

# Synthesis and Characterization of Natural Pesticides from Custard Apple Seeds

Tabbsum U. Shaikh<sup>1</sup>, Vidya P. Waghmode<sup>2</sup>, Sumit v. Suryawanshi<sup>3</sup>, Akash G. Waghmare<sup>4</sup>  
Students, Department of Chemical Engineering, D. Y. Patil College of Engineering and Technology Kolhapur

Dr. K. T. Jadhav  
HOD of Chemical Engineering Department,  
D. Y. Patil College of Engineering and Technology Kolhapur

**Abstract:-** The agricultural sector plays an important role in developing countries towards sustainability for that there is a strict need for eco-friendly pest management. Pesticides are the chemical or biological substances proposed for preventing plants by destroying and repelling targeted pests, bugs, & weeds. It is classified as a natural pesticide and a synthetic pesticide. Synthetic pesticides are expensive also they affect soil fertility and the environment. So, bio-intensive integrated pest management is now a need of Indian farmers. The solution to this, objective of this research paper is The Production of Natural pesticide – from oil Extracted from custard apple seeds which is done by Extraction Followed by Distillation by selecting the appropriate solvent and amount of solvent that give a better Extraction yield. Finally, identify the properties and composition of chemicals in the Extracted oil.

**Keywords:-** Bio-pesticides, Custard apple seed oil, Extraction, Distillation, Ethyl acetate, Benzene, Hexane, Labolene Solution.

## I. INTRODUCTION

Increasing population & rural development leads to increased demand for better yield of food. Nowadays the biggest challenge for farmers is attaining food sustainability and sufficiency. An integral part of modern agriculture for getting efficiency in food production is Pesticides so agroindustry and government are initiating the large use of Pesticides.

- **Pesticide:** - Pesticide is a substance that is used to kill destructive microorganisms which affected the growth of plants. It helps the farmers to provide an abundance of nutrition by raising productivity by protecting crops. Basically, it has two types natural and Synthetic but Naturally based pesticides are safer than Synthetic by considering health, Environment, Soil fertility, etc. so India needs to develop its own biocontrol agent.
- **Bio Pesticides:** - Bio-pesticides promoting sustainable agriculture. They increase the crop yield and cultivate an organic garden by affected on only targeted pests. It is a Plant growth regulator derived from natural materials such as animals, Plants, Bacteria, and minerals by a non-toxic mechanism. We can reduce carbon footprint by using organic pesticides which are eco-friendly and cost-effective.
- **Plant extracts were used as bio:** Pesticides from the 17<sup>th</sup> century. Firstly nicotine is used to control plum beetles.

Various optional metabolites of plants are utilized as bio-pesticides like Citronella oil, Garlic separate, Neem removal, Datura, orange oil, Basil, and Lemon. Initially, only neem extract is known to the farmers which is act as a Pesticide.

- **Custard apple:** Custard apple seed oil is employed as a pesticides which is derived from the family “Annonaceae”.The powerful respiratory inhibiting toxic component “Acetogenin” isolated from seeds of “Annona Squamosa”act as a pesticide against pest. Seeds are bitter and poisonous & seed pest is used in cancer treatment. Production of pesticides is done by the Extraction of oil from custard apple seed followed by distillation with suitable solvents like Ethyl acetate, Benzene, Hexane, acetone, etc.

## II. PROBLEM STATEMENT

In order to increase industrialization and try to achieve better & early production, farmers are using a large number of Synthetic pesticides, but it creates an adverse effect on human health and the Environment because it affects other than targeted species also disrupting our hormonal growth and leads to cancer the cost of synthetic pesticides is also more. For maintaining crop yield Bio-pesticide is a sustainable alternative leading to safe organic farming.

## III. OBJECTIVE

- Firstly extract the oil from custard apple seeds which are possibly used as natural pesticides.
- Selection of appropriate solvent which gives a better yield of extraction and Solvent recovery.
- Analyze properties, composition, and chemical content present in extracted oil.
- Synthesize the bio-pesticides from the oil extracted from custard apple seed Powder.

## IV. SIGNIFICANCE OF STUDY

- Help to identify the possibility of Custard apple seed oil used as bio-pesticides.
- Help to understand agricultural and environmental aspects with comparative study of Bio-pesticides and synthetic pesticides on custard apple seed powder.
- Analyze the effect of different solvents on seed powder during Extraction.
- It will keep the Environment secure and reduce the risk of disease due reduction in the use of synthetic pesticides.

## V. METHODOLOGY

### A. Material, Equipment and Operations:

- **Raw material:** Custard apple seed powder, Labolene solution.
- **Solvents:** Hexane, Ethyl acetate, Benzene.
- **Equipment & Instruments:** Soxhlet Extraction unit, Simple Distillation unit GLC, Thermometer, Specific gravity bottle, Gravity separator, Beaker, filter paper, Funnel. Operations: - Extraction, Distillation, Filtration, Drying.



Fig. 1: Experimental setup of Extraction

### C. Effects of different parameters on extraction yield:

- **Temperature:** - Extraction temperature effect on solubility. It must be up to the boiling point of the solvent. If the Temperature is more than the boiling point of the solvent it will give less extraction yield because a higher temperature causes oxidation and degradation of
- **Solvent-solid ratio:** - The most favorable extraction result is obtained by a higher solid-to-solvent ratio. It results in an increasing diffusion rate and promotes a concentration gradient that allows greater extraction of solids by solvent. The solvent-to-solid ratio of between 1:10 was most favorable for extraction.

### D. Solvent selection:

Following factors, you can take into account for selecting a solvent.

- **Solubility:** The substance extracted should be highly soluble in Solvent.
- **The polarity of solvent:** - Polarity is the most important factor for selecting the solvent. Non-polar molecules are used to remove oil and fatty material & give a large Extraction Yield. You should proceed from the nonpolar to polar solvent, which means water should be the last solvent in any case with hexane/petroleum ether being the first to be used.
- **Boiling point:** - The boiling point of the solvent should be less. The difference in the boiling point of pure solvent and solution is called elevation in boiling point. So boiling point of the solution is higher than the boiling point of the pure solvent.

### B. Solvent Extraction (Soxhlet apparatus):

Solvent extraction is a most versatile and popular method of separation in which solute is separated from solution based on relative solubility with the suitable solvent. In this method we circulate the same solvent through the extractor several times and maintain temperature up to its boiling point during this process condensed vapor comes in contact with Powder and soluble compound mixed with the solvent.

- **Principle:** Components are separated on the Basis of differences in relative solubility and Distribution Law.

the desired compound and also increase cell membrane permeability.

- **Extraction Time:** - For better Extraction obviously we need a longer extraction time so the time for the Extraction should be 2 to 3 hr. or more than it. As time is more, the yield of extraction increases.
- **Cost of solvent:** - It is also a major factor while selecting the solvent are costly and have the maximum efficiency for the extraction of oil. We have to choose a solvent which having high extraction Yield with minimum Cost.
- On the basis of the above parameters, we have chosen the solvent Ethyl acetate, Benzene and Hexane.

### E. Experimental procedure:

The procedure for Synthesizing Organic Pesticide from custard apple seeds is done by following the Steps: -

- **Raw material collection & Preparation:** - Custard apple plant raised plant flowers from April to May & bearing fruits seasonally between August & November. During that period seeds can be removed from custard apple and collected manually. Custard apple seeds are also available in the market in every season.
- **Washing & Drying:** - Collected seeds are washed with water. Afterward, cleaned seeds were dried for a week using the sun for removing moisture content. The sample was stored in polythene bags at room temperature. Then use it for further process.
- **Size Reduction:** - After removing moisture content from the seeds, crush the seeds with the help of a grinder. The size of 20 mm seeds is reduced up to 0.5 mm. Small size

particle gives a better yield of extraction. After that again dry the powder.

- **Soxhlet Extraction:** - For the extraction process, the Soxhlet setup must be arranged in the proper manner. Maintain temperature up to the solvent's boiling point. Extract oil from the powder for 3 hr. And simultaneously check temperature and cooling supply to condenser.
- **Filtration:** - After extraction, the solution collected in the round bottom flask is filtered with the help of funnel and filter paper instead of that we can also use gravity separator for

separating solid particle from extracted solution.

- **Simple Distillation:** - After filtration, oil and solvent are separated on the basis of their boiling point difference during this process solvent is collected in the receiver and the oil is remaining in a round bottom flask which is used for pesticide, skincare, hair care, cancer treatment. Simple distillation is time efficient process for obtaining more pure Substrate. It can be used only when the Boiling point difference between two compounds is high.



Fig. 2: Experimental Setup of Distillation

After the separation of oil and solvent by distillation, the oil sample was examined to determine its physical and

chemical properties such as % yield of oil, PH, fatty acid composition, density, specific gravity, etc.



Fig. 3: Oil Sample Extracted from seed Powder

- **Pesticide preparation from oil:** - Extracted oil is mixed with 6 parts of Labolene solution and 94 parts of water. Mix this Composition and transfer it into a spray gun and spray on plants affected by the pests. Pesticides reduced number of pest in 10 to 12 days. Fatty acid shows toxicity against mealy bugs and pests and it affect only on targeted species which is harmful to plant.

Labolene solution is reliable cleaning agent which is ideal for all purpose cleaner. It is safe, efficient, Biodegradable, Phosphate free, Economical and Environment friendly solution so that it help to get right result.

## VI. CALCULATION AND RESULT ANALYSIS

$$\% \text{Yield of oil} = \frac{\text{Mass of oil}}{\text{Mass of seed powder}} \times 100$$

$$\% \text{recovery of solvent} = \frac{\text{solvent recovered}}{\text{solvent taken}} \times 100$$

Table 1: Test results at chemical lab DYPCET Kolhapur

Oil Sample Properties	Solvent used		
	Hexane	Benzene	Ethyl Acetate
Weight	2.47	2.65	5.87
Volume	3.74	3.02	6.5
Density	0.66	0.876	0.902
% Yield of oil	12.35	13.25	29.35
% Solvent Recovery	53.3	55	60

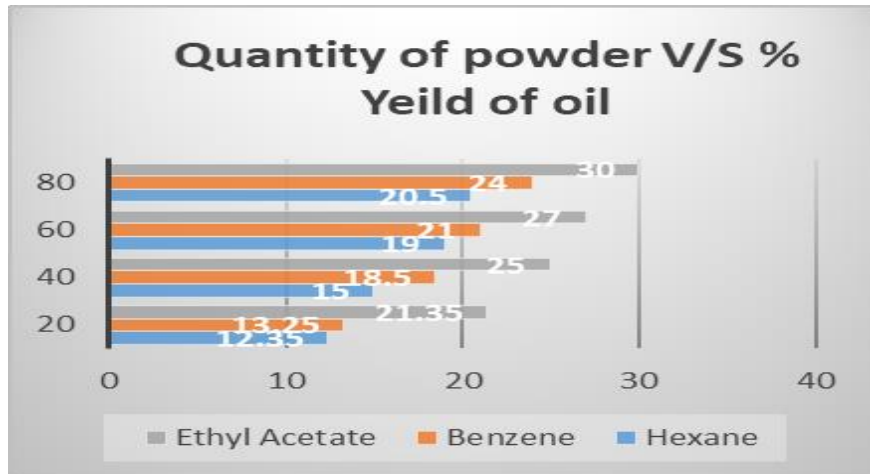


Fig. 4: Graphical representation of % yield of oil

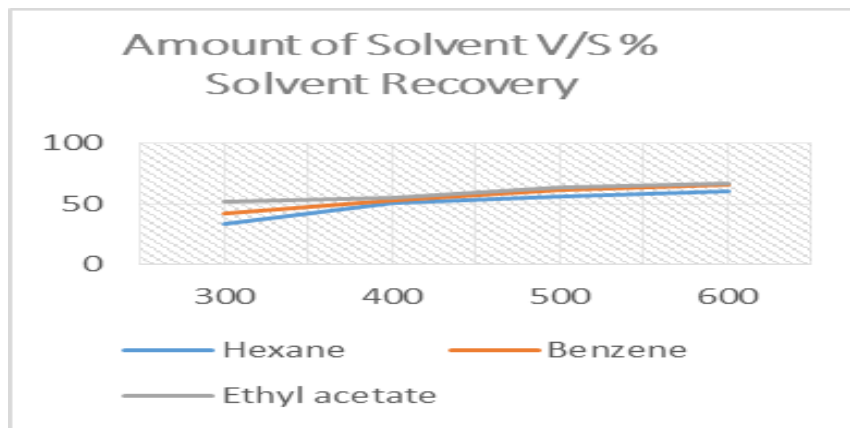


Fig. 5: Graphical representation of % recovery of solvent

**VII. OBSERVATION AND SAMPLE TESTING IN GLC**

Table: 2 Properties of oil

Fatty acid	Fatty acid Composition GLC (%)		
	Hexane	Benzene	Ethyl Acetate
Palmitic	13.3	11.3	13.5
Palmitoleic	0.1	0.1	0.1
Stearic	11.1	11.7	11.1
Oleic	48.3	49.1	48.1
Linoleic	25	25.4	25.2
Linolenic	1.7	1.8	1.7
Arachidic	0.1	0.1	0.1
Behenic	0.2	0.3	0.2
Arachidonic	0.2	0.2	0.1
Lignoceric	0.1	0.1	0.1



Table 3: Acid composition of the oil

Parameters	Oil Sample		
	Hexane	Benzene	Ethyl Acetate
Color	Yellowish brown	Dark brown	Yellowish dark brown
PH	7.67	6.78	4.2
Acid Value(mg/gm)	14.61	8.98	11.03

Table 2, 3: - Test result of ITALAB Private Limited, Mumbai.

### VIII. FUTURE SCOPE

- Availability of raw materials & demand for products as per need in agriculture leads to the development of agroindustry.
- It can generate employment for nonskilled people as well as skilled people who are interested in planting fruit plants.

### IX. CONCLUSION

With the comparative study of different extraction methods and different solvents for extracting oil from custard apple seeds, Conclusion obtained in present study as follows:

- Solvent extraction come forward as the best extraction method.
- The most preferred solvent is Ethyl acetate & benzene. Ethyl acetate gives a 30% oil yield and provides near about 6% recovery which is available at a low cost.
- Fatty acid showed toxicity against pests and organic pesticides maintain soil fertility.

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