CHAPTER I

INTRODUCTION

1.1 General introduction

Viscosity is one of the most important flow properties of petroleum oils and their mixtures[1]. It is a measure of the interval fluid friction which tends to oppose any dynamic change in the fluid motion [2]. Since viscosity is defined as a shearing stress per unit area divided by a velocity gradient, it is expressed in poises. The kinematic viscosity is the ratio of the viscosity to the density and the unit is the stoke.

The kinematic viscosity is used to control the yield of finished products of the requisite specifications in every lube blending plant. The kinematic viscosity is the resistance to flow of a fluid under gravity at a specified temperature [3-5]. The standard test method developed by ASTM is generally used to determine the viscosity. The kinematic viscosity of finished products can vary significantly, depending on lubricating base oil composition and process conditions.

Blend formulations are usually developed based on the manufacturer's experience with the properties of the blending lubricating base oil stocks, in conjunction with some trial and error of experimentation in the laboratory to identify a formulation that meets a certain viscosity target. A considerable amount of laboratory time is needed to optimize the useful blends. As a consequence, equations or models for predicting viscosities have been developed in an attempt to resolve actual or potential difficulties in the field. Each manufacturer has developed empirical blend equations or formulations for use in their individual process.

Estimation and prediction are often used as if they were synonymous. Estimates may be based on theory, on correlations of experimental values, or on a combination of both. A theoretical relation, although not generally valid, may nevertheless serve adequately in specific cases[2].

Information on the viscosity of oil fractions and their mixtures is of considerable importance for estimating transport properties and solving problems in petroleum processing. The effect of temperature or characteristics of oil on its viscosity is especially noteworthy.

It is advantageous to be able to predict the physical properties of mixtures of petroleum products from the properties of the components by use of a viscosity correlation that must be applicable for range of compositions and temperatures. Preferably, minimal input data are fed into a model, which can provide reliable and accurate predicted values. Safe and fast convergence is needed because the viscosity must be predicted a great number of times.

This research involves the prediction of the kinematic viscosity of lubricating base oil blends by weight method, using the principle of statistics linear regression, to be one choice of viscosity prediction and to solve the formula problem easily, quickly and accurately and to try to reduce the variation in mixing.

There are different advantages and disadvantages between blending by weight and volume of lubricating base oil. Blending of a small amount is in a laboratory level but blending of a large amount is in an industrial level.

The advantage of the weight method is an accurate amount, which is more precise than the measurement of volume because the remainder of oil in a vessel would be less than the remainder in a tube and a pipe. This is especially true in high viscosity such as 150 BS. Under these circumstances, the temperature is not taken into consideration because the weight does not vary according to the temperature. On the other hand, the temperature must be known for the measurement of volume. Because of the temperature, an obstruction in the measurement of the volume will occur, but the weight will not be affected. Therefore, the calibration of a balance can easily be made, while the calibration of a meter or pipe is much more difficult regardless of the flow rate, air pressure and temperature.

The advantage of the volume method is the convenience and quickness of the measurement. This is because almost every type of industry produces a large number of goods through a formula of production, which is the weight ratio. Weight can be converted to volume for the convenience of an industrial production by the use of density and calculation through the formula $D = M/V$. Thus, the formula will be more relevant to the real production and it will identify the additives in a ratio of weight. An effective formula of production making should, therefore, be controlled to make the least mistakes because mistakes can occur more often during processing than in the laboratory.

1.2 The purpose of the research

This research aims to investigate and provide a method to predict the kinematic viscosity of lubricating base oil blends by weight method for solving problems in processing and to issue the blending formula with safety and quickness by using statistic tools.

1.3 Scope of research

This research focuses on the blending of lubricating base oils consisting of 150 SN, 500 SN, 150 BS at various weight fractions. The kinematic viscosity of their blends were investigated and provided a method to predict the viscosity of lubricating base oil mixtures based on linear regression and were also compared with blending by volume, which was used as a reference.

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