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EFFECT OF TEMPERATURE AND TIME INTERVALS ON THE SOLVENT EXTRACTION OF ESSENTIAL OIL FROM AZADIRACHTA INDICA (NEEM) LEAF POWDER BY USING SOXHLET EXTRACTION METHOD

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ABSTRACT

Extraction of essential oil from Azadirachta indica leaf powder was carried by Soxhlet extraction method using ethanol, n-hexane and ethyl acetate. Results revealed that at constant temperature (50^0C) the average yield obtained was found to be ranging between 25.06% to 42.02% in n-hexane; 35.07% to 49.03% in ethanol and 37.08% to 49.05% in ethyl acetate with changing time intervals between 1 to 3 hours. At constant time interval (60 minutes) the average yields obtained ranged between 25.06% to 24.04% in n-hexane; 35.07% to 49.05% in ethanol and 37.08% to 35.01% in ethyl acetate with changing temperature from 50 to 70 ^{0}C.

KEYWORDS: Azadirachta indica, Essential oil, Particle size, Soxhlet extraction, Solvent type.

INTRODUCTION

In the world of Indian traditional system of medicine, the Ayurveda, neem is a popular medicinal herb that's been part of traditional remedies that date back almost 5000 years. Also known as Azadirachta Indica in English or 'Neemba' in Sanskrit, the neem tree is a really good example of how nature holds both the problem and the cure. It's home to more than 130

different biologically active compounds. No wonder it's such an effective anti-viral and anti-bacterial, along with being a powerful immuno-stimulant. Neem is very useful for purification the blood, prevention damage caused by free radicals in the body, remove toxins materials, and treat insect bites and ulcers. Neem leaves have anti-bacterial properties which is why it works wonders on infections, burns and any kind of skin problems and disease. Neem destroys the bacteria that causes infections, stimulates the immune system and encourages rapid healing.[1] It is one of two species in the genus *Azadirachta*, and is native to the Indian subcontinent, i.e. India, Nepal, Pakistan, Bangladesh, Sri Lanka, and Maldives. It is typically grown in tropical and semi-tropical regions. Neem trees also grow in islands located in the southern part of Iran. Its fruits and seeds are the source of neem oil. Neem oil is widely and mostly used as insecticides, lubricant, drugs for variety of diseases such as diabetes and tuberculosis. This oil could also prolong leather goods when it is applied on them.[2] The neem tree (Azadrichta indica) is among the fastest-growing trees, it attains a height of about 12-25 feet and is a drought resistant tree.[3-4] It has a bitter taste and an offensive odor similar to the combined odors of garlic and peanut. Soxlate extraction methods preferred due to very high oil yield and less turbid oil obtained. The solvent n-hexane is the most commonly used, as well as preferred choice in extraction from leaves of neem due to its availability at a reasonable cost and its suitable functional characteristics for oil extraction. Amongst such characteristics and property is its high solvent power for triglycerides at fairly low temperatures, non-reactivity with oil and oil miscella, as well as with equipment.[5]

The main objective of present study was extraction and characterisation of essential oil from neem leaves using various organic solvents as well as studied of their property through various parameter such as solvent variation, temperature and time intervals for extraction.

MATERIAL AND METHODS

Preparation of plant leaf powder: The fully grown leaf of neem was collected from the campus of National Research Laboratory for Conservation of Cultural Property, Aliganj Luknow. The collected plant leaves thoroughly washed with tap water and then rinsed with sterile distilled water. The leaves of neem were shed dried and grind in electric mixer. Digital electronic analytical balance was used for weighed neem leaf powder. Sieve was used for separate fine particles from neem leaf powder. The powder material was kept in airtight sampler container. This stock powder was used for further extraction.[6]

Preparation of leaf extracts using n-hexane, ethanol and ethyl acetate solvents

50 gm of dried and ground leaves powder of neem was placed in a thimble of soxhlet apparatus. Sample was extracted in a Soxhlet extraction system using 250 ml of various solvents viz. n- hexane, ethanol and ethyl acetate solvents. The heating power set with heating mantle was set with constant temperature and constant time as per observation table-1 and 6 and graphs- 1 and 6. n- hexane, ethanol and ethyl acetate solvents used in this extraction process. The crude extract solutions obtained and rotary evaporator used to remove the solvents and completely dried in an atmospheric oven. High temperature treatment was avoided to minimize the component degradation.[7] Extract was then stored at room temperature before weighing gravimetrically to determine the yields. The % oil yield of extracted neem oil was calculated by using the following equation.

$$\% \text{ oil yield} = \frac{(W1-W2)}{W1} X100$$

Where: W1=Sample weight initially placed in the thimble

W2= sample weight after dried in the oven.[8]

Table. 1: Oil yield (%) of Soxhlet extraction using n-hexane at constant temperature and different time intervals.

Trial	Temperature (^{0}C)	Time (min)	Oil yield (%)
1	50	60	25.06
2	50	120	37.05
3	50	180	42.02

Table. 2: Oil yield (%) of Soxhlet extraction using n-hexane at constant time and different temperatures.

Trial	Temperature (^{0}C)	Time (min)	Oil yield (%)
1	50	60	25.06
2	60	60	25.01
3	70	60	24.04

Table. 3. Oil yield (%) of Soxhlet extraction using Ethanol at constant temperature and different time intervals.

Trial	Temperature (^{0}C)	Time (min)	Oil yield (%)
1	50	60	35.07
2	50	120	47.01
3	50	180	49.03

Table. 4: Oil yield (%) of Soxhlet extraction using Ethanol at constant time and different temperatures.

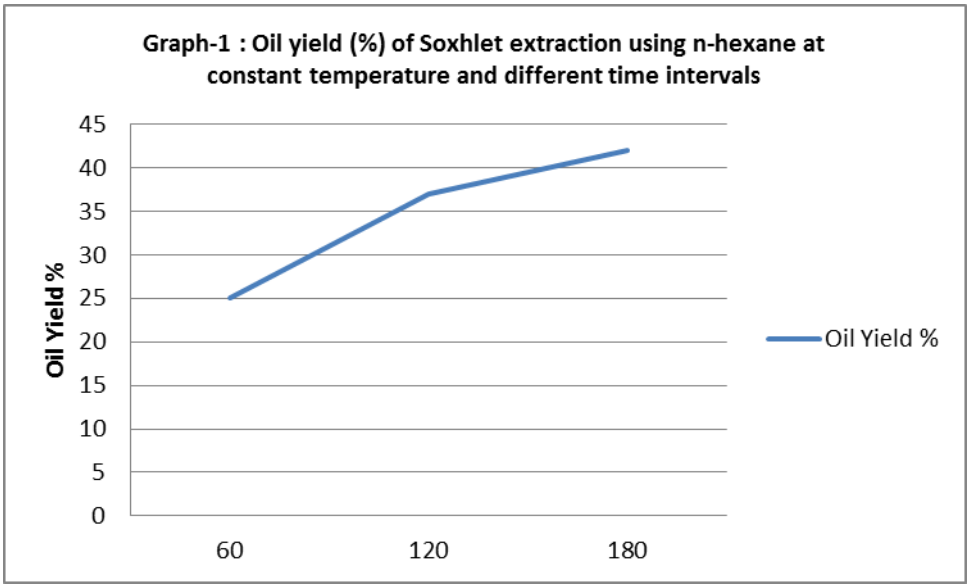
Trial	Temperature (^{0}C)	Time (min)	Oil yield (%)
1	50	60	35.07
2	60	60	45.02
3	70	60	42.06

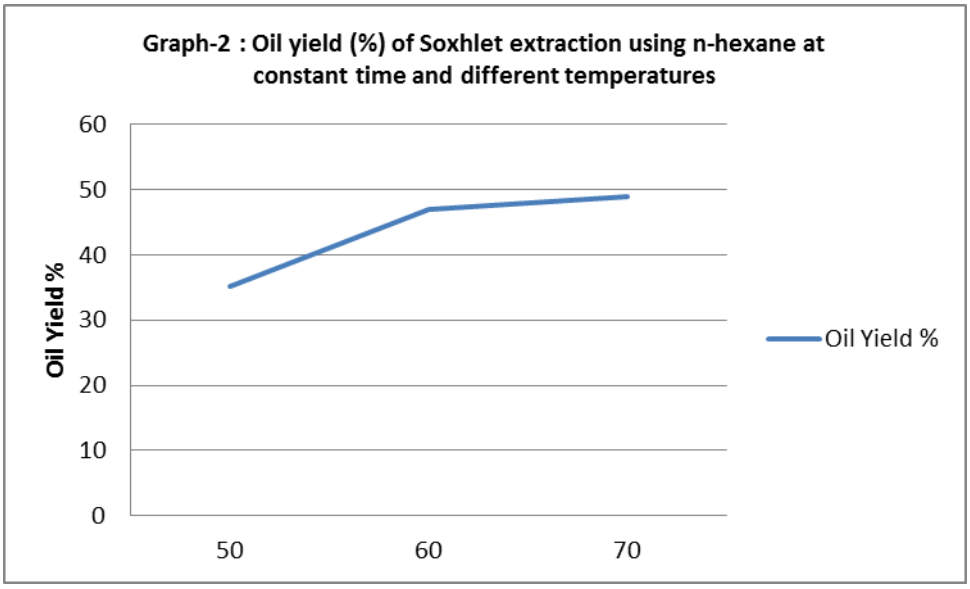
Table. 5: Oil yield (%) of Soxhlet extraction using Ethyl acetate at constant temperature and different time intervals.

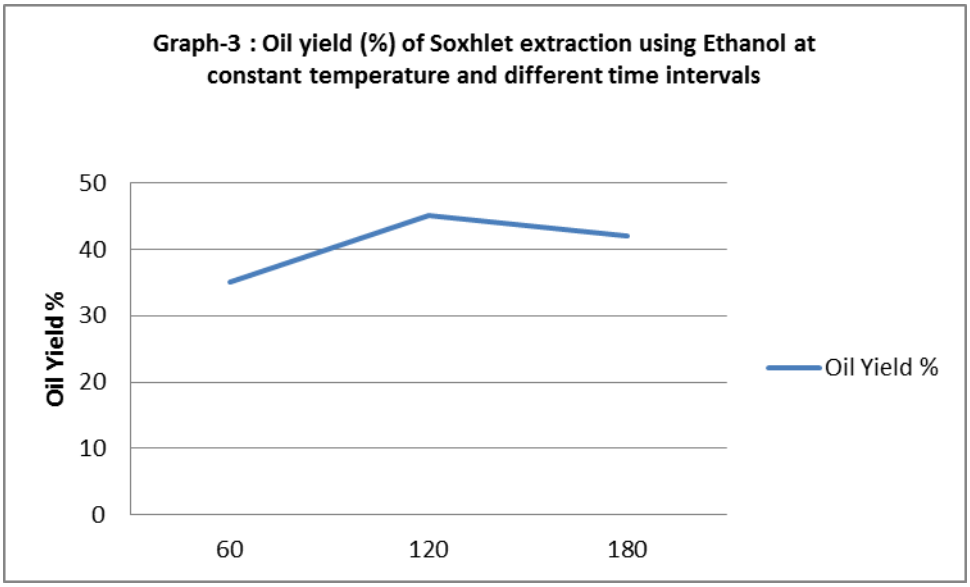
Trial	Temperature (^{0}C)	Time (min)	Oil yield (%)
1	50	60	37.08
2	50	120	46.03
3	50	180	49.05

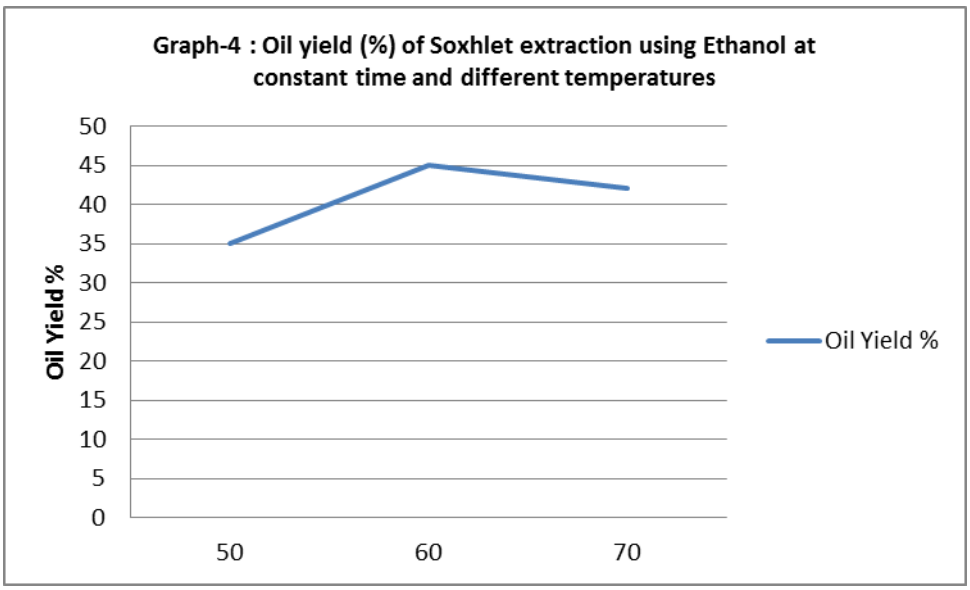
Table. 6: Oil yield (%) of Soxhlet extraction using Ethyl acetate at constant time and different temperatures.

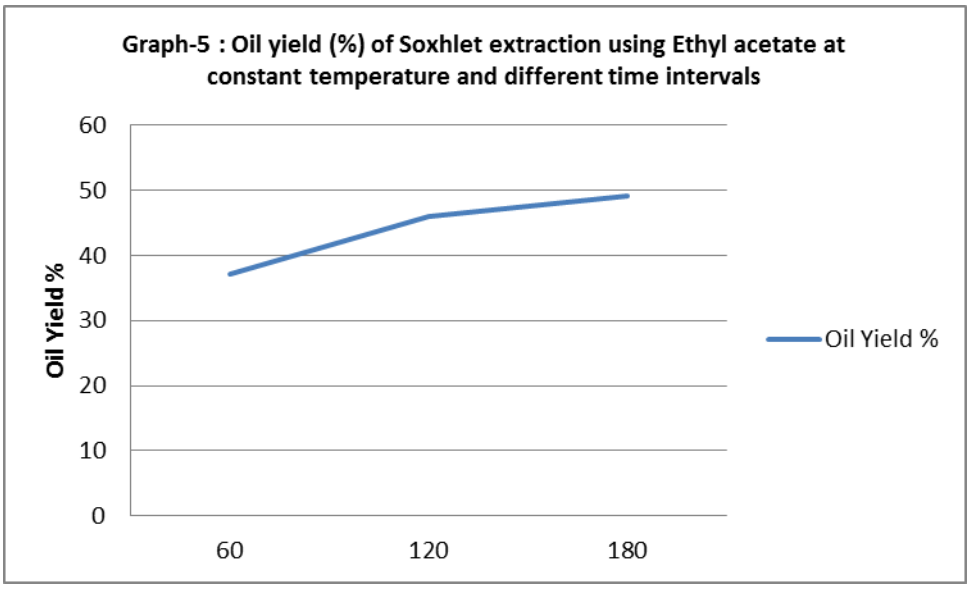
Trial	Temperature (^{0}C)	Time (min)	Oil yield (%)
1	50	60	37.08
2	60	60	36.05
3	70	60	35.01

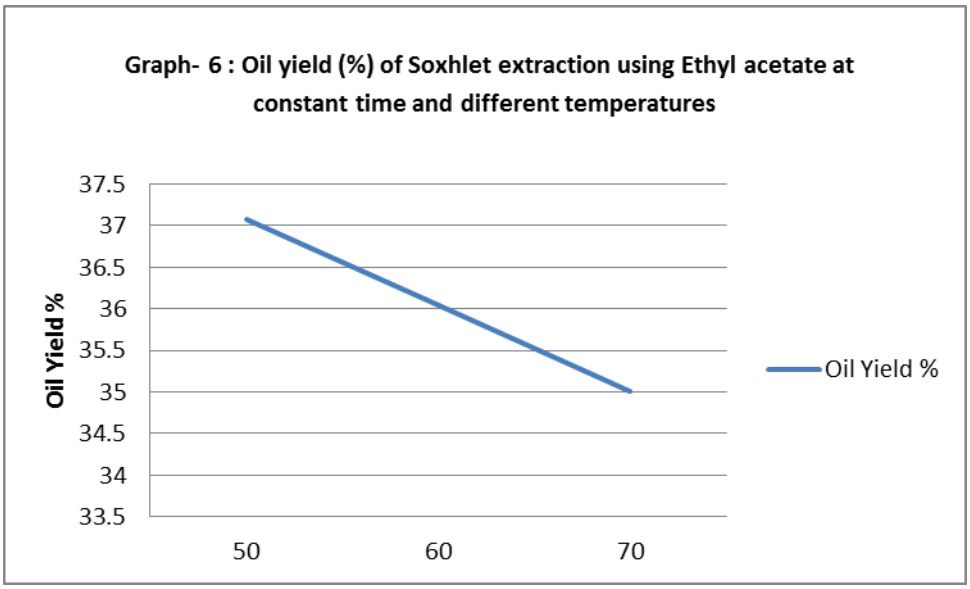





Graph-3 : Oil yield (%) of Soxhlet extraction using Ethanol at constant temperature and different time intervals
Oil Yield %
50
40
30
20
10
0
60
120
180
Oil Yield %


Graph-4 : Oil yield (%) of Soxhlet extraction using Ethanol at constant time and different temperatures
Oil Yield %
50
45
40
35
30
25
20
15
10
5
0
50
60
70
Oil Yield %


Graph-5 : Oil yield (%) of Soxhlet extraction using Ethyl acetate at constant temperature and different time intervals
Oil Yield %
60
50
40
30
20
10
0
60
120
180
Oil Yield %



a **b** **c**

Fig. a- Preparation of leaf powder, b & c- Extraction by Soxhlet method.

RESULT AND DISCUSSION

Extraction of essential oil from neem leaf was carried out by Soxhlet extraction method using different organic solvents viz. n-hexane, ethanol and ethyl acetate. All experiments were carried out on laboratory scale with various parameters such as temperature, time and particle size were studied. Results were tabulated in the observation tables and graphs (01 to 06). Three replicate measurements were carried out for each parameter.

Effect of Temperature: Results shows that there is no appreciable dependence of neem oil yield on temperature in extraction operations where n-hexane and ethyl acetate were used as extracting solvents. The average oil yield has been around 25% in n-hexane and between 35 to 37% in ethyl acetate at temperatures 50, 60 and 70 ^{0}C., though there has been very small declining trend of yields. The extracting behaviour was found to be different in case where,

ethanol was used as extraction solvent. When ethanol was taken as extracting solvent, the oil yield rose to 45.02% from 35.07% on increasing the temperature from 50 to 60 ^{0}C. It was decreased from 45.02% to 42.06% when temperature was increased from 60 to 70 ^{0}C.

Effect of Time

Oil yields obtained were found to be dependent on extraction time. In general, the oil yield increases with the increase of extraction time, Results as shown in table-1 for Soxhlet extraction using hexane, the oil yields was increased by 67.6% (from 25.06% to 42.02%) when the time interval was increased from 1 hour to 3 hours. In case of ethanol and ethyl acetate solvents, the increase in oil yield were 39.8% (from 35.07% to 49.03%) and 32.2% (from 37.08% to 49.05%) respectively when time interval was raised to 3 hours from 1 hour.

CONCLUSION

The extraction yields of neem oil using Soxlet method are significantly influenced by the nature of solvent and time intervals for extraction though there is no appreciable change in oil yield by changing the temperature of extraction materials except in case where ethanol was used as extracting solvent.

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