Extraction and Separation of Watermelon Seed Oil by Soxhlet Apparatus

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ABSTRACT

% yield and recovery of Oil using solvent extraction with different feed to solvent ratio. For solvent petroleum ether shows 1:3 and 1:4 seed powder to petroleum ether ratio the % yield 32 % and 36 % resp. For solvent petroleum ether shows 1:3 and 1:4 seed powder to petroleum ether ratio the % recovery 80 % and 90 % resp. As per observation petroleum ether is the best suitable for extraction of oil from the watermelon seed. petroleum ether can easily separate after extraction and has higher yield than other with low cost.

The ration of feed to solvent also important factor to be consider for extraction process which effect on the yield of oil. The optimum value for feed to solvent is 1:4 on which maximum yield for watermelon seed oil extraction. As the feed to solvent ration increase more than 1:4 there is appreciable change in the yield but the cost of solvent increase. The 1:4 feed to solvent ration is to be optimum value for watermelon seed oil extraction.

The time of extraction increased yield of oil also increase and up to maximum level. The extraction of date seed oil carried out 90-120 min. The optimum time for extraction is 2 hrs. Crushed seed in powdered form gives large surface area for solid-liquid contact. Due to small size particles increase rate as well as yield of extraction of oil from watermelon seed. Extraction carried out at boiling temperature of solvent should be better for rate and yield of extraction. Temperature for extraction with petroleum ether, methanol and hexane up to 35-40 ^{O}C.

Keywords – Watermelon Seed Oil, Soxhlet Extraction, Petroleum Ether.

1. INTRODUCTION

High amounts of unsaturated fatty acids, linoleic and oleic acids are present in seed of watermelon fruit. Watermelon seed oil contains considerable amount of PUFAs which are very receptive to oxidation and other side reactions that causes deterioration of oil. White seeds of watermelon contain 40% crude oil. Watermelon seed of Indian origin for extraction of oil and proteins. Watermelon Seeds are waste product of Watermelon fruit. Extraction of Watermelon seed oil was carried out using Soxhlet apparatus. Three solvents were used for the extraction of Watermelon seed oil namely; n-Hexane, Acetone and petroleum ether.

2. LITERATURE REVIEWS

The yield of the seed oil found to be 40 %. The pH value of 3 - 4 suggests that the oil is acidic which is indicative of the presence of free fatty acids in the extracted oil. [1] **Watermelon seed of Indian origin for extraction of oil and proteins.** Watermelon Seeds waste product of Watermelon fruit. White seeds of watermelon contain 40% crude oil. Crude oil contains maximum amount of polyunsaturated omega-6 fatty acids (PUFA) especially Linoleic acid. Extraction of Watermelon seed oil was carried out using Soxhlet

apparatus. Three solvents used for the extraction of Watermelon seed oil namely n-Hexane, Acetone and petroleum ether. From that hexane gives good results as compared to Pet. Ether and Acetone. [2] **Seeds contain nutrients like protein, essential fatty acids, vitamins and minerals. Oil content in the seeds is between 35-40 %** and the unsaturated fatty acid content in oil is 78-86 % predominantly linoleic acid (45-73 %). Extraction of watermelon seed oil by solvent extraction process with the use of different solvents . Solvent extraction was carried by n-hexane, benzene and mixed solvent system. The best oil quality which we got from n-hexane with an optimum yield 30.55 %. and of best quality. The color of oil extracted from benzene and mixed solvent was dark brown of dark color. This happened because benzene may have extracted the pigments present in seeds due to this reason benzene could not be the suitable solvent for extraction of watermelon seed oil by solvent extraction even though the yield was highest 32 %. The solid to solvent ratio was kept at 1:5. cake contains 26.8 % protein which was used for formulation of detergent. The de-oiled seed can be used as cattle feed or used in protein extraction which could be used in nutraceutical industries. [3] **Watermelon seed oil was extracted using the solvent extraction method using n-hexane.** The extracted oil was pale yellow liquid at ambient temperature with characteristic unique odor. The oil yield of Watermelon was determined as 85.5 %. Acid value of oil is an important parameter which affects the transesterification of oils. Soxhlet apparatus used for solvent extraction where 300ml of n- Hexane was poured into round bottom flask.10 grams of powdered Watermelon seed was placed in the thimble and inserted in the center of the extractor. The Soxhlet was heated at 60 ^{O}C. [5] **Oil extract from a number of fruits, nuts and seeds are used in cooking, soap making** and as ingredient in confectioneries of baked or fried foods. Seeds of many edible fruit are often thrown out as waste despite. Dried and pulverized watermelon seed family Cucurbitaceae was extracted with solvent extraction method using hexane solvent at 60-70 ^{O}C. [6] **Watermelon seeds, 50 g weighed into an empty thimble which placed in a Soxhlet extraction set. 250 ml of n-hexane solvent then poured into the extraction flask.** The bottom of the extractor containing the sample was connected to the extraction flask and placed on the heating mantle. [7] **Watermelon seed-oil was extracted with n-hexane using Soxhlet extraction method, at the temperature range between 60 to 70 ^{O}C.** [8] **Thirty grams of seeds flour of each variety were placed in a paper thimble and fed into a 250 mL capacity Soxhlet extractor.** The extractor fitted with a 500 mL round bottomed flask containing 300 mL of solvent. The oil extraction carried out with n-hexane on a flask heater at 80 °C for 2 h. n the solvent extraction methods where the oil yields were the highest in Soxhlet extraction 36.3 %. The extraction yields by the mechanical method are often lower than those by solvent extractions. [9]

Applications of Water Melon Seed Oil

1.Watermelon seed oil has excellent humectant and moisturizing properties.

2. It is to be observed that it has positive effect over the both oily and dry skin.

3. It is easily absorbed by the skin and helps in restoring the elasticity of the skin.

4. Watermelon oil can be utilized by cosmetic industries.

5. Preparation of moisturizer which shows properties similar to market grade moisturizer.

6. Antioxidants property of oil beneficial role in skincare in combating free-radicals resulting from sun damage and pollutants.

7. Seed oil formulated into skincare products in the form of emulsions and nano emulsions.

8. Seed oil should be more effective than peel wax as an additive in cosmeceutical products to reduce and prevent cellular damage.

9. Two forms of cosmeceutical products emulsions and nano emulsions were successfully formulated from watermelon seed oil extract.

10. Physicochemical properties of watermelon seed oil for their suitability in biodiesel production as raw materials to obtain biodiesel fuel.

11.As industrial ingredients in soap production, cosmetics and foam ingredient.

12. The high oil content of the watermelon seed coupled with a fairly high concentration of fatty acid make the seed suitable as food supplement.

13. Preparation of emulsions, soaps and detergents formulation.

14. Watermelon seed oil is good source of omega-6 fatty acids.

15.Watermelon seed has a great potential to use as an excellent source of edible protein.

16. Watermelon seed proteins shows various amino acids mainly Histidine and Glycine.

EXERIMENTAL ANALYSIS

Raw Materials

1. Water Melon Seed

2. Petroleum Ether (B.P. 35-40 ^{O}C)

Apparatus Requires

1. Soxhlet Apparatus

2. Simple Distillation

3. Thermometers

4. Heating Element/Mental

5. Measuring Cylinders

6. Beaker and Filter Papers

Experimental Process Solvent Extraction

Extraction with Petroleum Ether for Feed to Solvent Ratio 1:3

1. Take 100 gm water melon seed dried in oven (at 105 ^{O}C) or sunlight to remove moisture.

2. Crush the watermelon seed to form powder.

3. Take 1: 3 ratios of watermelon seed powder (100 gm) to petroleum ether (300 ml).

4. Take cotton cloth or filter paper and watermelon seed powder in cloth or filter paper.

5. Put cloth or filter paper in thimble of Soxhlet Extraction apparatus contains seed powder.

6. Take 300 ml of the petroleum ether as solvent in round bottom flask of Soxhlet.

7. The mixture was then heated at 35 ^{O}C- 40 ^{O}C (B.P. solvent) for 1.5-2 hrs.

8. After extraction removal of round bottom flask from Soxhlet apparatus.

9. Date seed oil to be separated from the solvent using simple distillation.

10. Separation by simple distillation carried out at temperature 35-40 ^{O}C.

11. In distillation petroleum ether recover as top product and oil as a bottom product.

Extraction with Petroleum Ether for Feed to Solvent Ratio 1:4

1. Take 100 gm water melon seed dried in oven (at 105 ^{O}C) or sunlight to remove moisture.

2. Crush the watermelon seed to form powder.

3. Take 1: 4 ratios of watermelon seed powder (100 gm) to petroleum ether (400 ml).

4. Take cotton cloth or filter paper and watermelon seed powder in cloth or filter paper.

5. Put cloth or filter paper in thimble of Soxhlet Extraction apparatus contains seed powder.

6. Take 400 ml of the petroleum ether as solvent in round bottom flask of Soxhlet.

7. The mixture was then heated at 35 ^{O}C- 40 ^{O}C (B.P. solvent) for 1.5-2 hrs.

8. After extraction removal of round bottom flask from Soxhlet apparatus.

9. Date seed oil to be separated from the solvent using simple distillation.

10. Separation by simple distillation carried out at temperature 35-40 ^{O}C.

11. In distillation petroleum ether recover as top product and oil as a bottom product.

Results And Discussion

Experimental Material Balance

% Yield and Recovery of Watermelon Seed Oil

The maximum amount of oil in watermelon seed oil up to 35-40 %. Hence according this composition yield can be calculated. The maximum yield will be 40 %.

% Yield of Oil = [Mass of Oil Extracted / Mass of Watermelon Seed Oil] *100

% Recovery of Oil = [Oil Extracted / Maximum Amount of Oil in Seed] *100

Yield and Recovery for Feed to Solvent Ratio 1:3

1. % Yield Of Oil

% Yield of Oil = [32/100] * 100 = 32 %

2. % Recovery of Oil

% Recovery of Oil = [32/40] * 100 = 80 %

Yield and Recovery for Feed to Solvent Ratio 1:4

1. % Yield Of Oil

% Yield of Oil = [36/100] * 100 = 36 %

2. % Recovery of Oil

% Recovery of Oil = [36/40] * 100 = 90 %

Observations

Feed to Solvent Ratio	% Yield With Oil	% Recovery Oil
1:3	30	80
1:4	35	90

% Yield and Recovery of Oil for Different Feed to Solvent Ratio

Observation table shows % yield and recovery of Oil using solvent extraction with different feed to solvent ratio. For solvent petroleum ether shows 1:3 and 1:4 seed powder to petroleum ether ratio the % yield 32 % and 36 % resp. For solvent petroleum ether shows 1:3 and 1:4 seed powder to petroleum ether ratio the % recovery 80 % and 90 % resp. As per observation petroleum ether is the best suitable for extraction of oil from the watermelon seed. petroleum ether can easily separate after extraction and has higher yield than other with low cost.

ECONOMICS

1. Watermelon seed contain 35–40 % oil which economical for extraction of oil.

2. Oil extracted from waste material to be available in the market easily with very low cost.

3. Selected method for oil recovery also economical and easy to operation.

4. Cost of solvent also low and it have very high recoverability.

5. Oil will be demanding due to presence of fatty acid and antioxidants property.

6. Watermelon seed oil has excellent humectant and moisturizing properties.

7. Watermelon oil can be utilized by cosmetic industries.

8. Preparation of moisturizer which shows properties similar to market grade moisturizer.

9. As industrial ingredients in soap production, cosmetics and foam ingredient.

10. The oil has high oxidative stability due to low content of polyunsaturated fatty acids.

11. Watermelon seed oil is good source of omega-6 fatty acids.

12. Antioxidants property of oil beneficial role in skincare.

13. Seed oil formulated in skincare products in the form of emulsions and nano emulsions.

14. As industrial ingredients in soap production, cosmetics and foam ingredient.

FUTURE SCOPE AND DEVELOPMENTS

Watermelon seed oil has lots of usage and applications as commercial and industrial use. It has excellent humectant and moisturizing properties. Oil can be utilized by cosmetic industries. Preparation of moisturizer which shows properties similar to market grade moisturizer. Antioxidants property of oil beneficial role in skincare in combating free-radicals resulting from sun damage and pollutants. Seed oil formulated into skincare products in form of emulsions and nano emulsions. Seed oil should be more effective than peel wax as an additive in cosmeceutical products to reduce and prevent cellular damage. Preparation of emulsions, soaps and detergents formulation. Oil is good source of omega-6 fatty acids. Watermelon seed has a great potential to use as an excellent source of edible protein. Watermelon seed proteins shows various amino acids mainly Histidine and Glycine. After extraction of oil from watermelon seed cake separated from oil. Cake produce contains very high protein value. That can be used to produce protein for human feed. So we can increase the yield by optimize the various parameters that can affected on extraction rate, yield and

from the waste cake high value protein can be produce. Watermelon seed oil has lots of application so oil high demanding in market.

CONCLUSION

Solvent extraction is one of the traditional techniques of extracting vegetable oil. Oil seeds is one of the cheapest sources, applied to produce oil from seeds. Rate of extraction of oil from date seed depends on type of solvent, partial size of watermelon seed, time of extraction and temperature. Soxhlet extraction is the most common technique for oil seed extraction. Watermelon seed oil is obtained from watermelon seed through Soxhlet extraction technique. Oil content in the seeds is between 35-40% and the unsaturated fatty acid content in oil is 78-86% predominantly linoleic acid (45-73%).

% yield and recovery of Oil using solvent extraction with different feed to solvent ratio. For solvent petroleum ether shows 1:3 and 1:4 seed powder to petroleum ether ratio the % yield 32 % and 36 % resp. For solvent petroleum ether shows 1:3 and 1:4 seed powder to petroleum ether ratio the % recovery 80 % and 90 % resp. As per observation petroleum ether is the best suitable for extraction of oil from the watermelon seed. petroleum ether can easily separate after extraction and has higher yield than other with low cost.

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