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Refractive Index Determination of Groundnut Oil from Paratwada Village of Amravati District (M.S.), India at Various Temperatures

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Abstract
This study investigates the refractive index (RI) of edible oil, specifically groundnut from Paratwada village of Amravati district in Maharashtra state of India at various temperatures. The RI, is a critical parameter for assessing oil quality and composition which is directly related to human life. In this study RI of groundnut oil was measured using an Abbe refractometer at 35 to 50 degree Celsius temperature ranges. Results indicate that the RI of oil decreases proportionally with temperature, reflecting the properties of their pure components. The decline in RI with temperature is attributed to increased molecular motion and reduced oil density. These findings emphasize the importance of RI as a simple yet effective tool for monitoring oil quality and composition, with potential applications in quality control and adulteration detection in the edible oil industry.

Key words: *Groundnut oil, Refractive index*

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I. INTRODUCTION

The refractive index (RI) is defined as the ratio of the speed of light in a vacuum to that in a medium. As refractive index is a ratio of two similar quantities, both of which are speed of light hence have no specific unit. In edible oils, RI provides insights into oil composition and quality, as variations can indicate differences in fatty acid profiles, degrees of unsaturation, and potential adulteration [1]. RI measurement in oil industry is a rapid quality assessment tool to check the purity of the edible oil. This study aims to measure and compare the RIs of groundnut oil contributing to understanding their quality and characteristics. Numerous studies have examined the relationship between RI and the quality of edible oils. Salah and Nofa1 (2021) emphasized the importance of RI in differentiating between pure and adulterated oils [2]. Research by Aluyor *et al* (2009) indicated that refining processes significantly affect the RI of oils [3]. These studies highlight the relevance of RI as a reliable parameter for quality control in the edible oil market. The distinct refractive indices highlight the potential of RI measurements for quality control in the edible oil industry [4], [5]. Routine monitoring of RI can help detect adulteration and ensure that consumers receive high-quality products. The simplicity and speed of RI measurements make them suitable for commercial applications [6], [7]. Investigating the effects of temperature and storage conditions on RI could provide further insights into oil stability and quality [8], [9], [10]. The distinct RI values reflect the unique compositions of each oil type, emphasizing the potential of this method as a quality control tool in the edible oil industry [11], [12].

II. MATERIALS AND METHODS

Materials

- Edible Oil: Groundnut oil was extracted using expeller. Oil seeds collected from village Paratwada of Amravati district, Maharashtra, India.
- Refractometer: An Abbe refractometer (Model: Atago, Japan DR-A-)1with temperature controller was employed for precise measurement
- Calibration Standards: Distilled water (RI = 1.333) was used for calibration.

Sample Preparation

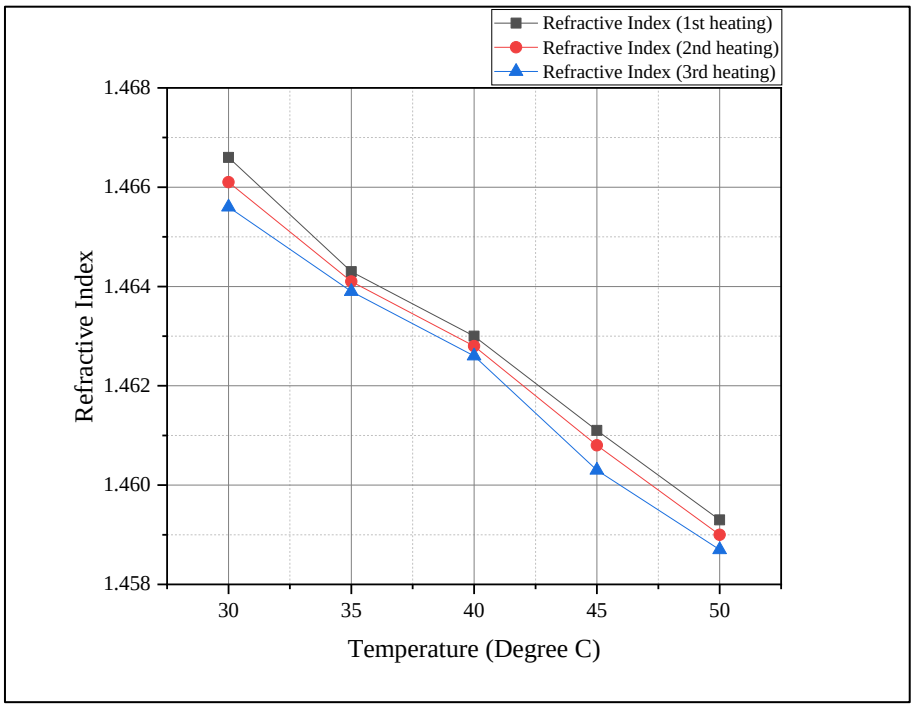
1. Oil: After extraction of pure groundnut oil, it was stored in sample bottles.
2. Temperature Control: All measurements were conducted from temperature of 30°C to 50°C.

Experimental

The refractometer was calibrated by using distilled water. A few drops of oil were placed on the refractometer's prism at 30°C. Refractive index (RI) was recorded at the intersection of the light and dark fields. This procedure was performed in triplicate and the average value was taken as reading for calculations and the results obtained are given in **Table No.1** and calculated. This groundnut oil was kept at room conditions to attend the room temperature. Same oil was used for 35°C reading. This oil was heated up to 35°C and RI was calculated same procedure was carried out as in 30°C. This procedure was continued for 40°C, 45°C and 50°C and the refractive indices obtained from 30-50^{O}C is summarized in **Table No.1.** Similarly, relationship in between temperature against refractive index is shown in **Graph No.1**.

Table No.1
RI of groundnut oil at different temperatures

Sr. No.	Temperature (^{O}C)	Refractive Index (1st heating)	Refractive Index (2nd heating)	Refractive Index (3rd heating)
1	30	1.4666	1.4661	1.4656
2	35	1.4643	1.4641	1.4639
3	40	1.4630	1.4628	1.4626
4	45	1.4611	1.4608	1.4603
5	50	1.4593	1.4590	1.4587



Graph No.1
Temperature Vs Refractive index

From the **Table No.1** and **Graph No.1** it is cleared that when the temperature increases from 30^{O}C to 50^{O}C then refractive index (RI) of the groundnut decreases and this relationship was found to be linear.

III. CONCLUSION

The decrease in RI of groundnut when temperature increases this is due to decrease in density of oil. When temperature of groundnut oil increases, then viscous nature of the oil decreases so oil becomes less dense and less viscous hence light travels faster through the oil (medium) which decreases refractive index.

From this research it is cleared that, when the groundnut oil is heated-cooled-heated means repetitions of making use or re-use of same oil for any purpose become dangerous to human life, due to re-use and heating the same oil viscous nature of the oil goes continuously decrease and oil becomes less denser and less viscous at every stage so the original properties, uses and applications of the groundnut oil get lost and it will become harmful to the life of human beings. Food prepared by such re-used oil is harmful and dangerous to human

beings hence heart patients in Asian countries goes increasing. The decline in RI with temperature is attributed to increased molecular motion and reduced oil density. These findings emphasize the importance of RI as a simple yet effective tool for monitoring oil quality and composition, with potential applications in quality control and adulteration detection in the edible oil industry.

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