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Chapter 29

The effect of the operating conditions on the apparent viscosity of crude palm oil during separation

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ABSTRACT

This paper discusses the apparent viscosity of crude palm oil, using rotary viscometer, under different boundary conditions. It was experimentally shown that the apparent viscosity of palm oil drops with increasing shear rate and temperature. However, the effect of temperature on the viscosity tends to fade at temperatures beyond 80°C. A correlation between the apparent viscosity of crude palm oil and the operating conditions was developed. The derived correlation represents well the experimental data. This correlation can be used in design of crude palm oil settlers and in determining the optimum operating conditions.

Keywords: Crude palm oil; settler; apparent viscosity; Shear rate; modelling; separation

INTRODUCTION

The raw palm oil as pressed from the fruits is a product even cruder than the commercial crude palm oil. It contains a lot of fibres, dirt, and a lot of water, soluble impurities, and considerable amount of debris. The average composition (volume to volume), of the raw palm oil as received from the screw press is 40-75% oil, 10-40% water and 6-25% non-organic solids [1]. The crude palm oil is left in a clarifier to allow for the separation of oil from water (together with most of the debris). Water and its content of debris form immiscible liquids with the oil. The heavier water and debris settle to the bottom leaving the relatively clean and light oil on the top to be skimmed off later.

Previous studies found that a lot of oil is lost in the settler and a most of the waste water is produced there. It is very important to determine the optimum design parameters of crude palm oil settler. The separation of clear oil droplets from crude palm oil mixture is treated as a coalescence process [2, 3 and 4]. with oil droplets rising upward. To determine the optimum design parameters of crude palm oil settler, it is essential to determine the rising velocity of oil droplets in the aqueous phase. There are two main factors affecting the rising velocity, namely, density and viscosity [2]. The effect of the operating conditions, such as temperature and shear rate on the density is relatively small compared to their effect on viscosity [5, 6, and 7]. Hence, the density may be treated as a constant and the viscosity is considered the main operating condition influencing the separation process. Regardless of