Effect of Heat Treatment on Corrosion Resistance of Mild Steel

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The corrosion behavior of heat treated mild steel in 0.1 M citric acid was studied using weight loss technique. Mild steel samples were heated at 650 and 950 °C for 30, 60 and 90 min. The effect of heat treatment time and methods of cooling (normalizing, quenching and stress relief) on the corrosion resistance of mild steel in 0.1 M citric acid solution was also studied. The experimental results showed that the corrosion rates of the heat treated mild steel increased with time of heating irrespective of the cooling method used. The corrosion rates of samples treated at 650 °C and 950 °C at 30 and 90 min, respectively decreased with increase in weight loss. Also, the corrosion rate of mild steel treated at 950 °C (normalizing and quenching) for 30 min were higher than those treated at 650 °C (normalizing and quenching) for 30 min. However, the samples cooled using stress relief method at 650 °C showed higher corrosion rates compared to that at 950 °C. The corrosion rates of mild steel treated at 650 °C for 90 min, exhibited lower corrosion rate than those treated at 950 °C for 90 min. In general, mild steels heat treated at 650 °C using normalized method showed lowest corrosion rates compared to the other cooling methods used. Also, heat treated at 950 °C using stress relief showed lowest corrosion rate compared to the other cooling methods used.

Keywords: Corrosion, Heat treatment, Mild steel, Organic acid.
This study presents the Run Octane Number (RON) analysis of gasoline obtained from catalytic cracking of \( n \)-hexadecane using composite fluid catalytic cracking catalyst. Composite FCC catalyst was formulated using as-synthesized zeolite Y and ZSM-5 anchored on support matrix made of activated alumina, metakaolin and silica sol. The as-prepared catalyst was characterized using X-ray diffraction, the composite catalyst performance at 400, 500 and 550 °C were 53.07, 73.17 and 88.85 %, respectively. The gasoline produced at 400 °C had paraffinic content of 53 %, olefin and aromatic content of 47 %. The gasoline produced at 500 °C had paraffinic content of 39 % olefin and aromatic content of 43 % while the gasoline produced at 550 °C had paraffinic content of 36 % olefin and aromatic content of 44 %. The gasoline obtained at 400 °C had the least RON value of 51.47 % whereas those obtained at 500 and 550 °C had RON values of 85.39 and 87.38 %, respectively. This study has shown that the optimum operating temperature was 500 °C and incorporation of ZSM-5 in FCC catalyst formulation improved the catalyst performance.

Keywords: Zeolite Y, ZSM-5, Fluid catalytic cracking catalyst, Catalytic cracking, Catalytic performance, Run octane number.
Effect of Fibre Hybridization on Dynamic Mechanical Performance of Bagasse/Glass Fibre Hybrid Reinforced Epoxy Composite

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The dynamic mechanical analysis of sugarcane bagasse/glass fibre hybrid reinforced epoxy composite was investigated and compared with all glass reinforced counterpart. Bagasse fibre mats were produced and non-woven glass fibre mats obtained locally were used to produce the composites laminates at 45% volume fraction at different layering arrangement using the compression moulding technique. The storage modulus ($E'$), loss modulus ($E''$) and the mechanical damping factor ($\tan \delta$) of the composite were analysed at 1 Hz over heating temperature of between 33 to 200 °C at 2 °C/min heating rate. Results showed that the hybridization reduced the storage modulus and the damping factor irrespective of layering sequence. Also, hybridization shifted the glass temperature ($T_g$) slightly to a higher temperature, and glass reinforced composite had the highest storage modulus value of 8GPa whereas all bagasse reinforced composite exhibited the highest damping factor of $4.74 \times 10^{-1}$.

Keywords: Storage modulus, Loss modulus, Composite, Dynamic mechanical analysis.
Development and Characterization of Triethanolamine Functionalized Coconut Shell Activated Carbon for Carbon Dioxide Adsorption

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This study provide an insight into the potential of amine functionalized coconut shell activated carbon for carbon dioxide adsorption and storage. The coconut shell was carbonized (CAC) and chemically activated with KOH. The prepared CAC was further functionalized with triethanol-amine (TCAC). The activated carbons were characterized for its crystallinity, functional group and surface area using X-ray diffraction, Raman spectroscopy and Brunauer-Emmett-Teller theory, respectively before and after carbon dioxide adsorption. The effect of temperatures (40, 50 and 60 ºC) on the rate of CO₂ adsorption as a function of time was also investigated. The adsorption capacity of CAC and TCAC were found to be 51 and 62 mg/g, respectively. The results characterization before and after CO₂ absorption revealed that the alteration of the structural and function group that favour formation of ammonium bicarbonate and carbonate. This study demonstrates that triethanolamine functionalized coconut activated carbon is a promising adsorbent for CO₂ sequestration and storage.

Keywords: Adsorption, Activated carbon, Carbon dioxide, Triethanolamine, Coconut.
Corrosion Studies of Mild Steel in Organic Acid/Chloride Media

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This study investigated the corrosion behaviour of mild steel immersed in 0.5 M organic acid media and in 90%/10% 0.5 M organic acid media/3.5 % NaCl by surface observation and weight loss technique. In all the solutions (0.5 M organic acid and the organic acid containing 3.5 % NaCl), mild steel corroded more in acetic acid compared to other solutions, while NaCl was lowest. The corrosion rate of mild steel immersed in 90 % organic acid contaminated with 10 % of 3.5 % NaCl was lower than that found when the steel samples were immersed in 100 % organic acid. It can be suggested that there was lack of Cl⁻ ions which could break down passive films on the mild steel surface to accelerate corrosion. Scanning electron microscope (SEM) was used to examine and characterize the mild steel surface before and after its immersion in the respective media. The elemental composition on the corroded surface of mild steel was detected with the SEM coupled with electron dispersive spectroscopy. The SEM and the physical observation results showed corrosion products, which were confirmed to be oxide films on the surface of the mild steel studied in 100 % organic acid solutions. Meanwhile, morphology of the mild steel after corrosion in organic acids containing NaCl showed that the corrosion products were protective oxide films. The oxides of Fe, Mn, Na, and Si were mostly detected on the surface of mild steel after corrosion.

Keywords: Chloride, Corrosion, Organic acid, Mild steel.
Producing AA1170 Based Silicon Carbide Particulate Composite through Stir Casting Method

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Metal matrix composites (MMCs) with improved thermal conductivity, abrasion resistance, tribology, creep resistance, dimensional stability, good stiffness-to-weight and strength-to-weight ratio have many application in the aerospace, automobile, mechatronics components (such as sensor) and other engineering outfits. In the present work, the aim is to develop aluminum (AA1170) based silicon carbide particulate metal matrix composites with an objective to develop a conventional low-cost method of producing MMC’s and to obtain homogenous dispersion of silicon carbide. To achieve these objectives two step-mixing methods of stir casting technique has been used. AA1170 and SiC (3, 9, 29 and 45 µm grit sizes) have been chosen as matrix and reinforcement materials, respectively. Experiments have been conducted by varying weight fraction of SiC (2.5, 5.0, 7.5 and 10 %). The results indicated that the stir casting method is quite successful in obtaining uniform dispersion of reinforcement in the matrix. Measured properties of aluminium silicon carbide (composite) showed increase in young's modulus (E) and hardness above the unreinforced aluminium, however, there was marginal reduction of electrical conductivity in the composite.

Keywords: Aluminium, Metal matrix composites, Silicon carbide, Stir casting, Mechanical properties.
Fixed-Bed Biosorptive Removal of Metanil Yellow from Simulated Wastewater by Hen Egg Membrane

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The ability of hen egg membrane which is an agricultural waste used to remove metanil yellow, a toxic dye from simulated wastewater, in a fixed-bed column was investigated. The effects of varying influent dye concentration ($C_0$), adsorbent mass ($m$) and flow rate ($Q$), at pH 3 and temperature 29 °C on biosorption capacity ($q_e$) of the membrane were investigated. Experimental data were modelled with Langmuir, Freundlich and Temkin isotherm as well as Thomas, Yoon-Nelson and Clark kinetic models. Results show that biosorption capacity, increased with increase in dye concentration, increase in flow rate and decrease in adsorbent mass. Saturation of the biosorbent could not be reached in 8 h, $C_0$ 100 mg/g, $m$ 2g and $Q$ 15 mL/min were optimum. Analysis of experimental data with Langmuir, Freundlich and Temkin, as well as Thomas, Yoon-Nelson and Clark models, showed them to be good fits based on correlation coefficient values, $R^2$, which were generally above 0.9. This study shows hen egg membrane to be a potential biosorbent for treating anionic - dye polluted wastewaters.

Keywords: Biosorption capacity, Egg membrane, Fixed-bed column, Kinetic models, Metanil yellow.
Lignin Isolation from Coconut Coir with Variation of Time and Concentration of NaOH in Process of Alkaline Delignification

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Coconut coir is a solid waste coconuts that contain lignin to be used as raw material for various chemical industries. Lignin is taken by alkaline delignification stage and continued with the isolation of lignin using acidification. The process of alkaline delignification coco using NaOH solution with varying concentration of 15-35 % and processing time 60-150 min. Phase of lignin isolation using 20 % H$_2$SO$_4$ solution followed by a purification process. Analysis result of lignin using Klason method obtained the highest yields of 37.16 % by using 25 % NaOH and processing time of 120 min.

**Keywords:** Alkaline delignification, Coconut coir, Lignin.