

SUMMARY OF CONTENT

There are five papers in this seventeenth issue of Petroleum Technology Development Journal. In the first paper with the title *Synthesis and characterization of carbon nanotubes over binary Fe-Co- CaCO₃ Catalyst*¹, the authors investigated the influence of synthesis parameters such as mass of support, drying temperature and drying time on the yield of Fe-Co/CaCO₃ catalyst prepared by the wet impregnation method using 2³ factorial design of experiment. The suitability of the produced catalyst for the production of carbon nanotubes in a catalytic vapour deposition method was also investigated. Results obtained indicated that highest yield of 95.71 % of the catalyst after calcination was obtained at the synthesis conditions of 10g of catalyst, drying temperature of 120°C and drying time of 12 hours. Particle size analysis of the catalyst revealed that the catalyst sizes are in the ranges of 96.6-10.9 nm, with specific surface area of 3.904m²/g while the HRTEM analysis shows that the catalyst is highly crystalline and well dispersed without agglomeration. Results of the characterization conducted on the carbon nanotubes produced shows that the carbon nanotubes produced is a multiwall carbon nanotube. The TGA analysis revealed that the multiwalled carbon nanotubes produced is thermally stable. While the XRD shows characteristic of graphene layers that make up the tube walls at 2θ values of 25.8736° and 44.6584 °. TEM and SEM/EDS images exhibit a clearly defined multiwall concentric tubular morphology, with 92.29 wt % C with inner diameter of 16 nm. The MWCNTs had aspect ratio of 265 with length of 4.8 μm and specific surface area of 274.06 m²/g and pore volume of 62.97 cm³ g⁻¹. Authors conclude that it can be inferred from the various analysis conducted that the developed catalyst is suitable for multiwalled carbon nanotubes in a catalytic vapour deposition reactor.

The second article on *Application of K-Means Clustering for Hydrocarbon Reservoir Delineation and Reservoir Parameter Estimation*² demonstrate how the K-means clustering algorithm was integrated with well logs to build a machine learning model for delineating hydrocarbon-bearing zones of conventional reservoirs and estimating reservoir parameters from well logs. The well log data used for training the model were loaded and necessary clean up processes were performed which entail the handling of missing values and the removal of outliers, and some exploratory data analyses (EDA) were carried out including the plotting of numerical distributions, followed by feature selection and scaling. All the aforementioned steps were taken in order to transform the well logs to a format suitable for the K-means algorithm. After the data transformation phase, the K-means algorithm was applied on the well logs to develop a machine learning clustering model that grouped depth points together based on the similarity of their log values. The clusters generated from the clustering process were evaluated to determine the one that consistently and accurately predict the hydrocarbon reservoirs in the wells. Some equations, such as Archie's water saturation equation, were incorporated so that reservoir parameters could be estimated by the program. The model, when tested on three wells, delineated about twelve zones as potential hydrocarbon-bearing zones. These zones were manually interpreted to assess the accuracy of the model and it was found that its precision in delineating the hydrocarbon reservoirs was high. The authors suggest that the significance of the research study is that the model developed can be used to automate the task of delineating hydrocarbon reservoirs from well logs.

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² Abe S. James, Makanjuola David R.

The third article *Adoption of Gas to Liquid (GTL) Conversion Technology as a Solution to Gas Flaring in Nigeria*,³ the author asserts that the underutilization of gases, which has contributed to global warming, led to the modelling of an advanced refinery process of gas to liquids (GTL) conversion. She explains that GTL with a condensation point of 100°C and above is used in the conversion of natural gas and other associated hydrocarbons that are found in gaseous state into a longer chain hydrocarbon. This longer chain hydrocarbon according to her, includes high energy density such as residual oil, diesel fuel or gasoline. GTL according to her, is used in the production of liquid fuels, which are easily and readily conveyed when compared to methane, and that for methane to be liquidities under pressure, it must be cooled at a critical temperature of -82.3°C. Exceptionally, GTL diesel is sulphur-free with extreme cetane number that ranges from 75 – 80, and it is absolutely clean. As of 2010, Nigeria had a proven natural gas reserve of 185 trillion cubic feet (Tcf), which ranked Nigeria as the largest proven reserve country globally. On the contrary, Nigeria has contributed to the global flaring of natural gas with about 11% in 2010 as reported by the Nigeria National Petroleum Corporation (NNPC), which resulted to the loss of billions of dollars in revenue. The paper identifies the prospective opportunities associated with GTL technology in Nigeria. The author observes that GTL has an unlimited market, which renders innovative/attractive options to accessing the proven gas reserves. This in the author's opinion will further commercialize the flared gases, thereby reducing and possibly eliminating gas flaring in Nigeria.

The aim of the fourth paper with the title *Fulfilment of Social Contract as Panacea for Conflict Over Natural Resources in Nigeria: An Analysis*⁴ is to take a turn from existing predications, to assert that conflicts over natural resources arise from the failure of fulfilment of social contract and the lack of resource governance. The authors explain that every possesses one form of Natural Resources, or the other be it land, water, mineral oil, ore, gold, diamond etc, and that history bears record of nations, states, communities, and the peoples who inhabit such country having battled to a point of fatality over natural resources. They observe that in Nigeria, agitations within the Niger-Delta Region over the oil resources in the region has drawn international attention particularly when viewed along the line of the provisions of United Nations Resolution 1803 of 1962 that recognizes Permanent Sovereignty Over Natural Resources, and the Nigerian Constitution and other laws that vests mineral resources in the government of the Federation. The authors concede that while it is settled that there is a link between natural resources and conflicts, some writers have predicated the conflict on some particular theories, especially the Malthusian theory of scarcity, perhaps on the notion that conflict over natural resources is as a result of scarcity. Adopting the doctrinal methodology, the study used the Hobbesian concept of social contract theory and its analysis of man in a state of nature from his text titled 'Leviathan' to jurisprudentially analyse the cause of the present-day conflicts over natural resources. Relevant statutory and judicial authorities were appraised to consider an attempt at resolution. This study paid particular attention to conflicts over natural resources within Nigeria in view of oil in Niger Delta and the link between social contract and the said conflict. The authors say they found out that man's quest for self-preservation is what generally leads to conflict, while the social contract existing between the sovereign and the citizens, if sufficiently pursued in terms of the obligations it places on the sovereign, would eliminate conflict over natural resources. The paper recommends amongst other things, the vigorous pursuit of the substantial meeting of the obligations created under the social contract.

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⁴ Bello Ajibola and Prof. Muktar A. Mohammed

The fifth paper on *Determination of Optimum Conditions for the Production of Biodiesel from Gmelina arborea Seed Oil and Shea Butter Using Zeolite as Heterogeneous Catalyst*⁵ aimed to optimize the operating variables such as the effect of different zeolites, various concentrations of KOH support loaded during activation of zeolite, heterogeneous, and homogenous catalysts. Heterogeneous catalyst concentration (5wt % to oil mass), temperature (70°C), reaction time (7 h), and reaction speed (600rpm) were all fixed during the reaction while for homogenous catalyst NaOH concentration used was (1wt % to oil mass) and reaction time was one hour, mixing intensity and temperature condition were the same for zeolite. The authors synthesized Biodiesel by transesterification of Gmelina arborea seed oil and Shea butter with methanol using KOH/Zeolite and NaOH. Biodiesel from both Shea butter and Gmelina arborea seed oil, they noted, has high flash points, high cetane numbers, and low viscosity. Gmelina arborea seed oil as a non-food feedstock was transformed into biodiesel with a high yield of 89.4 % and the same conditions applied to Shea butter oil with a high yield of 95.8 %. They report that both biodiesels have good fuel parameters, and the biodiesel produced from fresh zeolite gave the highest flash point, lowest viscosity for Gmelina arborea oil methyl esters, and high cetane number and low viscosity for Shea butter methyl esters.

⁵ Alkairu Hassan, Abdulrahman A. Audu, Bishir Usman, Ahmed A. Aliyu, Dini Sabo, Said H. Musa, Daniel Eric, and Adam S. Alhassan