ABSTRACT

Adulteration and impurities in the natural fluids affect the health of human beings, performance of vehicles and machines in industries etc. Various methods for determining the adulteration of the fluids have been used in the past. Most of these methods are costly and time consuming as they require a number of reagents, moderate laboratory facilities and trained analysts to carry out the analysis. Thus, the need of the hour is to carry out research for simple and accurate methods for the measurement of such impurities and adulteration.

In the following paragraphs the development of new electronic techniques for analyzing the properties and characteristics of some of the natural fluids is summarized.

A novel technique for the measurement of liquid viscosity has been proposed. The principle involves that the torque required to rotate a disk by a motor, at constant speed, inside a liquid bath is directly proportional to its viscosity. The current in a dc shunt motor being proportional to its torque and hence, the current measures the viscosity of the liquid under test. The change in motor current is further converted into a proportionate voltage which is amplified by an instrumentation amplifier. Thus, the
viscosity of the liquid can directly be expressed in terms of the output voltage of the instrumentation amplifier. The resulting linear variation, between the voltage and the viscosity of oils is a desirable feature. Therefore, one can easily and quickly measure the viscosity of the required liquid, by simply observing the output voltage of the circuit, without bothering for the difficulties involved with the different types of viscometers being in use.

The second proposed electronic technique is useful for the determination of the adulteration of natural milk with synthetic milk. Synthetic milk is prepared by emulsifying vegetable oils with appropriate amount of detergent and urea. A number of samples of the natural milk mixed with synthetic milk are analyzed by the method of Electrical Admittance Spectroscopy. The conductance of milk samples is measured by this method which considerably varies with the variation of frequency upto100 kHz but, remains almost constant above this frequency. It is also noted that the value of the conductance decreases with increase in the concentration of the synthetic milk at a given frequency. The conductance of the milk sample is measured by the operational-amplifier circuit. The output voltage of this circuit is found inversely proportional to the conductance of milk sample and hence, its adulteration.
The next developed electronic technique is suitable for the determination of the adulteration in pure honey with different quantities of impurity. This technique involves the measurement of the capacitances of the mixture (adulterated honey) resulting from the variation of its dielectric constant, with variable percentage of adulteration. It is observed that the capacitance of the honey sample increases with the increase in its adulteration. This variable capacitor is also connected in the circuit of a relaxation oscillator and the change in capacitance varies the output frequency of the oscillator. The frequency of the output signal is measured using the digital counter which decreases with the percentage increase of the syrup in honey.

An electronic technique is proposed to determine the adulteration of petrol and diesel with kerosene. The principle involves the use of a light emitting diode at one end of the fiber which provides sufficient radiant energy over the wavelength region, where its absorption can be measured. In the present technique, the light is guided inside an optical fiber through the principle of total internal reflection. The cladding of an optical fiber is removed over a small length of the fiber, the evanescent wave, and thus, the guided light interacts with the measurand. The light received at the other end of the fiber is converted into a proportional current using a photodiode. This current is further converted into a proportionate output
voltage using a current to voltage converter. It is observed that the output voltage decreases almost linearly with increase of kerosene adulteration in petrol and diesel.

The last discussed electronic technique is meant for the discrimination of vegetable oils viz; castor, olive, sunflower, mustard, and groundnut oils. Monochromatic light at wavelengths of 635nm, 565nm, 470nm and 430nm, emitted from LED is passed through the oil sample, contained in the polystyrene cuvette. A fraction of the incoming light is absorbed by the oil sample resulting in its emergence with lower intensity. It is detected by the photoconductor, which changes its electrical resistance. This change in the electrical resistance of the photoconductor connected with voltage controlled oscillator circuit changes its frequency. The frequency of the output signal is measured with the help of a digital frequency counter. The observations at 635nm, 565nm and 470nm wavelengths do not discriminate the vegetable oils. However, at 430nm the separation of all oil classes is successfully obtained.

The techniques thus, described will find applications in the design of low cost instruments for studying the profiles of various natural fluids.