

# University of Waterloo

## Department of Chemical Engineering

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#### Seminar

Tuesday, May 21, 2013

2:00PM – E6 4022

“Higher Alcohol Synthesis using K-doped CoRhMoS<sub>2</sub>/MWCNT Catalysts: Influence of pelletization, particle size and incorporation of binders”

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#### Abstract

In this study, alkalized MWCNT supported MoS<sub>2</sub> catalysts have been doubly-promoted with Co and Rh. Catalysts were prepared by the conventional co-impregnated method and stabilized under argon atmosphere. A thorough characterization of the oxidic samples by BET, TEM, and SAXS revealed that the mesoporosity of the pristine MWCNT support was not compromised after loading a combined total of 30 wt% metals (9wt.% K, 4.5wt.% Co, 1.5wt.% Rh, and 15wt.% Mo) on the support; however, a significant decrease in specific surface area was observed. Broad angle XRD analysis confirmed the homogenous dispersion of catalyst metals on the support. Two catalyst grain sizes were first investigated to elucidate the effect of particle size: a finely ground powder (88µm mesh) and a pelletized form (1780µm mesh). Despite the total alcohol yield of 0.261 g/(g cat h) observed by conducting higher alcohol synthesis reaction at T=330°C, P=8.3 MPa, H<sub>2</sub>/CO=1.25, and GHSV=3.6 m<sup>3</sup><sub>STP</sub>/(kg cat/h) for the fine powdered sample, a high pressure drop was recorded in comparison to the pelletized form. Finally, a systematic study of variety of binders was conducted to gain insight of catalyst's applicability for industrial purposes. Three selected binders namely: Bentonite clay, coal tar, and humic acid were thus investigated; taking into consideration significant factors such as melting point and binder requirement per catalyst support.

## **Professor Ajay Kumar Dalai**

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**Professor and Canada Research Chair in Bioenergy and Environmentally Friendly Chemical Processing**

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Dr. Ajay K. Dalai began his career with the University of Saskatchewan in 1996 as Assistant Professor in the Department of Chemical Engineering. He was promoted to Associate Professor in 1998 and to Full Professor in 2002. To date, Dr. Dalai has supervised and co-supervised over 80 M.Sc. and Ph.D. students (including summer students), 24 post-doctoral fellows, and 16 visiting professors. In 2009, Dr. Dalai accepted the position of Associate Dean of Research and Partnerships for the College of Engineering, in addition to his professorship and supervisory role.

Dr. Dalai's remarkable success in research is highly recognized and generously supported through various provincial, federal, and industry funding agencies, including Agriculture and Agri-Food Canada, Saskatchewan Canola Development Commission, the Saskatchewan Mustard Development Commission, Syncrude Canada, Imperial Oil Ltd., Petro-Canada Ltd., Natural Resources Canada, the Natural Sciences and Engineering Research Council, SaskPower and SaskEnergy, the National Research Council, and Nova Chemicals Ltd. In 2001, he was awarded a Tier 2 *Canada Research Chair in Bioenergy and Environmentally Friendly Chemical Processing*, and Tier 1 in 2009. His research focus is the novel catalyst development for gas to liquid (GTL) technologies, biodiesel productions and applications, hydrogen/syngas production from waste materials, hydroprocessing of heavy gas oil, and value-added products from biomass. He is currently working on the production and applications of activated carbon and carbon nanotubes (CNTs). Dr. Dalai is also working on developing environmentally-friendly processing methods for improved, reformulated gasoline, a project for which he was honored with the *Petro-Canada Young Innovator Award*. The worldwide impact of this research is tremendous in terms of combating pollution and finding alternate energy resources, and has generated much interest and collaborative projects with research institutes and universities around the world.

During his years as a researcher, Dr. Dalai has published 250 research papers mostly in heterogeneous catalysis and catalytic processes in international journals and conference proceedings. He has submitted several patent applications. His ground-breaking research in environmentally-friendly processing and the conversion of bio-mass to bio-energy have made him highly sought after as a guest lecturer/speaker at many National and International conferences, Universities, and discussion forums as an expert panel member. His expertise and strategic initiatives in bio-economy have earned him several national and international awards, including the *McMaster University's Brockhouse Institute for Materials Research Distinguished Speaker Award*, the *Institute of Chemical Technology Mumbai Professor R.A. Rajadhyaksha Memorial Lecture Series Award*, the *Indian Chemical Engineering Congress NEERI Distinguished Speaker Award*, the *Kentucky Colonel Award*, and the *Syncrude Owl Award*.

Dr. Dalai is an active board member, reviewer, and guest editor for several international journals. He is a life member of the Indian Institute of Engineers, the Indian Catalysis Society, the American Institute of Chemical Engineers, and an active member of the American Chemical Society and the Chemical Institute of Canada. He is a Fellow of CIC, CAE and EIC. He has served as Chair of Catalysis Division of Chemical Institute of Canada and as Director of Divisions of Canadian Society of Chemical Engineering.