\*Department of Chemical Engineering, IIT Kanpur\*

\*SEMINAR\*

Speaker: Dr. Ajay K. Dalai, Associate Dean, Research and Partnership

Professor & Canada Research Chair in Bioenergy & Environmentally

Friendly Chemical Processing, University of Saskatchewan, Canada

Topic: Frontiers in Catalysis for Meeting Climate Change Issues in

21^st Century

Date: Monday 5^th March 2012

Place:L-4

Time:16:00 to 17:00

\*All are welcome\*

Tea will be served at 15:45 near L-4

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\*Abstract:\*

The crude oil demand is in rise globally with the population and the

conventional oil is in short supply. The demand for efficient processing

of crude oil and novel oil production processes is increasing day by

day. As a result, there is a shift to alternate industrial feedstock and

green processes in this century to produce fuels and chemicals from

renewable biomass resources. The biofuel produced from biomass such as

plants and organic wastes reduces the world's dependency on fossil fuel

and minimizes the fossil fuel burning, CO\_2 production, and global

warming. Additionally, biofuel production along with bio-products

provides new income and employment opportunities to agriculture sector

and in rural areas.

The presentation will include an overview of the petroleum refining and

biofuel refining processes and the cutting edge research needed for the

reduction of green-house gas emissions. The efficient hydro-processing

of gas oils will be highlighted and the performances of a number of

novel catalysts for this process will be presented.

Research related to biodiesel production using homogeneous and

heterogeneous catalysts has been in progress worldwide for the past

decade. The current research is focused on production and analysis of

biodiesel. In the production part, various vegetable oils such as canola

oil, greenseed canola oil, used cooking oil, soybean oil, karanja oil,

and jatropa oil were used as feedstock for trans-esterification with

short-chain alcohols (mainly methanol and ethanol) utilizing both

homogeneous and heterogeneous catalysts. For homogeneous catalysis, H\_2

SO\_4 and KOH are used to catalyze esterification and

trans-esterification, respectively. An ASTM grade biodiesel is achieved

using homogeneous catalysts. Heterogeneous catalysis on

esterification/trans-esterification was studied in response to simplify

biodiesel purification process where the requirement for process water

is drastically reduced. Various heterogeneous solid acid catalysts have

been tested for their activity towards esterification and

trans-esterification of feedstock containing up to 15% free fatty acid

(FFA). This will be discussed in the presentation. The other important

processes include the catalytic conversion of green-house gases such as

methane and carbon dioxide to syngas (a mixture of hydrogen and carbon

monoxide).

Fischer-Tropsch (FT) synthesis is an important process for the

conversion of synthesis gas (derived from farm waste, municipal wastes

and forest residues) to liquid fuels. These fuels are free from sulfur

and nitrogen compounds and are thus quite clean with high octane and

cetane numbers. In this presentation, the effects of novel materials

such as carbon nanotubes on the structure of iron and cobalt catalysts

on Fischer-Tropsch (FT) reaction rates and selectivities to produce

higher hydrocarbons compared to those on available commercial catalysts

will be discussed.\*\*

\*About the Speaker: \*

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

also accepted the position of Associate Dean of Research and

Partnerships for the College of Engineering. 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 novel

catalyst development for gas to liquid technologies, biodiesel

production and applications, hydrogen/syngas production from waste

materials, hydro-processing of heavy gas oil, and value-added products

from biomass. Dr. Dalai has published over 250 research papers in

heterogeneous catalysis and catalytic processes. His expertise and

strategic initiatives in catalysts for bio-economy have earned him

several national and international awards, including 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, Professor Mann Lecture

Series Endowment Lectureship Award from University of Ottawa Department

of Chemical Engineering, the Indian Chemical Engineering Congress NEERI

Distinguished Speaker Award, the Kentucky Colonel Award, the Syncrude

Owl Award, JSPS fellowship from Japan, DAAD fellowship from Germany,

Fulbright Fellowship from USA, and Engineering Institute of Canada (EIC)

fellowship. Dr. Dalai is an active board member, reviewer, and guest

editor for several international journals. He is an active member of the

Chemical Institute of Canada, the Catalysis Division of the CIC, and the

American Chemical Society; a life member of the Indian Institute of

Engineers, the Indian Catalysis Society, and the American Institute of

Chemical Engineers.