Joint Seminar on Microalgae Biotechnology for Fuels, Chemicals and Material Synthesis

The Center of Research Excellence in Nanotechnology in collaboration with Department of Chemical Engineering organized a joint seminar on "Microalgae biotechnology for fuel, chemicals and material synthesis" presented by Dr. Wasif Farooq, an Assistant Professor at the Department of Chemical Engineering, King Fahd University of Petroleum & Minerals, on April 17, 2017. The seminar was attended by CENT personnel, faculty, students and staff from... {details on page 2}

FEATURED ARTICLE

Conversion of Dimethyl Ether to Olefins over Nanosized Mordenite Fabricated by a Combined High-Energy Ball Milling with Recrystallization

This article has been selected as a highlight and depicted on the cover of the most recent issue of Industrial & Engineering Chemical Research. The issue can be viewed at: http://pubs.acs.org/toc/iecred/56/17.
The Center of Research Excellence in Nanotechnology in collaboration with Department of Chemical Engineering organized a joint seminar on microalgae biotechnology for the synthesis of fuels, chemicals and material presented by Dr. Wasif Farooq, an Assistant Professor in the Department of Chemical Engineering, King Fahd University of Petroleum & Minerals, on April 17, 2017.

The event was attended by CENT personnel and faculty, students and staff of the Department of Chemical engineering. The speaker gave an introduction to the topic and emphasized the potential of microalgae, a biological cell factory to produce oil that can be utilized for transportation, and produce chemical for cosmetics, food, and medicine for humans and animals. He highlighted the advantages of the microalgae biorefinery concept over other techniques which include the ability to capture CO₂ from the atmosphere and fight global warming. He further explained the absorption and uptake of CO₂ by microalgae and how the technique can be integrated with other CO₂ capture and sequestration techniques.

The complete microalgae production chain including harvesting, catalysis, separation, and purification was also described and the potential research avenues in each area were highlighted. The speaker described how microalgae can be cultivated in waste water to reduce the cost of cultivation and identified harvesting from dilute water cultures and low light penetration as the main bottlenecks against commercialization. Finally, the speaker emphasized on new research trends including on the potential use of magnetic nanoparticles to improve oil recovery from microalgae without harming the algae.
**Abstract**

Fabrication of cost-effective catalysts is one of the key strategies to monetize natural gas derivatives such as dimethyl ether to olefins. In this study, the particle size of natural mordenite (MOR) was reduced into micro- and nanosize by high-energy ball milling with variation in milling time. The selected milled MOR was recrystallized using a silicate solution that favored the growth of the mordenite phase to recover the demolished mordenite structure. The mesopore volume and external surface area were increased significantly after milling and remained large even after recrystallization. A high conversion of dimethyl ether was obtained over the recrystallized MOR (99.7%) and milled natural MOR (54.1%) as compared to the parent (1.2%). Moreover, the milling-only and the milling–recrystallization processes improved the selectivity toward olefins and prolonged the catalyst lifetime. The reduced particle size combined with the hierarchical porous structure and acidity effectively enhanced the activity and selectivity of the catalysts to olefins.
Muhammad Mansha of Department of Chemistry

Dissertation title: Design, Synthesis and Evaluation of 1,3 diaryl pyrazoles as inhibitors of GGTase-1, a target for anti-cancer drugs

Dissertation Abstract
In his study, a series of pyrazole-based GGTIs, structural analogues of GGTI-DU40, 2-16 have been synthesized and biologically evaluated for their GGTas-I and farnesytransferase (FTase) inhibition. The screening results revealed that 2 (IC50= 2.4 µM) and 5 (IC50 = 3.1 µM) are potent inhibitors of GGTase-I, possessing higher inhibitory activity compared to the control compound 1 (GGTI-DU40, IC50 = 3.3 µM). The anti-proliferative efficacies against MDA-MB-231 cells line of target compounds demonstrated a significantly higher activity of 2 (IC50 = 7.6 µM) compared to 1 (IC50 = 23.0 µM). The efficiency of the target compounds was further validated by western blot analysis in MDA-MB-231 cell line, which revealed very high inhibitory cellular activity of 2 and 5, demonstrating their capacity to inhibit prenylation of endogenous proteins. Molecular docking studies of 2 with the crystal structure of GGTase-I complexed with a geranylgeranyl pyrophosphate (GGPP) Analog and a CaaX (C = cysteine, aa = aliphatic amino acids, and X = any amino acid) portion of the KKKSKTKCVIL peptide substrate revealed several H-bonding interactions and π-π contacts between 2 and the binding pocket of GGTase-I. Therefore, highly potent in vitro activity of 2 merits its extensive in vivo investigation.

Saheed Adewale Ganiyu of Department of Chemistry

Dissertation Title: Single-Pot Synthesis of Modified SBA-15 NiMo Based Catalysts for Fuel Hydrodesulfurization

Dissertation Abstract
Mesoporous materials have received much attention due to high surface areas, large pore volumes and are of great interest for adsorption, sensing, and catalysis. The present work focuses on novel hydrothermal development, synthesis and characterization of heteroatoms modified SBA-15 NiMo hydrodesulfurization (HDS) catalysts. Structural and textural properties are characterized by extensive characterization techniques such as Raman, X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS), temperature programmed techniques (TPR and TPD), Fourier transformation infrared (FTIR), X-ray fluorescence (XRF), and N2-physiosorption. The morphology and catalysts compositions are availed by field emission scanning electron microscope (FESEM), high resolution transmission electron microscope (HRTEM) and inductively coupled plasma-optically emission spectroscopy (ICP-OES) to examine and determine the morphology, active phase distribution, metal charge and composition. The as-developed catalysts are tested and evaluated on a simulated fuel containing different organosulfur compounds (dibenzothiophene, methyldibenzothiophene, dimethyldibenzothiophene) in a batch reactor.

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CONGRATULATIONS

Congratulations to the following CENT affiliated students on the successful presentation of their MS theses

Mr. Oluwole O. Ajumobi
Chemical Engineering
Thesis Title: Developing Ceria-Based Nanocomposites for Hydrocarbon Cracking

Mr. Amar Kamal
Physics Department
Thesis Title: Synthesis and Modification of Tin Oxide Based Thin Films for Hydrogen Gas Sensing

Mr. Hafiz Khuram
Mechanical Engineering
Thesis Title: Development of Ceramic Nanocomposite Membrane for Water Filtration Application

Mr. Umar Azam
Mechanical Engineering
Thesis Title: Development of Hybrid Nanocomposite Polymer Coatings for Tribological Applications under Dry and Water Lubrication Conditions

Mr. Saheed Lateef
Chemical Engineering
Thesis Title: Development of SSZ-54 Catalyst for the Catalytic Cracking of Alkanes for the Production of Light Olefins

Mr. Ridwan Yusuf
Mechanical Engineering
Thesis Title: Development of Transparent Superhydrophobic and Self cleaning Surfaces

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