ABSTRAK

STUDI LABORATORIUM PERBANDINGAN EFEKTIVITAS INHIBISI *SHALE* DARI SISTEM LUMPUR *POLYMER*

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Stabilitas *shale* merupakan faktor krusial dalam operasi pemboran, terutama pada formasi yang bersifat reaktif terhadap fluida pemboran. Ketidakstabilan *shale* dapat menyebabkan berbagai permasalahan serius seperti pembengkakan (*swelling*), dispersi (*dispersion*), dan terbentuknya *bit balling*. Salah satu metode yang umum digunakan untuk mengurangi reaktivitas *shale* adalah dengan menerapkan sistem lumpur polimer yang mengandung inhibitor dan mampu mengenkapsulasi cutting. Penelitian ini bertujuan untuk membandingkan efektivitas inhibisi *shale* dari tiga formulasi lumpur, yaitu KCL Polymer, KCL PHPA, dan KCL *Polyamine*.

Uji laboratorium dilakukan dengan menganalisis sejumlah parameter lumpur, meliputi: *mud properties*, *mud weight*, *Plastic Viscosity* (PV), *Yield Point* (YP), *Low Shear Yield Point* (LSYP), *API Filtration Loss*, pH, *Bentonite Equivalent Content* (BEC), serta konsentrasi ion kalium dan klorida. Selain itu, dilakukan *shale study* menggunakan sampel *cutting* untuk mengevaluasi efektivitas inhibisi *shale* dari masing-masing formulasi lumpur. Pengujian shale ini mencakup *accretion test*, *dispersion test*, *swelling test*, dan *bulk hardness test* guna menilai interaksi lumpur terhadap *shale*.

Jenis batuan yang digunakan sebagai sampel *cutting* dalam penelitian ini adalah *shale*. Berdasarkan hasil pengujian *Cation Exchange Capacity* (CEC) sebesar 15,5 meq/100 gr, menurut Mondshine (1966) *clay* tersebut diklasifikasikan sebagai jenis *illite mixed layer*, yaitu mineral *clay* yang tergolong reaktif. Sebelum dilakukan uji *shale*, dilakukan pengujian sifat fisik dan kimia terhadap ketiga sampel lumpur. Hasil pengujian *shale* pada formulasi KCl–Polyamine menunjukkan nilai *accretion* sebesar 0,29%, *dispersion* sebesar 85,87%, pengembangan shale (*swelling*) sebesar 5,5%, dan *bulk hardness* sebesar 360 lbf-inch. Secara keseluruhan, hasil penelitian menunjukkan bahwa setiap formulasi lumpur memiliki tingkat inhibisi shale yang berbeda. Lumpur KCL Polyamine menunjukkan performa inhibisi terbaik dengan kemampuan menekan ekspansi shale serta meningkatkan stabilitas formasi.

Kata kunci: stabilitas *shale*, lumpur pemboran, inhibitor *shale*, Polyamine

ABSTRACT

COMPARATIVE LABORATORY STUDY OF SHALE INHIBITION EFFECTIVENESS OF POLYMER MUD SYSTEM

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The stability of shale is a crucial factor in drilling operations, especially in formations that are reactive to drilling fluids. The instability of shale can cause various serious problems such as swelling, dispersion, and the formation of bit balling. One of the commonly used methods to reduce shale reactivity is by applying a polymer mud system that contains inhibitors and is capable of encapsulating cuttings. This study aims to compare the effectiveness of shale inhibition from three mud formulations, namely KCL Polymer, KCL PHPA, and KCL Polyamine.

Laboratory tests were conducted by analyzing several mud parameters, including: mud properties, mud weight, Plastic Viscosity (PV), Yield Point (YP), Low Shear Yield Point (LSYP), API Filtration Loss, pH, Bentonite Equivalent Content (BEC), and the concentration of potassium and chloride ions. Additionally, a shale study was conducted using cutting samples to evaluate the shale inhibition effectiveness of each mud formulation. The shale testing includes an accretion test, a dispersion test, a swelling test, and a bulk hardness test to assess the interaction of the mud with the shale.

The type of rock used as a cutting sample in this study is shale. Based on the Cation Exchange Capacity (CEC) test results of 15.5 meq/100 gr, according to Mondshine (1966), the clay is classified as a mixed layer illite type, which is a reactive clay mineral. Before conducting the shale test, physical and chemical property tests were performed on the three mud samples. The results of the shale testing on the KCl polyamine formulation showed an accretion value of 0.29%, dispersion of 85.87%, shale swelling of 5.5%, and bulk hardness of 3 lbf-inch. Overall, the research results indicate that each mud formulation has a different level of shale inhibition. KCl polyamine mud shows the best inhibition performance with the ability to suppress shale expansion and enhance formation stability.

Keywords: shale stability, drilling fluids, shale inhibitor, Polyamine