Petroleum Technology Development Journal

Editor's Comment

This issue, 2014 Vol. 4 No. 2 PTDJ is the seventh issue of Petroleum Technology Development Journal (PTDJ). In the first article - *Effects of Polymer Addition on Pressure Drop and Interfacial Waves in Horizontal Oil-Water Flows*, Lawrence C. Edomwonyi-Otu[1] and Panagiota Angeli[2] investigate the effect of polymeric additives on pressure drop measurements and interfacial waves during oil-water pipe flow. The authors report that "The experiments were conducted in an acrylic test section 4.0 m long with 14 mm internal diameter. Tap water (density; 1.0 g/cm^3, viscosity, 1.0 mPa s at 23 ^{o}C,) and a middle distillate oil (Exxsol D140: density; 0.830 g/cm^3, viscosity; 5.5mPa s at 23 ^{o}C) were used as test fluids."[3] Flow patterns they said, were identified with high-speed imaging and pressure drop was measured with a differential pressure transducer. They used a conductivity probe to study interfacial waves. They then used 1000 ppm master solution of magnafloc 1011 (polyacrylamide) as drag reducing polymer in the water phase with concentrations ranging from 2.5 ppm to 60 ppm. In single-phase water flow, they obtained drag reduction of over 75 %. In two-phase oil-water flow without polymer, there was a good prediction of the experimental pressure drop data by the two-fluid model. When they added polymer, drag reduction of 40 % was obtained. They found a 20 ppm polymer concentration to be optimal for drag reduction in both single and two-phase systems. They observed that in stratified flows, interfacial wave characteristics were influenced by the nature of the polymer injection system.

In the second article - *Oilfield Scales Treatment and Managerial Measures in the Fight for Sustainable Production*, M. D. Garba[4] and M. S. Sulaiman[5]observe that formation of oilfield scale is recognised as one of the major problems associated with oil and gas production. They note that it poses a lot of serious threat in field production and it is a menace to production flow assurance, which in turn reduces the production flow resulting in production losses. They further observe that scale mitigation and management strategies are considered as a new development in the field to face the challenges. They reemphasize that mitigation strategies are considered as simple routine job when a fast and effective technique is employed to clean up the scale deposits or preventing further scale formation and the threat that might arise.

The third articles - *Hydraulic Fracturing Technology and Shale Gas Production in Nigeria: Legal and Sustainability Assessment* by Damilola S. Olawuyi[6] provides a legal and sustainability assessment of the hydraulic fracking technology and its potentials in Nigeria. The author observes that "While the United States and other European countries have cashed in on this shale gas revolution, Nigeria remains one of the countries with little or no activity with regards to shale gas production." "This" he says, "is a worrisome trend to many commentators who argue that Nigeria must not be left behind in the shale gas boom." He wonders if Nigeria is truly ready in terms of legal and regulatory frameworks, for shale gas production. He notes that "while a lot has been said about how shale production through hydraulic fracking could result in energy

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security, increased financial activities, income diversification, investments in priority sectors, and generation of local employment opportunities in Nigeria, none of these studies have provided in-depth examinations of the overall long-term costs of hydraulic fracking to the Nigerian environment, human health, water resources, and to life expectancy."

The author adopts a comparative approach that draws on experiences from Canada and the United States where he asserts that the technology has been profoundly utilized to analyze its sustainability potentials, paradoxes and challenges. He then proposes a legal framework built on the theory of sustainable development, through which the environmental concerns associated with hydraulic fracking could be anticipated and addressed in Nigeria.

Fatty acid methyl ester (biodiesel), a renewable fuel that can be produced from edible, non-edible and waste oils is the subject of the fourth article by Michael Bamitale Osho[7] and others. The paper - *Enzymatic Production of Fatty Acid Methyl Ester by Aspergillus Niger ATCC 1015 Lipase from Non-Edible Oil,* is the result of a research study by the authors. They explain that vegetable oils have attracted attention from researchers as potential renewable sources for production of alternative energy due to diminishing petroleum reserve. They used Structural Fibrous Network (SFN) of Carica papaya to immobilize Aspergillus Niger ATCC 1015 lipase by direct incorporation of the SFN on rice bran-physic nut medium and incubated at 30 °C for 72 h. They then used SFN-immobilized lipase for the production of biodiesel from Jatropha curcas seed oil. Immobilized whole cells of A. Niger ATCC 1015 resulted in lipase with specific activity of 445 U/mg at 96 h. Methanolysis of J. curcas progressed faster than ethanolysis. Methanol added to oil (molar ratio 4:1) at 8 hourly intervals resulted in 87.7 %wt methyl ester content at 24 h. They conclude that cross-linked immobilized lipase can be used repeatedly with 90 % initial lipase activity and was retained after 13 cycles. The study showed that immobilized lipase from A. niger ATCC 1015 obviates the need for labour intensive and costly purification steps involved in the application of enzyme for biodiesel production.

The fifth paper is the report on *Investigating the Effects of Contaminants on the performance of Oil Based Invert Emulsion Drilling Fluid* by Yomi Kumapayi i[8] and others. The study takes off from the premise that drilling fluid optimization is the main focus while drilling, and that this entails ensuring the fluid is at its right condition downhole at all time during drilling operation. They explain that the composition, including all additives added to the fluid must key into achieving the foremost goal of fluid optimization. Maintaining the integrity of drilling fluids downhole has become herculean especially at HTHP conditions. The possibility of fluid contamination at such prevalent downhole condition, they observe, poses another major challenge to the fate of the drilling fluid.

The study was therefore undertaken to investigate the effect of clay and sea water (containing calcium and magnesium ions) contaminations on the rheology of the oil based invert emulsion fluid. Barite (Ba_2SO_4) was used as the weighting agent; the based fluid used for the oil based invert emulsion system was EDC-99, a specialized kind different from the conventional diesel oil. The fluid were analysed before and after aging using, rheometer, filtration and emulsion stability tests.

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From the experimental result, they discovered that addition of contaminants lowered the electrical stability of the invert emulsion fluid. Fluid loss, Plastic viscosity, yield point and gel strength increased in the presence of contaminants. Only the plastic viscosity of the invert emulsion fluid was slightly out of API range for each set of contaminations, but this, they assert, is still within the tolerance limit of an invert emulsion fluid with a S.G less than 1.6[9][1]. They conclude that fluid Rheology stabilization after HT aging indicate the suitability of the fluid to be employed for downhole HTHP drilling that may take longer time.

The sixth paper - *Reduction of Formation Damage and Fluid Loss using Nano-sized Silica Drilling Fluids* is based on a research by Adel M. Salem Ragab[10], and Ahmed Noah[11]. They start by reemphasizing the fact that drilling fluid is an important part of the drilling process and assert that all drilling fluid must have common specifications that enable safe and satisfactory completion of the well. The key challenge in developing a water-based fluid for such operations in their view has been to maintain the stability of key fluid properties such as rheology and fluid loss at higher temperatures. They observe that drilling Fluid represents up to one fifth (15 to 18%) of the total cost of well petroleum drilling.

The main objective of the research work is to reduce the formation damage due to drilling operation by investigating the fluid loss characteristics of water-based mud when nanoparticles are used as fluid loss additives. They used three different sizes of silica nanoparticles in conducting the experiment in order to determine the nanoparticles size range that yields the minimum filtrate loss. They conducted further experiments on the best nanoparticle size by studying the relationship between the filtrate volume and nanoparticle concentration to reach the concentration that provides the most filtrate volume reduction at the lowest possible cost. They also studied the changes in rheological properties of the mud along with the fluid loss values, and performed an overall evaluation of drilling fluid technology. The rheological properties and the API filtrate losses of laboratory-prepared water based mud results are presented in the paper, and comparative analysis of the fluid loss reduction was conducted on silica nanoparticles as fluid loss additive with an industry standard polymer-based fluid loss additive.

The research finding was that the optimum size of nanoparticles was 5-15 nm (size 1). They conclude that the most economic and yet effective concentration of nanoparticles is the range between 20% and 30% wt./vol., which lead to a 56% reduction in fluid loss in comparison with the base fluid.

The seventh paper by Babangida Jibrin[12] is an investigation of Seismic evidences of fluid accumulation and migration with insights from the deepwater Niger Delta. Babangida used 3D seismic data acquired in the deepwater Niger Delta to investigate potential links between seabed manifestation of fluid flow, potential sources of the

[9] Taugbol, K, Gurnar, F Prebersen, O.I, Kaare, S, Omland, T.H, Svela, P.E, Breivik, D.H. 2005. Development and field testing of a unique high temperature and high pressure (HTHP) Oil based drilling fluid with minimum rheological properties and maximum sag stability. Paper SPE- 96285 presented at the Offshore Europe, Aberdeen, 6-9 September, 2005

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fluids and migration conduits. He explains that the seabed consists of numerous bathymetric ridges, submarine canyons and fluid-venting structures with morphologies similar to pockmarks. He also states that an ENE-WSW trending arcuate bathymetric ridge divides the seabed topography of the studied area in the deepwater Niger Delta into northern and southern domains. The main geomorphic features in the former, according to him, are fluid-venting structures clustered along and within canyons, but also within bathymetric ridges and grooves and in isolation in the latter. His analysis of sub-seabed structures using seismic attribute data computed to highlight discontinuities reveals a strong link between pockmark craters along canyon margins with vertical and lateral migration of fluids along discontinuities and damage zones next to faults in two locations. He concludes that these areas are clearly linked to strong but localized seismic amplitude anomalies most likely representing hydrocarbon-water interface in the hanging wall and footwall folds.

Finally, in the Book Review section, Dr. Layi Fatona reviews the book **Geology of Nigeria's Sedimentary Basins** by Professor C. S. Nwajide[13]. The 565 page book was first published in 2013 by CSS Bookshops Limited, Lagos, Nigeria. Fatona's verdict on the book is that "It is simply the most comprehensive single reference document on the Geology of Nigeria's Sedimentary Basins from the Chad Basin, Benue Trough, Bida Basin, Iullemmeden Basin, Dahomey Basin, Anambra Basin, Niger Delta Basin, Onshore to the Deep Offshore provinces." He concludes that "The many years of Dr. C. N. Nwajide's petroleum industry collections and knowledge are laid bare for everyone…, every Geologist or earth scientist, will have his or her full cup of coffee or tea in this elaborate book…"

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