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OBTAINING AND CHARACTERISTICS OF DRILLING FLUID

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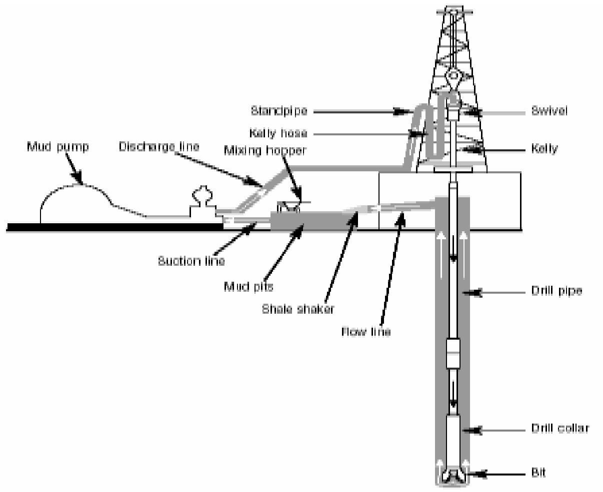
ABSTRACT:

Introduction Petroleum drilling is the primordial step in the success of oilfield exploration. This success is based, on the one hand, on the important details derived from geological drilled formations and, on the other hand, on the good drill-in reservoir conditions. Thus, the paramount drilling objectives are to reach the target safely in the shortest possible time and at the lowest possible cost, with required additional sampling and evaluation constraints dictated by the particular application. Drilling the wellbore is the first and the most expensive step in the oil and gas industry. Expenditures for drilling represent 25% of the total oilfield exploitation cost and are concentrated mostly in exploration and development of well drilling.

Keywords: drilling fluids, petroleum products, petroleum hydrocarbons, swelling of clay, carbohydrates.

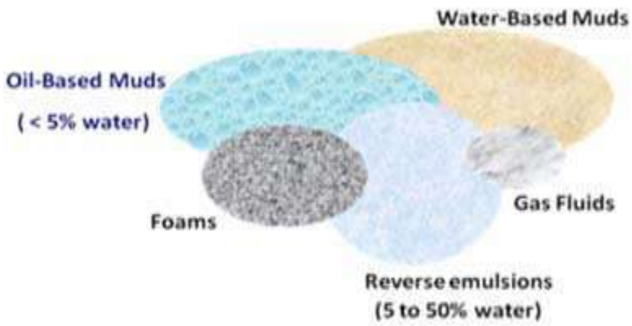
INTRODUCTION:

Drilling fluids, which represent till one fifth (15 to 18%) of the total cost of well petroleum drilling, must generally comply with three important requirements: they should be, i) easy to use, ii) not too expensive and iii) environmentally friendly. The complex drilling fluids play several functions simultaneously. They are intended to clean the well, hold the cuttings in suspension, prevent caving, ensure the tightness of the well wall, flood diesel oil or water and form an impermeable cake near the wellbore area. Moreover, they also have to cool and lubricate the tool, transfer the hydraulic power and carry information about the nature of the drilled formation by raising the cuttings from the bottom to the surface. Figure 1 shows a simple diagram of a rotary rig. Drilling fluids went through major technological evolution, since the first operations performed in the US, using a simple mixture of water and clays, to complex mixtures of various specific organic and inorganic products used nowadays. These products improve fluid rheological properties and filtration capability, allowing to penetrate heterogeneous geological formations under the best conditions.



However, although OBM often give better performances, they have major drawbacks such as to be generally more expensive and less ecologically friendly than WBM.

These fluids are called 'underbalanced fluids'. This underbalanced drilling technology is generally adopted for poorly consolidated and/or fractured formations. Controlled drilling rate tests in various rocks have confirmed that air or gas is a faster drilling fluid than water or oil. Water should be the fastest drilling liquid, however, in this case, drilling tests show that the most commonly used additives have detrimental effects on the drilling rate. Choosing a mud system begins with the selection of a mud family, according to the nature of the rock formation, and should take into account environmental and economic constraints. The choice of the mud formulation will be the second step, where one has to decide on the range of desired properties, leading to use minimum amounts of additives. Figure 2 summarizes the drilling fluid types.



Biodegradability of drilling fluids. The biodegradability of petroleum products is dependent on the chemical structure of their various components. Compound resistance to biodegradation increases with increasing molecular weight. The oils used in OBM can be classified according to their aromatic hydrocarbon concentration, which contributes to fluid toxicity. However, the relations between hydrocarbon physico-chemical properties and biodegradability have been little studied. Several works , dealing with laboratory techniques of biodegradability determination and the influence of experimental conditions, showed the variation of the results according to the used method and considered conditions. In general.

Products and Services; from R&D to Final Solutions the more soluble, lighter petroleum hydrocarbons are more biodegradable than the less soluble, heavier members of the group. Viscosity is also known to have an important impacton biodegradability. Highly viscous hydrocarbons are less biodegraded because of the inherent physical difficulty in establishing contact among contamination and microorganisms, nutrients, and electron acceptors compounds. The viscous diesel oil at highamount (>10%) shows low biodegradation rate (4%), but, in the presence of mixed culture (Enterobacter sp., Citrobacter freundii, Erogenous Pseudomonas, Staphylococcus auricularis, Bacillus thuringiensis, Micrococcus varians,…) it presents good biodegradation properties. Moreover, the biodegradation behaviour of diesel oil does not obey that of individual compounds. With high amount of aromatics in diesel oil (33%), the difficulty was considerable to relate diesel oil biodegradability to its composition. Numerous works showed good correlation between biodegradability and some physical and chemical parameters. Haus et al. demonstrated that biodegradability decreased with increasing amounts of aromatic and/or polar compounds. He showed that kinematic viscosity is the significant factor in biodegradability variation with chemical composition and oil physical and chemical properties. Zhanpeng et al. based their method to calculate biodegradability on three parameters: ratio, CO2 production and microorganism activity by ATP (adenosine triphosphate). On the chemical structure scale, some works (Hongwei et al., 2004) showed that biodegradability was a function of total energy and molecular diameter.

Amines and derived salts. Simple amines are used in several areas for specific applications. Quaternary ammonium salts prevent swelling and dispersion of clays by ion exchange. Their disadvantages are their high cost, toxicity and their incompatibility with anionic additives commonly used in fluids.

Carbohydrates and derivatives. In response to environmental constraints, new families of compounds are proposed such as sugars and their derivatives (saccharides). Sugars increase the viscosity of the filtrate and reduce the flow of water in clays . In addition, they provide a low water activity and generate an osmotic pressure favorable to clay dehydration. The problem with sugars is their susceptibility to biological attack, making them difficult to maintain unspoiled when stored on site. However, methylglucoside (MEG) and generally methylated saccharides are less susceptible to biological attack. MEG is a derivative of glucose, supplied as liquid containing 70% solids. Made from corn starch, it is classified as "biodegradable". Saccharides are generally recommended for the stabilization of clays. Added salts to saccharide systems allowed effective dehydration of clays, reduction of "bit-balling" and increasing ROP. These MEG systems have a good filtrate and produce environmentally acceptable cuttings. Soluble in water,MEG has many hydroxyl groups in a ring structure capable of reducing the water activity of the drilling fluid and may be a good additive to WBM.

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