Custard Apple Seed Oil as a Pesticide

Vedant Lal[1], Swapnil Bansi[2], Rugved Deshpande[3], Nita Mehta[4*]

[1,2,3]Student, Chemical Engineering, Thadomal Shahani Engineering College, Mumbai, Maharashtra, India
[4]Associate Professor, Chemical Engineering, Thadomal Shahani Engineering College, Mumbai, Maharashtra, India
*Corresponding Author

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Abstract— *Essential oils are oils extracted from plants. These categories of oils are obtained through distillation or mechanical methods such as cold pressing. Custard Apple Seed Oil is a type of essential oil. This oil can be used as an eco-friendly biopesticide. They are cheap, safe to use also maintains the fertility of the soil. Therefore natural pesticides like custard apple seed oil are given preference over synthetic pesticides. Oil extracted from it can be used as a pesticide against several common pests like the white mealybug, aphid, termite, etc. The oil extracted from custard apple seeds contain acetogenin a group of powerful respiratory inhibiting toxic components, which is responsible to act as a bio-pesticide. Cold pressing, solvent extraction, steam distillation, maceration, percolation, tincture, and infusion are the methods that are used for custard apple seed oil extraction.*

Keywords— Essential oils, distillation, cold pressing, acetogenin, maceration.

I. INTRODUCTION

Maharashtra is the leading state in custard apple production with 92,320 tons. The raw material required for the process; custard apple seeds are available in abundance. There are various methods of custard apple seed oil extraction. The selection of appropriate solvent for extraction is done by taking into account various factors like cost, oil extraction efficiency, solvent recoverability, and environmental impacts.

II. METHODS OF OIL EXTRACTION

2.1 Conventional Methods

Conventionally, the oil for pesticides can be obtained by three methods:

1. Custard apple seeds are boiled in an approximate amount of water until the liquid is reduced to half. Dilute the filtrate with a high quantity of water to obtain the pesticide.
2. Add finely ground custard apple seeds to water. Leave it to stand for a day or two. Strain**.**
3. Grind seeds to extract oil using a grinder. Dilute one part of oil to 20 parts.

2.2 Experimental Methods

2.2.1 Cold Pressing

This method is most preferred for extracting oil from citric rinds such as orange, lemon, and grapefruit. This method involves the simple pressing of the rinds at a temperature of about 120 F to extract the oil. These rinds are first separated from the fruit, ground, or chopped and then are finally pressed. The result obtained is a watery mixture of oil and ethanol. The liquid which we separate given time little alteration from the oil original state occurs this citrus oil retain their bright, fresh, uplifting, aroma like that of smelling wonder cooling ripe fruit. The drawback of this method is the oil extracted using this has a short shelf life.

2.2.2 Solvent Extraction

In the solvent extraction method, the oil recovery and extracting unit is loaded with perforated trays of oil plant material and repeatedly wash with the solvent. A carbon and hydrogen-based solvent are used for extraction. All the extractable material from the plant is dissolved in the solvent. This includes highly volatile aroma molecules as well as non-aroma waxes and pigment. The extract is distilled to recover the solvent for future use. The waxy mass that remains is known as the concrete. The concentrate concrete is further processed to remove the waxy material which diluted pure oil. To prepare the absolute from the concrete the waxy concrete is warm and stirred with alcohol (Ethanol). During the heating and stirring process, the concrete breaks up into min globules. Since the aroma molecule are more soluble in alcohol than the waxes and efficient separation of two results.

2.2.3 Steam Distillation

Steam distillation is a special type of distillation or a separation process for temperature-sensitive materials like oils, resins, and hydrocarbons, etc. which are insoluble in water and may compose at their boiling point. The fundamental nature of steam distillation is that it enables a compound or a mixture of the compound to be distilled at a temperature that contains a substance substantially below that of the boiling point of the individual constituents. Essential oils contain a substance with a boiling point up to 200°C or higher temperature. In the presence of steam or boiling water, however, the substances are volatilizing at a temperature of 10°C very close to atmospheric pressure. Various factors determine the final quality of a steam distilled essential oil. Apart from plant material, the most important are time, temperature and pressure, and quality of the distillation equipment. Essential oils are very complex products. Each is made up of many, sometimes hundreds, of distinct molecules which come together to form the oil's aroma and therapeutic properties. So of these molecules are fairly delicate structures that can be altered or destroyed by adverse environmental conditions so much like a fine metal is more flavourful that longer distillation times may give more complete oil. It is also possible, however, that longer distillation times may lead to the accumulation of more artifacts than normal. This may have a curious effect of appearing to improve the odor, as sometimes when materials that have a large number of components are sniffed, the perception is often of slightly increased sophisticated, added fullness and character, and possibly, and extra pleasantness.

2.2.4 Maceration

The simple widely used procedure involved leaving the pulverized plant to soak in suitable solvents in a closed container. Simple maceration is performed at room temperature by mixing the ground grub with the solvents and leaving the mixture for several days with occasional shaking or starring. The extract is then repeated from the plant particles by stirring. The process is repeated with a fresh batch of solvent at least two times. Finally, the last residue is pressed out of the plant particles using the mechanical press or centrifuge. Kinetic maceration is different from a simple one by continuous stirring. This method can be used for both initial and bulk extraction.

2.2.5 Percolation

The powdered plant material is socked initially in a solvent in a percolator. Additional solvent is then poured on the top of the plant material and is allowed to percolate slowly out of the bottom percolators. Additional filtration of the extract is not required because there is a filter at the percolator.

2.2.6 Tincture

A tincture is typically an alcoholic extract of plant or animal material or a solution of such or of a low volatility substance. To qualify as an alcoholic tincture extract, the extract should have an ethanol percentage of at least. Sometimes an alcohol concentration higher than 90% is used in tincture. Alcoholic tinctures are made with various ethanol concentrations are the most common.

III. SOLVENT SELECTION

N-hexane is considered to be the most efficient solvent when dealing with oil extraction processes. When n-hexane is used the color obtained is the favorable yellowish-light brown as compared to the dark woody brown color obtained on using methanol as a solvent. Methanol gives the second-best yield after n-hexane. The acid value obtained was 1.683 for n-hexane. The natural pesticide produced from custard apple seed oil proves itself efficient, advantageous, cheap, and safe to handle. Its recovery by using Hexane solvent is 19% than the methanol solvent is 10.5%. This pesticide material can be made easily available for every farmer throughout India without taking much more effort. This raw material will be very cheap which

minimizes the total cost of processing along with solvent recovery. Many factors like oil extraction efficiency, environmental impacts, and the renewability of solvents must be considered while selecting the ideal solvent. Hexane is the preferred solvent for the extraction of oils from plant sources due to its low boiling temperature and easy recovery from the extract. Most oils are soluble in hexane too. The cost of n-hexane in laboratories is Rs.45 per liter.

IV. EXPERIMENTAL PROCEDURE

Seed kernels crushed and grounded to powder. Then the powder which is obtained from crushing is mixed with hexane or methanol solvent to extract oil from seed kernels. While doing the extraction, the solvent is used in the ratio of 15ml/g of seed kernels powder, and extraction time was 3hr, 4hr, 4hr for two hexane, and one methanol solvent respectively. The temperature was maintained near about 65- 70 degrees Celsius by regulating the magnetic cum heater and stirrer. After extraction, the sample is filtered out to remove solid material as residue, and the filtrate is contained with oil extracted. This filtered sample is lead to vacuum distillation for the first sample and simple distillation for the other two samples. Then after distillation solvents were distilled out while the oil extracted was remain in the distillation chamber. Then lastly the oil separated is analyzed for density, percent of oil, and acid value.

V. ANALYSIS AND APPLICATION OF PESTICIDE

The oil obtained above is tested for insecticidal properties by standard methods such as HPLC, Spectrophotometry, Polarography, and FTIR. After carrying out these standard tests, and analyzing the properties, the oil is applied to the target pests. For example, when applying mealybugs on a guava tree, preparation of the blank solution is carried out. The blank solution is formed by mixing 6 parts of labolene soap with 94 parts of water. To this blank solution, the required percentage of custard apple seed oil is added and sprayed on the pest attacked surface with a help of a spray gun.[16][17][18].

VI. PESTICIDE TEST ON WHITE MEALY BUGS

An experiment was carried out to test the effect of the pesticide on white mealybugs by Sikdar D.C et al,2016 [1].Oil solution of (blank 0.0%,0.15%,0.30%, and 0.75% was prepared by mixing with labolene soap solution and sprayed in one shoot on white mealybug present on the guava tree leaves surface affected by white mealy bugs. The numbers of the white mealy bugs left on the leaf's surface after spraying the pesticide solution are counted daily. Based on the data tabulated by them, at 0.75% concentration, the pesticide was most effective on the target pests.

The number of mealy bugs decreases to zero at 0.75% concentration within 2 days. Thus, an oil solution of 0.75% is effective to keep away the pests.

VII. FUTURE SCOPE

The project work is on how a pesticide is prepared from a discarded waste material, custard apple seeds. This pesticide can be used in place of toxic synthetic pesticides.

A study on the overall feasibility and profitability of the process can be carried out. The available cheap raw material required for the process can lead to the development of this industry.

This operation could be carried out on a small scale and could generate employment for skilled as well as unskilled labor.

VIII. CONCLUSION

The various methods of oil extraction were compared and solvent extraction came forward as the best method of oil extraction. The entire process of extracting oil from custard apple seeds takes place in three and half hours including the time required for cleaning. N-hexane is the most preferred solvent for the extraction process as it is available for a price of Rs.45/liter and provides recovery of about 19%. The three conventional methods have a low yield but can be performed at home at a negligible cost. Oil at 0.75% concentration is ideal to keep pests away.

REFERENCES

[1] Sikdar D.C, Sushmita Kushary, Roshnee Das, Vishva Mehta:" Evaluation of Effectiveness of Eco-Friendly Bio-Pesticide Extracted From Custard Apple Seeds On White Mealy Bugs"-International Journal of Technical Research and Applications, Volume 4, Issue 2.

[2] Ajay. V. Gawali, Sapna K. Deotale, Tousf Yunus Shaikh –"Annona Squamosa: A Source of Natural Pesticide": IARJSET, Vol.4, Special Issue 3, January 2017.

[3] Aanchal Moolcuandani, Aftab Sharif, Sohel Sayyed: "Eco-friendly Bio pesticide Extraction", IAETSD journal for advanced research in applied sciences.

[4] Prithusayak Mondal, Sritama Biswas, Kumaresh Pal: "Anmonasquamosa as a potential botanical insecticide for Agriculture Domains: A Review", International Journal of Bioresource Science, Citation: IJBS:5(1):81-89, June 2018.

[5] Physio-Chemical Properties of Oil Extracted From Custard Apple Seeds, by MrBharadwaj.

[6] Y.R.HARAL, B.R.PAWAR: "Economics of custard apple production in Maharashtra", International Research Journal of Agriculture Economics and Statistics, Volume 4, Issue 2, September 2013.

[7] KalpeshP.Borole, Jayprakash R.Sirsath, Mr.Swapnil M. Bhonde, Rushikesh D. Sable – " Extraction of Oil from Custard Apple Seeds": IJFEAT Issue 1 Vol 4.

[8] Dalia H. Eshra, Attia R.Shehata, Abdel-Nabey A. Ahmed, Jehan I. Saber - " Physiochemical Properties of Seed Kernels and the oil of Custard Apple": International Journal Of Food Science And Biotechnology Vol 4, No 4 2019.

[9] https://www.persistencemarketresearch.com/mediarelease/global-n-hexane-market.asp [Last accessed August 21,2021].

[10] https://www.expertmarketresearch.com/reports/acetone-market [Last accessed August 21,2021].

[11] https://niti.gov.in/methanol-economy#:~:text=Methanol%20Economy%20program%20initiated%20by,setting%20up%20Methanol%20Production%20Plants. [Last accessed August 21,2021].

[12] https://mcgroup.co.uk/researches/ethyl-acetate-etac [Last accessed August 21,2021].

[13] https://indianpetrochem.com/report/acetonereport [Last accessed August 21,2021].

[14] https://indianpetrochem.com/advisory/methanoladvisory [Last accessed August 21,2021].

[15] https://www.expertmarketresearch.com/reports/n-hexane-market [Last accessed August 21,2021].

[16] https://chemdictionary.org/gas-chromatography/#:~:text=%20How%20does%20gas%20chromatography%20works%3F%20%201,In%20this%20type%20of%20detector%20organic...%20More%20 [Last accessed August 21,2021].

[17] Spectrophotometry(Procedure):Physical Chemistry Virtual Lab: Chemical Sciences- Amrita VishwaVidyapeetham Virtual Lab [Last accessed August 21,2021].

[18] https://chemdictionary.org/hplc/ [Last accessed August 21,2021].