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Leaching Of Oil from Neem (Azadirachtaindica) Seeds

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ABSTRACT
The objective of this research is to select the suitable solvent for the extraction of neem(Azadirachtaindica) oil from its seeds which contains, approximately, 25-45% of the oil among three tested known solvents, namely n-hexane, ethanol and benzene and comparing the extracted oil from each by the three solvents in terms of physical, chemical properties and determining which of the three solvents is better for this purpose. Leaching was done using the solid extraction method that resulted in a recovery percentage of 90.8%, 75.6% and 58% for n-hexane, ethanol and benzene respectively. It was followed by performing three physical tests (Viscosity, Specific gravity and Refractive index) and two chemical tests (Free Fatty Acid and Peroxide Value) for the oil extracted by each of the three solvents separately. The data obtained from the performed tests was then analyzed using the Statistical Package for the Social Sciences (SPSS). Based on the SPSS results and comparing the physical and chemical properties with the standard ones it was concluded that hexane was found to be the best solvent for that the values of viscosity, Specific gravity, Refractive index, FFA and PV were 19.059 cp, 0.9098, 1.475, 1.09% and 2.91 ml/gm. respectively compared to 5.63 cp, 0.88, 1.478, 6.7% and 4.9 ml/gm. respectively for the oil extracted by ethanol. The benzene was eliminated from the comparison as the resulting oil wasn't pure. This research helps researchers and investors save time and effort by offering them three options of solvents along with the related data on the produced oil's quantity and the performed analyses. It is recommended to conduct more research on the issue using a pilot plant scale or through scale-up technique.

I. INTRODUCTION

Neem is a member of mahogany family. It is today known by the botanic name Azadirachtaindica A. juss. Neem is an aboriginal tree found in tropical and semi-tropical countries like Burma and India; neem has been declared non-toxic to humans and each part of the tree is used as an active ingredient in different industries. Neem tree has been given its due recognition, with a number of researches being conducted on an international level to understand the benefits and potential of neem. [1]Neem contains several active ingredients, and they act in different ways under different circumstances. These compounds bear no resemblance to the chemicals in today's synthetic insecticides. Chemically, they are distant relatives of steroidal compounds, which include cortisone, birth-control pills, and many valuable pharmaceuticals. Composed only of carbon, hydrogen and oxygen, they have no atoms of chlorine, phosphorus, sulfur, or nitrogen (such as are commonly found in synthetic pesticides). Their mode of action is thus also quite different. [1]

Neem protects itself from different pests with a multitude of pesticidal ingredients. Its main chemical broadside is a mixture of 3 or 4 related compounds, and it backs these up with 20 or so others that are minor but nonetheless active in one way or another. In the main, these compounds belong to a general class of natural products called "triterpenes"; more specifically, "llimonoids." [1] Today neem is used on a commercial basis and finds immense use in a number of products in industries ranging from cosmetics to agriculture, from pharmaceuticals to Ayurveda, it has hard brown grayish bark and it blossoms during spring season with small white colored flowers, it tree can be very easily cultivated in dry and stony soils and also it requires little quantity of water but too much sunlight. It is planted across India for purification of air, it is the most common tree found in villages. [1]

Objectives Of The Research:
1. Selection of solvent.
2. Determination of solvent solid ration.
3. Determination of the degree of mixing.
4. Investigation of the solvent recovery.

II. MATERIALS AND METHODS

2.1 MATERIALS

The materials used in the research include neem seeds (dried and crushed) and solvents such as N-Hexane, Ethanol and Benzene for extraction.

2.2 METHODS

For this research Solid extractionmethod is adopted. [2]

One liter of solvent was measured along with 200 grams of neem seeds. The seeds were then crushed and solvent was added to it in a flask and they were left for an overnight. The extracted oil was separated from the seeds by a filtration

process using filtration papers. The resulting oil was then left for another overnight to allow the solvent to evaporate to get pure neem oil.

III. RESULTS AND DISCUSSION

3.1 RESULTS

The results obtained through the research from using different solvents are shown in the following tables:

Table**1**: Neem oil quantity extracted by each solvent.

Solvent	Neem seeds amount (g)	Solvent amount (liter)	Oil amount (g)
n-Hexane	200	1	18.2388
Ethanol	200	1	48.8659
Benzene	200	1	84.9776 (not pure)

Table**2**: Chemical properties of oil leached.

solvent	Property	Value
Hexane	FFA (%)	1.09
	PV	2.91
Ethanol	FFA (%)	6.7
	PV	4.9005
Benzene	FFA (%)	0.2
	PV	15

Table**3**: Physical properties of oil leached.

solvent	Property	Value
n-Hexane	Refractive index	1.475
	Specific gravity	0.9098
	Viscosity (cp)	19.059
Ethanol	Refractive index	1.478
	Specific gravity	0.88
	Viscosity (cp)	5.630
Benzene	Refractive index	1.483
	Specific gravity	0.87
	Viscosity (cp)	1.342

Table**4**: ANOVA table (tests of significance).

		Sum of Squares	Mean Square	Sig.
Refractive index	Between Groups (Combined)	0.000	0.000	0.998
	Within Groups	0.180	0.030	
	Total	0.180		
Specific gravity	Between Groups (Combined)	0.003	0.001	0.940
	Within Groups	0.124	0.021	
	Total	0.127		
viscosity	Between Groups (Combined)	512.617	256.309	0.000
	Within Groups	16.080	2.680	
	Total	528.697		
FFA	Between Groups (Combined)	74.514	37.257	0.002
	Within Groups	10.020	1.670	
	Total	84.534		
PV	Between Groups (Combined)	268.168	134.084	0.001
	Within Groups	28.000	4.667	
	Total	296.168		

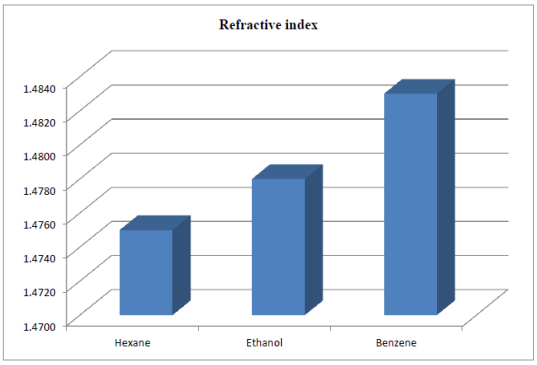

Figure**1**: refractive index chart for leached oils.

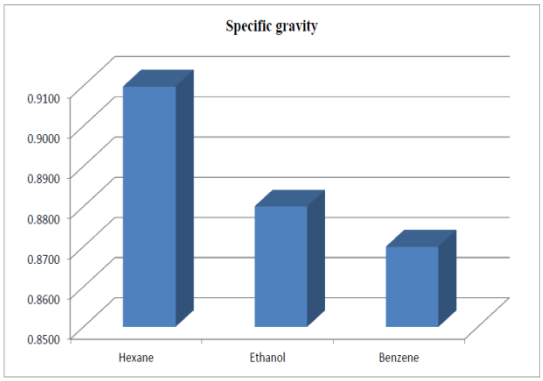

Figure**2**: Specific gravity chart for leached oils.

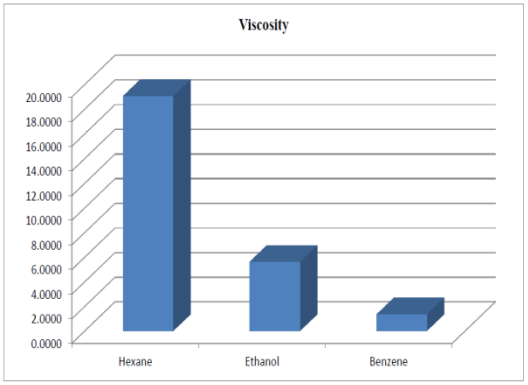

Figure**3**: Viscosity chart for leached oils.

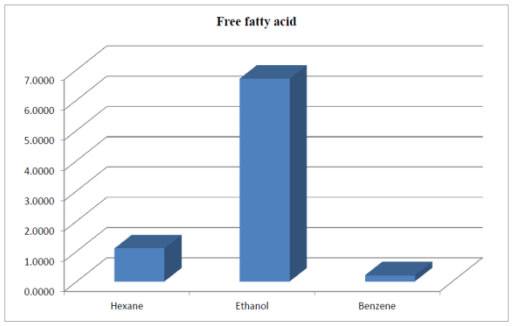

Figure**4**: free fatty acid chart for leached oils.

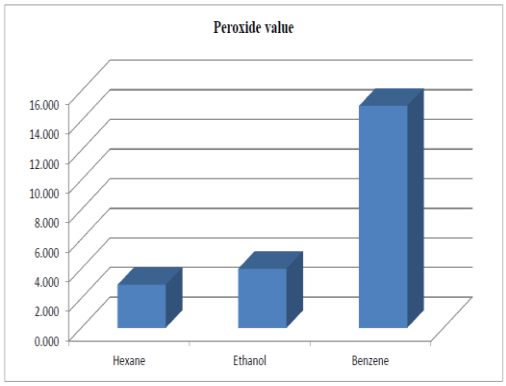

Figure**5**: Peroxide value chart for leached oils.

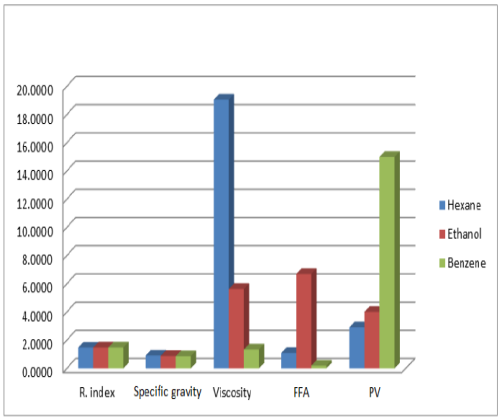

Figure**6**: physical and chemical analysis for leached oils.

IV. DISCUSSION

Based on the obtained results, significant differences were observed in terms of the amount of neem oil extracted, the extent of solvent evaporation and neem oil purity.

A heavy and pure neem oil was obtained when hexane was used due to its good evaporation while using ethanol resulted in an oil that contained a gummy substance and ethanol evaporated well too. On the other hand, benzene was proven to be not suitable for the purpose of neem oil extraction because of its poor evaporation resulting in impure oil so it won't be compared with other two solvents.

After conducting the statistical analysis on the obtained results from the physical and chemical analyses as shown in the previous tables and figures, it was found that the significant differences exists whenever the value of a specified analysis is less than or equals 0.05 and those differences appear clearly in viscosity, FFA and PV.

Comparing the obtained oil properties with the standard ones, it is obvious that the oil extracted using hexane is better than that extracted using ethanol as it contained gummy substance dissolved in it and its physical and chemical properties are in a good match with the standard properties (the standard properties are of neem oil that contained a dissolved gummy substance) while the one extracted by ethanol had the gummy substance separated from the oil which in turn resulted in the deviation of its properties from the standard ones.

Table**5**: summary of comparison between n-hexane and ethanol.

Property	values	Which solvent is better
Refractive index	1.475	n-Hexane
Viscosity	5.630 cp	Ethanol
Specific gravity	0.9098	n-Hexane
FFA	1.09 %	n-Hexane
PV	2.91	n-Hexane

V. CONCLUSION AND RECOMMENDATIONS

Conclusion

Three types of solvents (n-Hexane, Ethanol and Benzene) were used to extract neem oil from the seeds by aqueous neem oil extraction method. The extracted neem oil varied in quantity and purity based on the type of the solvent used.

Physical and chemical analyses were conducted on the neem oil separated by each solvent separately and the results were compared with standard ones and then statistical analysis was performed.
Hexane was found to be the best solvent as the most important outcome of the research showed that the oil extracted by hexane is the purest and the best matching with the standard properties.

Recommendations

To get the maximum amount of neem oil, the following points must be taken into consideration:
1- Optimum selection of neem seeds; fresh dried seeds are the most suitable for this purpose.
2- Crushing the neem seeds well.
3- Using a solvent that has a high purity.
4- Making sure that the solvent has evaporated completely.

When performing the physical and chemical analyses, viscosity, FFA and PV tests are sufficient because the significant values appear clearly in these tests.

It is recommended to conduct more research on the issue using a pilot plant scale or through scale-up technique, attempting to pretreat the neem seeds and economically optimizing the extraction process.

REFERANCES

[1]. Noel Vietmeyer (Study Director), NEEM: A Tree for solving global problems. Report of an ad hoc panel of the board on science and technology for international development, national research council, national academy press, Washington, D.C, 1992.
[2]. http://www.lalaessentialoils.com/cold-pressed.html, July 25 2015.