



Short Communication

A Novel Method of Using Refractive Index as a Tool for Finding the Adultration of Oils

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Abstract

Any physical parameter should find applications in our day-today life. This paper deals with the educational science in daily life for school students. In this paper, it has been shown that that how the refractive index can be used as a tool for finding the adultration of oils. Further more the refractive index of fifteen oils has been determined and presented here.

Keywords: Refractive index, adultration.

Introduction

Optics is a branch of physics which deals with the study of light. Refractive index is an important optical parameter to analyze the light rays traversing through materials medium¹⁻¹⁰. In laboratory, the refractive index of liquids can be found out by spectrometer using hollow prism. The Abbe's refractometer can also used for finding the refractive index with very good accuracy¹¹. Using the two techniques, present study deals with the refractive index and adultration of oils.

Material and Methods

Refractive index of oils : The refractive index of fifteen selected standard oils kerosene, coconut, palm, ghee, vanaspathi, olive, jatropha, neem, gingelly, paraffin, groundnut, mustard, castor, sunflower and sandal oils have been determined by spectrometer and Abbe's refractometer. Both are found to be in good agreement with each other and shown in table 1.

Adultration of oils: Adultration is a common problem everywhere. It has been confirmed from different people that the palm oil is mostly used for adultration of edible oils because of its lower cost and odorless property. Therefore, the coconut oil and sunflower oil have been chosen for the present adultration study and they have been mixed with palm oil in different percentages. The refractive index of these mixed oils have been found out by using Abbe's refractometer and presented in table 2. The calibrated graphs of refractive index as a function of percentage of palm oil mixed with coconut oil and sunflower oil respectively are shown in figure 1 and figure 2. Now, various samples of coconut and sunflower oils have been collected from various stores and the refractive index of these oils have been determined by Abbe's refractometer. From the calibrated graphs (figure 1 and figure 2), the percentage of adultration have been deduced and presented in table 3.

Results and Discussion

The refractive index of fifteen selected standard oils kerosene, coconut, palm, ghee, vanaspathi, olive, jatropha, neem, gingelly, paraffin, groundnut, mustard, castor, sunflower and sandal determined by spectrometer and Abbe's refractometer are found to be in good agreement with each other (table 1). The refractive index of the coconut oil and sunflower oil mixed with palm oil have been found out by using Abbe's refractometer and presented in table 2. The calibrated graphs are shown in Figure 1 and Figure 2. From the calibrated graphs (figure 1 and figure 2), the percentage of adultration of different samples have been deduced and presented in table 3.

Conclusion

The refractive indices of fifteen oils have been determined. The percentage of adultration of these oils has been deduced by using refractive index as a tool. This reveals that the simple laboratory measurement of refractive index can also be used as a quality control technique for finding the adultration of oils. From this study, it has been observed that in coconut oil, the adultration percentage is 30% to the maximum and in sunflower oil, the adultration percentage is less of the order of 45%.

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Table-1
The refractive index of different oils measured by using Spectrometer and Abbe’s refractometer

S. No	Oils	Refractive Index	
		Abbes refractometer	Spectrometer
1	Kerosene	1.441	1.4369
2	Coconut	1.454	1.4495
3	Palm	1.463	1.4583
4	Ghee	1.460	1.4608
5	Vanaspathi	1.462	1.4608
6	Olive	1.466	1.4627
7	Jatropha	1.467	1.4647
8	Neem	1.468	1.4667
9	Gingelly	1.469	1.4670
10	Paraffin	1.472	1.4673
11	Ground nut	1.466	1.4696
12	Mustard	1.470	1.4701
13	Castor	1.475	1.4702
14	Sunflower	1.472	1.4709
15	Sandal	1.489	----

Table-2
The variation of refractive index of Coconut oil and Sunflower oil with percentage of adultration of Palm oil using Abbe’s refractometer

S. No.	Percentage of Adultration	Refractive Index	
		Sunflower oil	Coconut oil
1	0% of Palm oil	1.472	1.4540
2	10% of Palm oil	1.470	1.4550
3	20% of Palm oil	1.469	1.4555
4	30% of Palm oil	1.468	1.4560
5	40% of Palm oil	1.467	1.4565
6	50% of Palm oil	1.466	1.4570
7	60% of Palm oil	1.465	1.4575
8	70% of Palm oil	1.4645	1.4580
9	80% of Palm oil	1.464	1.4585
10	90% of Palm oil	1.463	1.4635
11	100% of Palm oil	1.462	1.4635

Table-3
The Percentage of adultration found in Coconut oil and Sunflower oil from the measurement of refractive index

S. No.	Coconut Oil			Sunflower Oil		
	Samples	Refractive Index	Percentage of adultration	Samples	Refractive Index	Percentage of adultration
1	Sample 1	1.4545	5%	Sample1	1.472	0%
2	Sample 2	1.4540	0%	Sample2	1.472	0%
3	Sample 3	1.4550	10%	Sample3	1.471	4.5%
4	Sample 4	1.4540	0%	Sample4	1.471	4.5%
5	Sample 5	1.4550	10%	Sample5	1.471	4.5%
6	Sample 6	1.4560	30%	Sample6	1.472	0%
7	Sample 7	1.4540	0%	Sample7	1.472	0%

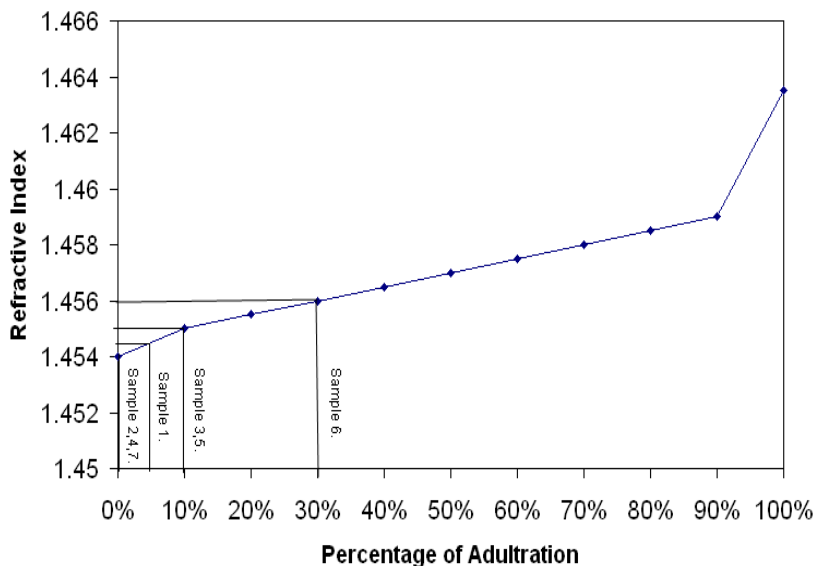


Figure-1
The Refractive index versus percentage of adultration of Palm oil with Coconut oil

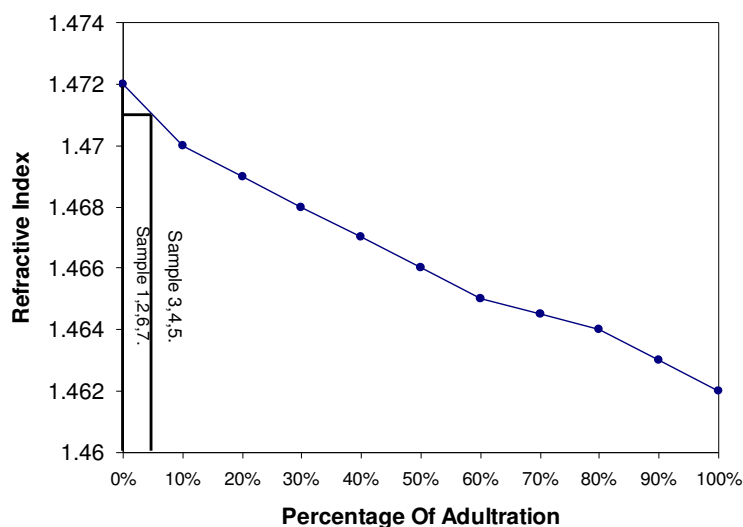


Figure-2
The Refractive index versus percentage of adultration of Palm oil with Sunflower oil