

**THE STUDY OF VISCOSITY-DENSITY PRODUCT OF FLUIDS BY
USING ULTRASONIC TESTING**

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ABSTRACT

The study of shear longitudinal wave's propagations of ultrasonic in different viscosity-density of fluids has been carried out. The ultrasound shear longitudinal wave reflections are playing very important role so that viscosity-density of fluids can be measured. This method based on the determination of reflection coefficient and velocity of sound. The velocity of sound can be determined due to Snell's law where are the 1st and 2nd critical angle occur from the refracted incidence of longitudinal and shear waves respectively while the reflection coefficient, RC can be determined due to acoustic impedance, $Z=\rho v$ of fluids and solid substrate that depends on density and velocity of sounds. For the purpose to determine viscosity-density product, sugar water solutions were used with concentrations ranging from 0%-70% at incremental steps of 10% concentrations. The acrylic and aluminum solid substrates are within the sugar water solution that functions as shear wave block so that the transmission amplitude of longitudinal and shear waves can be measured as angle changed from 0° to 90°. The results were compared for each solution in different of solid substrate. As concentrations of solid liquids increases, the velocity of sounds increases then the reflection coefficients decreases therefore increasing the viscosity-density value. This explains the solid substrate materials and fluids properties in different of viscosity-density product.

CHAPTER 1

INTRODUCTION

1.1 Background of study

Measurement of material properties using ultrasound is a well research area of study as well as other acoustical methods. Ultrasound has been used to measure viscosity of fluid as early as 1949 (W.P. Mason et al 1949). The shear wave reflection coefficient of ultrasound technique at a liquid to solid interface was developed to determine the viscosity response of fluids (W.P. Mason et al 1949). This viscosity measurement based on shear wave of ultrasound was developed where the propagation loss and the phase shift between the reference and loaded waveforms were used to predict the viscosity (T. Sato et al 1993). By study this ultrasound shear wave reflection, velocity of sound and viscosity density of fluid can be measured. This method based on determination of reflection coefficient and density of fluid. In this work, sugar water solutions were used to determine viscosity density with concentrations ranging from 0%-70% at incremental steps of 10% concentrations. The results were compared for each solution in different of solid substrate and the physical properties of solid substrates were discussed.