Extraction of Oil from Watermelon Seed using Soxhlet Extractor

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Abstract-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%). Soxhlet extraction is the most common technique for oil seed extraction. Watermelon seed oil is obtained from date seed through Soxhlet extraction technique. % Yield and recovery of Oil using solvent extraction with different feed to solvent ratio. For solvent petroleum ether shows 1:3, 1:4 and 1:5 seed powder to petroleum ether ratio the % yield 32 %, 35% and 37 % resp. For solvent petroleum ether shows 1:3, 1:4 and 1:5 seed powder to petroleum ether ratio the % recovery 80 %, 87.5 % and 92.5 % 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 1.5-2.5 hrs. Ihe 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 up to 35-40 °C.

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

INTRODUCTION

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. Three solvents were used for the extraction of Watermelon seed oil namely, n-Hexane, Acetone and petroleum ether.

EXERIMENTAL ANALYSIS

Raw Materials
1. Water Melon Seed
2. Petroleum Ether (B.P. 35-40 °C)

Apparatus Requires
1. Soxhlet Apparatus
2. Simple Distillation
3. Digital 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 °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 (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 300 ml of the petroleum ether as solvent in round bottom flask of Soxhlet.
7. The mixture was then heated at 35 °C- 40 °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.

Extraction with Petroleum Ether for Feed to Solvent Ratio 1:5

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: 5 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 500 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.

12. Calculate % recovery or yield of watermelon seed oil.

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 = [30/100] * 100 = 30 %

2. % Recovery of Oil

% Recovery of Oil = [30/40] * 100 = 75 %

Yield and Recovery for Feed to Solvent Ratio 1:4

1. % Yield Of Oil

% Yield of Oil = [35/100] * 100 = 50 %

2. % Recovery of Oil

% Recovery of Oil = [35/40] * 100 = 87.5 %

Yield and Recovery for Feed to Solvent Ratio 1:5

1. % Yield Of Oil

% Yield of Oil = [37/100] * 100 = 37 %

2. % Recovery of Oil

% Recovery of Oil = [37/40] * 100 = 92.5 %

Observations

Feed to Solvent Ratio	% Yield With Oil	% Recovery Oil
1:3	30	80
1:4	35	87.5
1:5	37	92.5

% 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, 1:4 and 1:5 seed powder to petroleum ether ratio the % yield 32 %, 35% and 37 % resp. For solvent petroleum ether shows 1:3, 1:4 and 1:5 seed powder to petroleum ether

ratio the % recovery 80 %, 87.5 % and 92.5 % 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.
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. 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, 1:4 and 1:5 seed powder to petroleum ether ratio the % yield 32 %, 35% and 37 % resp. For solvent petroleum ether shows 1:3, 1:4 and 1:5 seed powder to petroleum ether ratio the % recovery 80 %, 87.5 % and 92.5 % 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.

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