

LETTERS TO THE EDITOR

STUDY OF ADULTRATION IN OILS AND FATS BY ULTRASONIC METHOD

ADULTRATION of food stuffs and essential oils has become very common in our country and it has reached such proportions as to become a health hazard to the consumer. As such, in the National interest, it has become necessary to devise effective methods which can readily detect adulteration and declare a product as 'genuine and pure' or adulterated. In our country, different states have adopted different standards regarding the purity of consumable fats and oils. There is no specific yard stick to declare a particular sample as pure or impure.

From a study of the literature¹⁻⁵ regarding different physical and chemical methods, it is evident that no method can be singled out as perfect to detect and estimate the adulterant accurately. They must be supplemented by more than one test and specific tests are to be conducted to detect and estimate a particular adulterant.

In view of the limitations of the various physical and chemical methods used in the study of adulteration, a search has become necessary to find any new method which may be easy to operate and can effectively detect adulteration. Ultrasonic interferometer method is found to be most suitable for this purpose. Hence, the study of adulteration in some oils and fats by this method has been undertaken in the present investigation.

The composite ultrasonic interferometer⁶ designed in this laboratory is operated at a frequency of 1 MHz as fixed path type in the present study. It is observed that there is a marked change in the velocity of ultrasound when a pure sample is adulterated with an adulterant. As such, accurate measurement of velocity can be used as a tool to detect adulteration and the accuracy of this method is about 1%.

The velocities for a number of liquid systems are measured from the point of view of adulteration by the interferometer. The velocities obtained for a given system are plotted against different concentrations by volume of the adulterated mixtures. In all the systems, linear graphs have been obtained, showing that the velocity variation is directly proportional to the degree of adulteration. As such, it is found possible to determine the percentage of adulteration in a given sample directly from velocity measurements.

The following nine systems have been studied in detail:

1. Ghee and Vanaspathi

Pure samples of Ghee and Vanaspathi are taken and mixed in different proportions by volume varying

the composition of Vanaspathi from 1% to 100%. The velocity of ultrasound in these mixtures in molten condition at 58°C is determined. The temperature is maintained to an accuracy of $\pm 0.1^\circ\text{C}$ by an electronically controlled thermostat. The velocities thus obtained are plotted against different concentrations of Vanaspathi (adulterant) in Fig. 1 (Curve 1). From a reference to the graph, it can be seen that the velocity is directly proportional to the degree of adulterant. The system gave velocity variation of 73 m/sec and hence the adulteration to an accuracy of 1% can be detected. Commercial samples examined by this method showed an adulteration of 25% of Vanaspathi in Ghee.

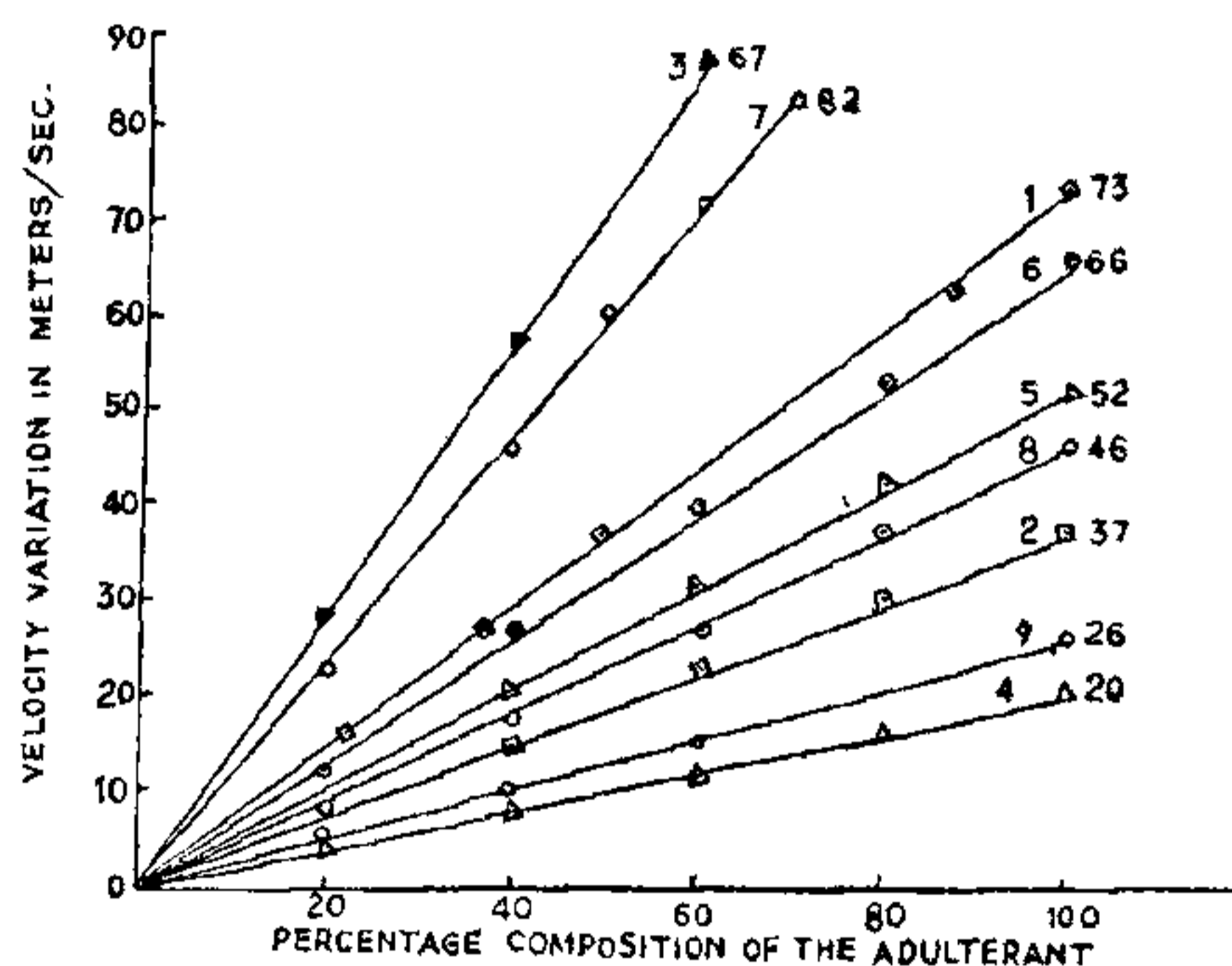


FIG. 1 VELOCITY VARIATION IN DIFFERENT ADULTERATED SYSTEMS.

2. Ghee and Coconut Oil

This system gave a velocity variation of 37 m/sec. The velocity variation with percentage composition of coconut oil as adulterant is plotted in Fig. 1 (Curve 2). The accuracy with which the adulterant can be detected is about 2 to 3% in this system.

3. Ghee and Gingelly Oil

This system gave maximum variation of about 146 m/sec in velocity. Adulteration less than even 1% can be detected accurately in this system due to large variation of velocity. Curve 3 in Fig. 1 shows the graph between percentage composition of gingelly oil and the corresponding variation in velocity. Commercial samples showed an adulteration of 15% of gingelly oil in ghee.

4. Gingelly Oil and Groundnut Oil

This system gave a small variation of velocity of about 20 m/sec and hence small quantities of adulteration of gingelly oil with groundnut oil is difficult to detect. The variation of velocity in gingelly oil with percentage composition of groundnut oil is

shown in Fig. 1 (Curve 4). Commercial samples showed an adultration of groundnut oil to the extent of 39%.

5. Groundnut Oil and Castor Oil

In this system, the velocity variation is 52 m/sec and the adultration of groundnut oil with castor oil can be detected to an accuracy of 2%. The velocity variation with percentage composition of Castor oil (adultrant) is shown in Fig. 1 (Curve 5).

6. Diesel Oil and Kerosene Oil

The graph of velocity variation with percentage composition of Kerosene is shown in Fig. 1 (Curve 6). This system gave a velocity variation of 66 m/sec. Adultration can be detected upto 2%. Commercial samples examined showed large scale adultration of kerosene in diesel oil to an extent of about 25% showing that one-fourth of Diesel is Kerosene oil.

7. Petrol and Kerosene

This system gave large variation of velocity to an extent of 120 m/sec. Due to this large variation, the presence of even small quantities (less than 1%) of Kerosene can be detected. Results are shown in Fig. 1 (Curve 7). Commercial samples obtained from different local petrol bunkers showed adultration of Kerosene in Petrol varying from 10 to 20%.

8. Groundnut Oil and Mineral Oil

This system showed a velocity variation of about 46 m/sec. Adultration of mineral oil upto 2% can be easily detected. Commercial samples showed large scale adultration of mineral oil to an extent of 30%. The results are shown in Fig. 1 (Curve 8).

9. Gingelly Oil and Mineral Oil

The results of this system are shown in Fig. 1 (Curve 9). This system gave a velocity variation of 26 m/sec. In this system accuracy with which the adultrant can be detected is 3% commercial samples showed large scale adultration of mineral oil upto 25%.

It is observed from the systems studied so far, except in the case of groundnut oil as adultrant in gingelly oil, all other systems have shown large variation of velocity, making precise velocity measurement, by ultrasonic interferometer, a powerful tool to study adultration. Interferometer method is known to give an accuracy of 1 in 1000 m/sec and hence adultration can be determined upto an accuracy of 1% in systems which show large variation of velocity (greater than 50 m/sec) between the two constituents. However, in the systems like groundnut oil in gingelly oil, where the velocity variation is very small, the accuracy of this method is very limited and the adultration can be determined only to an accuracy of about 5%. As accuracy of adultration depends on velocity variation, care must be taken in precise determination of velo-

city by this method. The only drawback of this method is that one can not pin down or identify the adultrant. But once the adultrant is known, it is easy to estimate the percentage composition of the adultrant. However to identify the adultrant, further experimentation is necessary.

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A → X BAND SYSTEM OF SrF

THE electronic spectra of the SrF molecule have been investigated by several workers¹⁻⁹. Seven electronic band systems of SrF have been observed in absorption and three of these in emission. Two of the band systems lie in the visible region and the remaining five in the U-V region.

The characteristic feature of the A → X band system of alkaline-earth halides is that the bands form long sequences. Johnson⁴ and Harvey⁹ photographed the A → X band system of SrF on a 21 ft. concave grating spectrograph in the first order. Recently, Domaille *et al.*⁷, used a cw dye laser to excite the B → X system