UNIVERSITI TEKNOLOGI MARA

YIELD STRESS BEHAVIOUR OF FORMULATED WATER BASED DRILLING FLUID WITH TANNIN ADDITIVE

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ABSTRACT

Deflocculant is added into water based drilling fluid to disperse the flocculated clay that has an adverse effect on rheological properties at a temperature above 120°C. Currently, commercial deflocculants introduced have negative environmental effect. Therefore, by using plant derived additives could help resolve the weakness, since they are nontoxic and inexpensive. This study aims to evaluate the potential use of tannin from *Rhizophora Mucronata* to act as deflocculant agent in water based drilling fluid. Three different concentrations of tannin which are 2g, 4g, and 6g were added to the drilling fluid and its rheological properties and filtration properties along with density and pH were measured. It was observed that the addition of tannin decreased the rheological properties such as plastic viscosity, yield point, and gel strength. Furthermore, filtrate volume and filter cake were decreased due to the effect of tannin additive. Addition of 4g of tannin to the base fluid has been found to be the optimum concentration of tannin that exhibited the best deflocculant behaviour in water based drilling fluid. In addition the relationship between shear stress and shear rate were constructed based on three different rheological models which are Bingham Plastic, Power Law, and Herschel-Bulkley. The result showed Herschel-Bulkley model was best representing the yield stress behaviour of water based drilling fluid with tannin additive.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

Drilling fluid is a fundamental element in drilling operation. The drilling fluid design is very important and becoming one of the main focus in order to maximize its performance. Successful drilling operation relied on the drilling fluid properties. The right selection of fluid and proper maintenance of the fluid in overall effect the total well cost. Moreover, the drilling fluid also effects on formation evaluation and the productivity of the well (Caenn, Darley, & Gray, 2017).

Drilling fluid serves a number of functions including remove cuttings from the borehole during drilling to clean the hole, cool and lubricate the drill bit and drill string, maintain borehole stability, provide right mud weight to control formation pressure, suspend cuttings in borehole when circulation ceases, facilitate collection of geological information as well as transmit hydraulic horsepower to the drill bit.

Drilling fluid is categorized into three types. They are water based, oil based, and air based drilling fluids. Water based drilling fluid is the most common fluid used in oil and gas operation, due to its cheap in cost and relatively more environmentally friendly compared to others (Yunita, Irawan, & Kania, 2016).

During drilling operation, the mixture of drill cuttings, hydrocarbons, formation waters, and drilling fluids, result in the significant rheological properties of drilling fluid which are plastic viscosity, gel strength, and yield stress. These properties are related to cuttings removal, holding cuttings in suspension when circulation ceases, indicating the flow behaviour in the annulus, and providing information about formations penetrated.

The quality of drilling fluid rheological properties which are density, viscosity, yield stress, and gel strength varies and changes with depth, lithology and conditions of a particular formation location. Therefore the introduction of additives to the drilling fluid is required to decrease, increase or control the rheological properties of the fluid. The most common additives used in drilling fluid are weighing material,