



Editor's Comment

This is the eleventh issue of Petroleum Technology Development Journal (PTDJ) and it contains seven articles and a note. The first paper is on *Delineation of Soil Corrosivity Regimes along Petroleum Pipeline Routes in the Geomorphic Zones of the Niger Delta using 2D Resistivity Tomography*¹. The authors conducted resistivity survey along petroleum pipeline routes in the Niger Delta area of Nigeria to establish soil corrosivity regimes in the different geomorphic zones of the area. They employed the Schlumberger electrode array for data acquisition. Thereafter, they carried out optimization of measured field data and calculated apparent resistivity data and analyses of the resistivity data using RES2DINV software and this revealed a variation in soil corrosivity. Soils were classed with resistivity values between 70 and 125 Ωm within the top 13m in the Meander Belt as “mildly corrosive”, while soil resistivity values between 16 and 24 Ωm within the top 26m in the Beach Ridges were classed as “corrosive”. The authors considered resistivity values less than 5 Ωm at a depth of 140m in the Low-lying Flood Plains as “very corrosive”, while soil resistivity values up to 9500 Ωm in the Coastal Plain Sands were said to be “non-corrosive” and resistivity value less than 10 Ωm within the top 24m in the Mangrove Swamp were categorized as “very corrosive”.

Their conclusion is that

“corrosivity regimes, which are in accordance with published benchmarks, are indicative of the fact that steel pipelines should be buried at depths below these very corrosive zones so as to mitigate the effects of corrosion and prolong the lifespan of such pipe-works.”

The results of their findings will be useful in determining the selection of the different types of coatings appropriate for new pipelines and suitable for the reconditioning of old pipelines in the different geomorphic zones.

The second paper on *Development of Seismic Survey Technology in Nigeria Oil Industry and the Volume of Seismic Acquisition 1997 – 2014*² presents an account of the development of seismic activities in Nigeria. The authors explain that two dimensional (2D) seismic exploration for hydrocarbons started in 1937 and concentrated in the south-eastern part of the country. This, they explain, increased with the discovery of oil in commercial quantity at Oloibiri in 1956, and the first offshore and onshore 3D seismic surveys took place in 1984 and 1986 respectively, they further explain. The first 4D seismic was not conducted until 2001, and this they say was conducted at the Nembe swamp with a shooting pattern that varied first from the brick wall to checker board while the recording equipment increased in sophistication from Sercel 368 to Sercel 428 XL capable of recording 10000 channels. From 1997 the Nigerian National Petroleum Corporation documented the volume of seismic acquisition and processing/reprocessing activities. The authors noted that 3D acquisition varied between 17,457 km^2 and less than 4000 km^2 between 1997 and 2012, and that the same period saw a significant reduction in 2D acquisition, while the volume of 3D seismic data processed/reprocessed was about 10,000 km^2 per year between 1997 and 2012.

¹ By G. I. Alaminokuma, J. Osokpor, J. E. Emudianughe and T. Warmate.

² By C. L. Eze, and J. I. Okeke,

They conclude that the increase in the volume and sophistication of seismic survey in Nigeria has contributed to the reduction of uncertainty in the whole exploration process and the boosting of the country's oil reserve.

The paper on "*A New Demulsifier Formulation for Crude Oil Emulsions Treatment*"³ is based on a research that involved formulation of an emulsion breaking chemical or demulsifier from locally obtained materials. The authors carried out the investigation to ascertain its effectiveness in breaking crude oil emulsion. Materials used included locally made liquid soap, starch, camphor, alum, castor oil, and distilled water. Two different demulsifier formulations were made and tested on a crude oil emulsion sample from a Niger Delta field (Oredo Field) and subjected to a temperature of 60°F. A foreign demulsifier, Separol, of the same quantity and under the same experimental condition, served as a basis for comparison (control). The result of the treatment was a successful separation of oil and water using formulated demulsifier. The separated water volume by the local demulsifier (LDP1) was found to be 31ml, while that separated by Separol was 6ml.

The authors conclude that this result shows that locally formulated demulsifier has a better water separation capability than the imported and commercially available demulsifier (Separol)

In "*Electrical Properties Correlations for The Niger Delta Depobelts*" the authors⁴ used computer simulator (Cross Correlation Expert), data on formation resistivity factor at different depths for five depobelts out of the six depobelts in the Niger Delta.⁵ They also, used an empirical correlation chart, to compare the cementation factors of the five depobelts. The Deep Offshore Depobelt was excluded in this study. They observe that there was no correspondence in formation resistivity factor between the Northern, the Greater Ughelli and the Central Swamp depobelts. There was 20 percent correspondence between the Central Swamp and Coastal Swamp depobelts, and a 23 percent correspondence between the Coastal Swamp and Offshore depobelts. The results also confirmed the chronological sequence of deposition in the depobelts.

From the comparison of cementation factors of five depobelts, they also observed that the formations in the Niger Delta are generally slightly cemented, which confirms the unconsolidated nature of Niger Delta sands.

The paper on *Effect of Heat Treatment on the Microhardness and Wear resistance of electroless Ni-P/Ni-W-P duplex coatings*⁶ is a study of electroless nickel based alloy deposition as an alternative to hard chromium and nickel-boron coating due to its superior hardness and outstanding wear resistance in abrasive environment. Its other qualities, as the paper explains, are its better readily enhanced properties and uniform thickness as well as its excellent corrosion and wear resistance at relatively high temperatures. Its composition and post deposition heat treatment the paper further argues are vital to the desired performance and the ultimate usefulness of this alloy coating. The study reveals the inherent and enhanced mechanical properties that composition and heat treatment have on multi-alloy, and that duplex

³ Paul Ebikapowei Pimeh and Kelani Olafihon Bello

⁴ Oscar I. O. Ogali, Julius O. Otiko, Wilfred C. Okologume

⁵ The six depobelts are Northern Depobelt, Greater Ughelli Depobelt, Central Swamp Depobelt, Coastal Swamp Depobelt, Offshore Depobelt and Deep Offshore Depobelt

⁶ By Oloyede Olamilekan R, Zhu Liu, and Hong Liu

nickel based coating has on mild steel substrate. The coating is described as a supersaturated alloy in its as-plated state which becomes strengthened as a result of controlled moderate annealing by precipitation of nickel phosphide crystallites which effectually enhanced its overall mechanical properties within a specified heat treatment temperature range. The authors observe that the entire mechanical properties of this coating decrease with excessive heat treatment above 450 °C due to grain coarsening, with the results showing that the optimum wear resistance of Ni-W-1.5% P and Ni-W-9.5%P coatings correspond to peak hardness at 350 °C to 450 °C respectively after one hour annealing in argon environment.

In *Log Quality Assessment for Forward Seismic Modelling Calibrated on the Buntsandstein Reservoirs, Southern North Sea, Offshore Netherlands*,⁷ a field study on the application of well data analysis based on well logs and core measurements in finding the best logging parameters, for the purpose of a further seismic-to-simulation modelling of a real field exploration data set in the effort to improve the reservoir quality of the field, is presented.

The paper posits that interpretation of the Buntsandstein gas reservoirs in the Southern North Sea suffers from the effect of the presence of solids within the reservoirs pore spaces, posing serious exploration challenge. Forward seismic modelling needed to be carried out in order to predict the subtle difference(s) between these pore fills. Firstly, the consistency between the different logs and core data had to be verified, and the approach adopted was carrying out analysis of the log responses of 13 wells on both the medium and acoustic properties at depths, and qualitatively and statistically studying the consistencies or otherwise of the logs requisite for the modelling. This involved log quality control, log correlation, evaluation of density Logs and cross-plots analyses. Results of these analyses show good consistency between the bulk density and the core density logs, implying that both of these logs may be utilized in the seismic modelling. However, the paper recommends that the calibrated bulk density logs should be chosen in the proposed synthetic-to-seismic calibrations with the appropriate data quality control. The use of the core log it concludes posed limitation in that the logs did not run through the reservoir intervals in all the wells.

The paper on *Fast Pyrolysis of Nigeria Danta Hardwood (Nesogordonia papaverifera.) and Obeche Softwood (Triplochiton scleroxylon) Sawdust*,⁸ presents the use of a fixed bed fast pyrolysis system for the conversion of indigenous wood species, hardwood and softwood, from sawmill residues to bio-oil. According to the authors, the hardwood produced slightly more liquid product than the softwood although both wood species yielded similar amounts of bio-char of 31 wt%. The bio-oil yield for hardwood was 48.1 wt% compared to 45.8 wt% for the softwood. FTIR spectrometric scan of the liquid products detected nineteen different functional groups in both hardwood and softwood bio-oils. They see this as indicative of similar chemical species in bio-oils produced from wood sources. The softwood was found to contain slightly more phenolic and alcoholic compounds than the hardwood and this, they say could explain the slightly higher values of viscosity and density of softwood bio-oil than hardwood bio-oil. The density and viscosity of softwood are 1082 kg/m³ and 2 cst respectively compared to 1074 kg/m³ and 1.3 cst for hardwood. Also, 28 of the chemical species found in the bio-oil were also present in fossil diesel suggesting a possibility of blending bio-oil with conventional diesel.

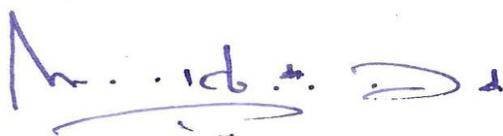
⁷ Auduson, Aaron E. and K. Mosto Onuoha

⁸ Ayoade Kuye, Julius C. Ahiekpor, Osei-Wusu Achaw

The recent commencement of commercial production of oil in Aje Field offshore Lagos State is the subject of the paper on Aje Field and Petroleum Discovery in Lagos State Nigeria⁹. The paper traces the history of search for bitumen, oil and gas in the Lagos area from early 20th century to the announcement of the eventual commercial production of oil in Lagos State on the 3 of May 2016. It chronicles the growth of OPL 309 from a rank, undrilled, frontier asset to a producing OML 113 acreage. It then explains the geological data and formation of the area and predicts potentials for the discovery of sizable oil and gas reserves in the area. The notes that though the commercial production of oil in Aje Field is a breakthrough in efforts to encourage local indigenous companies and personnel to be actively involved in the upstream sector of the petroleum industry, not much has been achieved in terms of local capacity building and petroleum technology transfer or development, as virtually all of the technical work was done and is still being done by the foreign partners and their expatriate staff. The paper cautions the federal and Lagos State governments, as well as the oil producing companies involved in the prospecting, exploration and production of petroleum in the area against both the economic and environmental mistakes associated with the discovery and production of petroleum in the Niger Delta region of Nigeria. OML 113 has prospects for the discovery of large petroleum reserves. The authors predict that if the indigenous operator of the Oil Mining Lease pays great attention to indigenous capacity building and petroleum technology acquisition and development, the company will grow to become an international company with operations in other African countries in the next twenty-five years.

The objective of the note *Dioxins in the Environment: A Critical Review*¹⁰ is to review the health effects and environmental risks of dioxins, which are persistent organic pollutants (POPs) present in the environment occurring naturally and as by-products of combustion and of various industrial processes. The review explains the nature of dioxins, how they are generated, highlighting particularly the environmental implications of constant exposure to these harmful substances and introducing pollution prevention/management strategies that will help promote public awareness.

We are grateful to the authors of these articles, our technical advisers and the anonymous paper assessors for their invaluable contribution to the publication of this issue and their sustained interest in the journal.



Momodu Kassim-Momodu
Editor and Chairman Editorial Board

Aje Field and Petroleum Discovery in Lagos State Nigeria

⁹ Momodu Kassim-Momodu and Toyin Akinosho

¹⁰ By K.I. Idehen, G. Obi