

Fig 2- Spinach leaves extraction (hexane:methanol)

iii.Spinach stalk - Extraction with Hexane: Methanol (2:8)

Another suitable solvent was chosen based on literature review in ratio Hexane: Methanol (5:5) on the type of compounds to be extracted, dried spinach stalk is then mixed with the chosen solvent by maceration process. This mixture is allowed to stand for 7 days, and then filtered to obtain liquid extract.

Fig 3- Spinach stalk extraction (methanol:hexane 50:50)

(D) Calculation of percentage yield.

Calculation of percentage yield: Percent Yield is defined as the actual yield divided by the theoretical yield times 100.

% yield = PY/TY x100
PY= Practical Yield
TY= Theoretical Yield

Hazards

There are no unusual hazards associated with this experiment. The proper handling and disposal of the solvents used should be observed. The organic solvents used in this experiment are flammable and should be isolated from ignition sources such as the coffee grinder described in the experiment.

RESULT

i. Extraction with $MgSO_4$, Acetone and Alumina
Percentage Yield = 4.35/100 x 100 = 4.3 %

ii. Extraction of Spinach leaves with Hexane: Methanol in 3 different proportion (8:2) (5:5) (2:8)
Hexane: Methanol (8:2)
Percentage Yield = 4.41/50 x 100= 8.82 %
Hexane: Methanol (5:5)
Percentage Yield = 4.34/50 x 100= 8.68 %
Hexane: Methanol (2:8)
Percentage Yield = 4.97/50 x 100= 9.94 %

iii. Extraction of Spinach stalk extract with Hexane: Methanol (2:8)
Percentage Yield = 4.65/100 x 100= 4.65 %

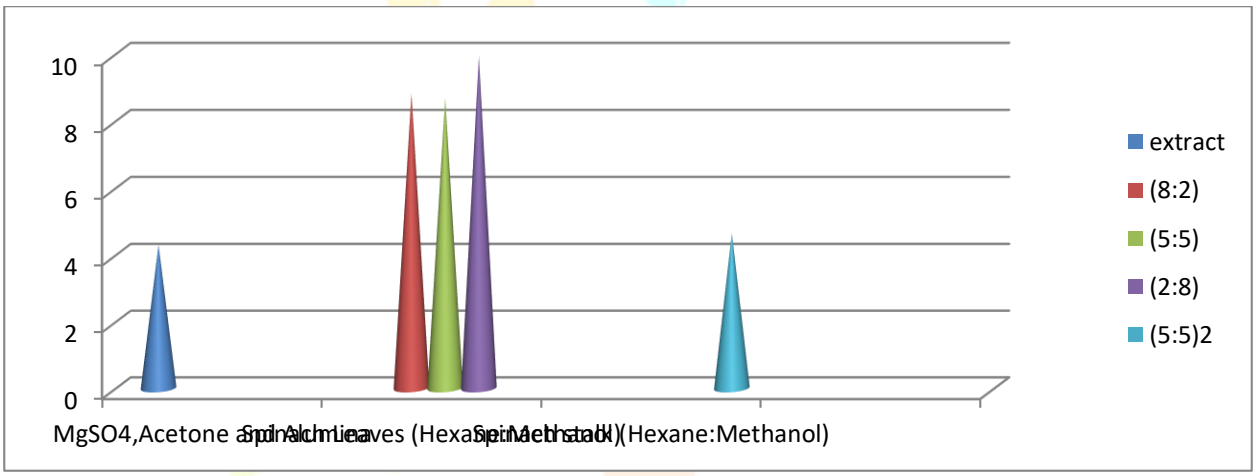

Fig 4- Result of percentage yield

CONCLUSIONS

The application of current techniques gives rough identification of % yield in spinach extract. Extraction with $MgSO_4$, Acetone and Alumina is 4.3 %, Extraction of Spinach leaves with Hexane: Methanol in 3 different proportion which involves Hexane: Methanol (8:2) = 8.82 %, Hexane: Methanol (5:5) = 8.68 %, Hexane: Methanol (2:8) = 9.94 %, Extraction of Spinach stalk extract with Hexane: Methanol (2:8) = 4.65 %. According to the above obtained results from the research use of an suitable solvents has been primary cause to identify and obtain maximum extraction and also the method used was quite a simple and easy method for obtain maximum yield. This method avoids the common complication arising from degradation products in the pigment extract and can be used on a variety of plants. Hence a conclusive research gives clear depiction that utilizing Hexane: Methanol in the ratio 2:8 gives maximum yield i.e. 9.94 %.

This research stresses on "green" approach to extraction methods, concerned with recovery of high quality and value-added compounds.

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