CUTTING EDGE DEVICE OVER USUAL SURFACE TENSION, INTERFACIAL TENSION, VISCOSITY EXPERIMENTAL MEASUREMENTS FOR SATURATED HYDROCARBONS AND DITHOERYTHRITOL: AIR FILTER FITTED SURVISMETER

Man SINGH
University of Delhi, INDIA

Abstract: Interfacial tension (IFT) of pentane, hexane, heptane and octane saturated pure hydrocarbons with water interfaces depicted as Liquid-liquid interfaces (LLI) and surface tension and viscosities for 2.5, 5.0, 7.5 and 1.0 aqueous millimoles/L Dithioerythritol (DTE) are reported. The IFT are decreased in the order: octane - hexane - pentane - heptane. The viscosities increase and the surface tension showed micelle formation with DTE compositions. The interfacial tension, surface tension and viscosities are frequently measured parameters for soaps, detergents, cosmetics, inkjet inks, syrups, sol-gels, solvents, fuels, textile spinning, paper technology, drug surface area and disintegration etc. Individually usual viscometers, stalgmometers/tensiometers are in use where suction is made for either lifting the sample up or dropping the sample downwards. In this process atmospheric air is used for pressure variations inside instrumental parts. The atmospheric air is heavily contaminated with so many pollutants like SO_x , CO_x, NO_x (x = 1,2,3), HCl, H_2O vapors, volatile organic compounds (VOC) and polychlorinated biphenyls (PCB). Air filter fitted Survismeter was used for measurements of the parameters using purified air for developing pressure gradients.

Keywords: hydrocarbons, interfacial tension, surfactant, interactions, pollutants

Introduction

The saturated hydrocarbons are most useful solvents and the DTE is a proteins denaturants [1]. Their study with clean conditions is must. Hence a new device is used here for their study. For a long the atmospheric air is in use for several physical parameters like IFT, surface tension, wetting coefficient, viscosity etc. The liquid samples which are under study are highly precious like bio-fluids, lipids, DNA etc. and no polluted air must touch and contaminate them during study. So control of air quality is essential, therefore, an air filter fitted Survismeter is used for measurements of physical data [2]. There is almost everyday report in electronic and print media about levels of polluting gases and SPM, dust particles in environmental air. Apart from exponential growth of cosmetic products, their uses like nail polish, facial creams, tattoos, deodorants, scents, fragrant, volatile flavor. Currently pure air is an urgent need, sometimes Radon is reported in air. The vehicles emit so many kinds of particles and gases due to incomplete combustion of fuels. The coating, polishing, also releases much VOC, thinners like ethers acetone, hexane ethanol, benzene, CCl_4, etc. Emerging fields of printing, polishing, calendaring, dry cleaning, textile cleaning-drying, have polluted environments, households, interior decorations, floriculture, fumigation, use of sprayants or domestic and agricultural levels have made our environment highly polluted. The environment is overloaded with several kinds of pollutants in larger amounts. Now use of environmental air for scientific purposes is not advisable due to many reasons. Initially Pascal, Boyle, Charles have initiated their studies on air samples [3-6] without further purification. Those days the air was pure but now before use of air samples purity check is essential. Several scientific experiments use environmental air especially for the viscosity, interfacial tension and surface tension measurements. The air produces a hydrostatic pressure over a surface of liquid sample to push the liquid to functional units of the apparatuses in use. The pollutants have posed a challenge in getting purified air for viscosity and surface tension measurements [7-13]. To solve this problem, a specific filter is used that detains all kinds of pollutants including moisture contents of the air.

Material and method

The pentane, hexane, heptane, octane hydrocarbons were procured from Wako, Japanese chemical company and were used as received. The DTE solution was prepared with Millipore water, w/v. The LLI were developed by hydrocarbons in reservoir bulb of the Survismeter [2,4] and water in IFT capillary. The data of few systems were compared with those of Face Automatic Surface Tensionmeter, CBVP-Z, Kyowa Interface Science Co. Ltd. Japan. A striking agreement in results of both devices was noted.

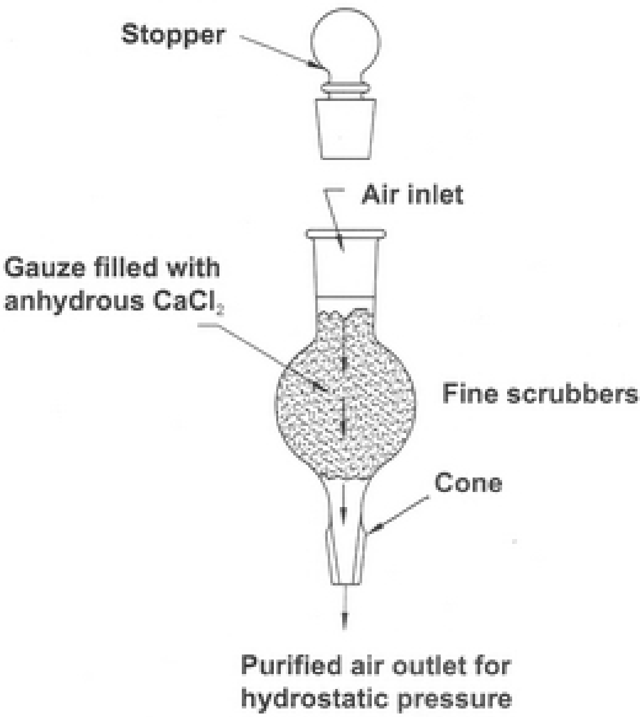

Fig. 1.1. Air filter unit

Methodology

Survismeter unit is depicted in Fig.1 and the ail filter in Fig. 1.1. The cone of a filter unit is fitted in the socket depicted with number 1 of the Survismeter (Fig. 1). The middle part of the filter unit contains gauze and is filled with anhydrous $CaCl_2$ to absorb the water vapor of the air. The fine scrubbers are also fitted along with fine gauze that detains suspended particulate matter (SPM) and dust particle. Thus almost all the chemicals impurities are detained and purified air is allowed to pass into a liquid to move to operational units for surface and viscosity study. The procedural details for measurements of the IFT, surface tensions, viscosity etc with Survismeter are given elsewhere [2,4].

Results and discussion:

The calculations of the data are reported in our earlier reporting [1,2]. The data were reproduced to 1.95 confidence level and high precision. The Fig. 2 depicts the higher IFT, mN/m of heptane and least of the octane with interfaces. In general their IFT data are as octane > hexane > Pentane > heptane.

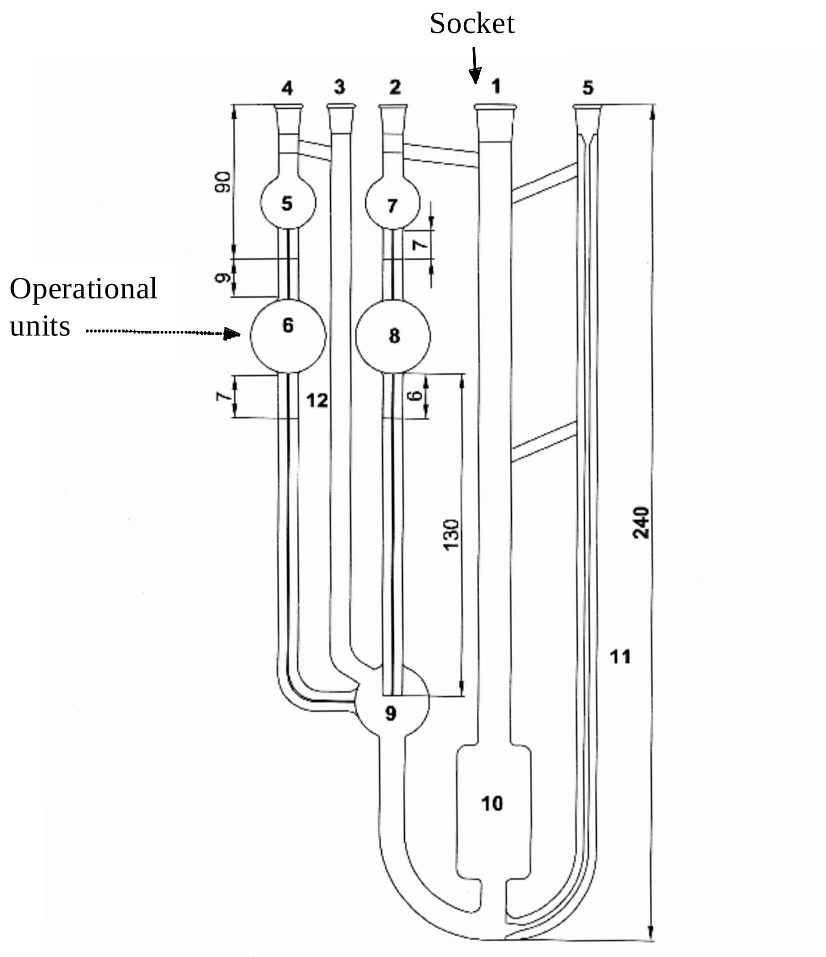

Fig. 1. Survistmeter

The pentane with less carbon atoms in alkyl chain showed the higher IFT than the hexane. Here induction effects develop mild hydrophilic and alky chain the stronger hydrophobic interactions. The octane behaved as a stronger nonionic surfactant but the heptane as mild surfactant. The viscosities of the DTE (Fig. 3) are increased with increase in its compositions due to stronger interactions of the terminal hydroxyl groups of the DTE. Its sulfur atoms also developed stronger interactions with water and it behaved as water structures breakers. The surface tension data initially were higher than those of the water but with 5.5 $mmol.dm^{-1}$ it showed micelles formation and with further increase in its concentrations the surface tension data increased with stronger intermolecular force development. Thus the DTE behaves as mild surfactants.

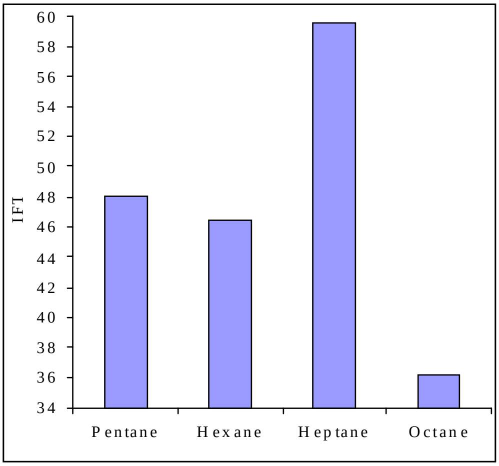

Fig. 2. IFT data of the hydrocarbons with water

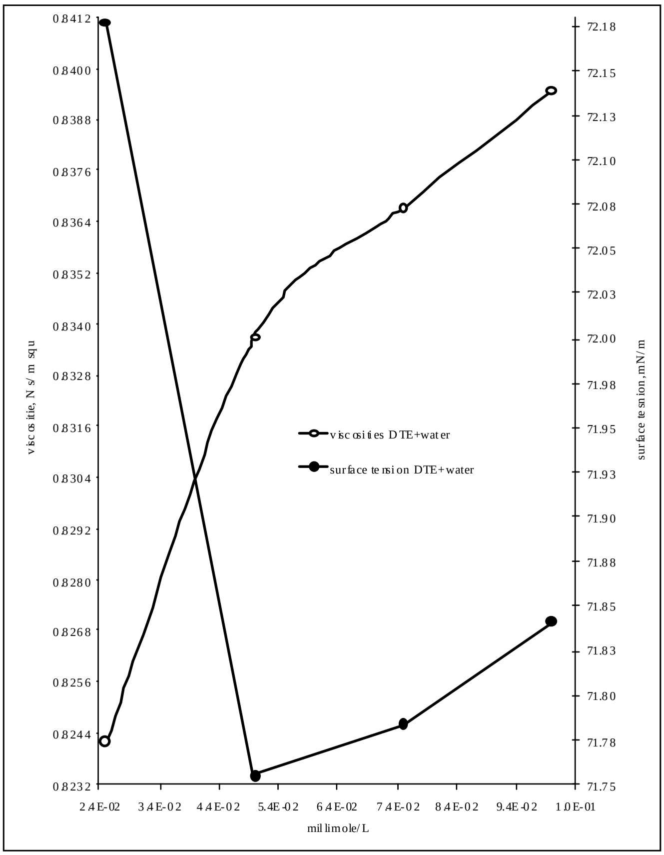

Fig. 3. Surface tension and viscosities of the DTE with systems

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✉ **Dr. Man Singh**,
Chemistry Research Laboratory,
Deshbandhu College, University of Delhi,
New Delhi 110019, INDIA
E-Mail: mansingh50@hotmail.c