POLYMERUPDATE ACADEMY

EDUCATIONEM RESPONSUM EST

BASIC UNDERSTANDING OF THE PETROCHEMICAL INDUSTRY

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INDEX

1. Introduction to Petrochemical Industry 1
2. Introduction to Petrochemical Business 2
3. Introduction to Polymers 32
4. Chemicals from C1 50
5. Chemicals from C2 80
6. Chemicals from C3 145
7. Chemicals from C4 197
8. Chemicals from C5 217
9. Chemicals from C6 226
10. Chemicals from C7 279
11. Chemicals from C8 291

INTRODUCTION
TO PETROCHEMICAL INDUSTRY

The present lifestyle needs the use of products based upon petrochemicals:- solvents, plastics, medicines, processed foods, packaging of different goods, pigments, furniture, entertainment, travel and so on. Currently, the basic organic chemical industry uses eight basic building blocks derived predominantly from petroleum feedstocks. This course discusses the different feedstocks such as crude oil, shale gas, shale oil and coal. The eight-building blocks are classified based upon the number of carbon atoms they possess. These are C1, C2, C3, C4, C5, C6, C7 and C8.

The compounds containing more than eight carbon atoms i. E. C9, C10 and onwards are used for making fuels or subjected to cracking or other processes to get C1 to C8 fractions. This Refresher Course, 'Introduction to Petrochemical Industry' reviews specifications, characteristics and general refining steps practised in refineries. It also presents the basic behaviour of polymeric materials in the first lecture. In the remaining 8 lectures, properties and manufacturing of important monomers and major polymers and their applications are briefly explained.

LECTURE 1 - INTRODUCTION TO PETROCHEMICAL BUSINESS

Lecture 1 briefly explains the general characteristics of the Chemical Industry followed by various aspects of feedstocks such as crude oil, shale gas, shale oil, natural gas, coal and agro waste as well as municipal solid wastes. Also, the lecture describes the basic behaviour of polymeric materials explaining the effects of thermal behaviour, end-use applications, molecular weight, glass transition temperature etc.

LECTURE 2 - CHEMICALS FROM C1

Lecture 2 is related to C1 chemicals, important being methane and methanol. The manufacturing of formaldehyde and polymer polyacetal is described. The processing and applications of polyacetal are also described. Discussion on chloromethanes, ammonia and syngas also is included.

LECTURE 3 - CHEMICALS FROM C2

Lecture 3 covers ethylene in detail. The historical developments of polyethylene as well as different polyethylenes are covered. The products made from oligomers of ethylene, vinyl acetate and copolymers of ethylene are covered. Manufacturing and properties of acetaldehyde, ethylene oxide, ethylene glycol and 1,4 butanediol are reviewed. Manufacturing of vinyl chloride is followed by manufacturing, processing and applications of PVC are described.

LECTURE 4 - CHEMICALS FROM C3

Lecture 4 explains the properties of propane, propylene and polypropylene have been discussed. The other important chemicals such as acrolein, acrylic acid, methyl methacrylic acid, propylene oxide and glycol, acrylonitrile, isopropanol, acetone, allyl chloride and epichlorohydrin are also discussed. The manufacturing and applications of PMMA are also described.

LECTURE 5 - CHEMICALS FROM C4

Various fraction of C4 such as butanes and butenes are described at the beginning of Lecture 5. Other important chemicals covered are acetic acid, acetic anhydride, solvent methyl ethyl ketone, maleic anhydride, butadiene, adiponitrile and hexamethylene diamine. The relevance of these chemicals in polymer industry has been brought out neatly.

LECTURE 6 - CHEMICALS FROM C5

The C5 chemicals like pentanes, pentenes, isoprene, chloroprene and cyclopentadiene are discussed in Lecture 6. Although the volume of these chemicals is relatively low, the cyclic cyclopentadiene and its derivatives may play a vital
role in new generation polymers.

LECTURE 7 - CHEMICALS FROM C6

Lecture 7 discusses the benzene, phenol and styrene initially. This is followed by manufacturing and applications of polystyrene, HIPS, ABS and elastomers like SBR, EPDM etc. The lecture also covers the manufacturing and properties of important chemicals such as bisphenols, cyclohexanone, aniline and nitrobenzene. The manufacturing of caprolactam and major polyamides with their applications are described. This fraction is very useful for the polymer industry.

LECTURE 8 - CHEMICALS FROM C7

Lecture 8 describes important chemicals such as toluene and benzoic acid followed by the manufacturing of important monomer tolylene diisocyanate, TDI, used in polyurethane.

LECTURE 9 - CHEMICALS FROM C8

Lecture 9 is the last lecture in this series. It covers three isomers of xylene (ortho, meta and para xylene) and three phthalic acids namely ortho phthalic acid, isophthalic acid and terephthalic acid followed by dimethyl terephthalate and phthalic anhydride. The manufacturing process and properties of these chemicals are described.

INSTRUCTOR

PROF. (DR.) D. D. KALE

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Born on November 16, 1945, Prof. (Dr.) D. D. Kale is a Chemical Engineer and has obtained his Ph. D. from University of Salford, UK.

With a teaching experience of over 40 years, Prof. (Dr.) D. D. Kale retired from University of Mumbai's Department of Chemical Technology, UDCT, Mumbai in 2005 as a Professor of Polymer Technology and as a Head of the Department of Polymer Engineering.

At present, he is a technical advisor to Giriraj Group, Mumbai and in the past has also been a consultant to several plastics industries.

He is a member of high power expert committee to Government of Maharashtra on various environmental issues and is on the expert panel for centers of excellence by DCPC. (Dr.) D. D. Kale is also a member of committee to define single use plastics set up by Ministry of Chemicals and fertilizers, New Delhi.

He has been a Visiting Professor in South Korea.

After superannuation in 2005, he has worked with Reliance Industries Ltd. for a tenure of three years.

His research interests include polymer processing, rheology, product design and recycling. He has guided 28 Ph. D. and 65 Masters Students. He has published more than 100 papers in peer reviewed journals and has one patent to his credit. He has presented papers in several International conferences such as IUPAC and has travelled widely.

He is associated with many professional bodies such as PLASTINDIA, All India Plastics Manufacturers Association, (AIPMA), IPI and SPE etc.

Prof. (Dr.) D. D. Kale has trained more than 5000 undergraduate and post graduate students in India and overseas. He has also trained more than 1000 industry personnel and has successfully authored two books. He was Honorary Editor of the journal, "Chemical Engineering Journal" published by I.I.Ch.E., India.

WORK EXPERIENCE:

- Jan 2018 till date - Technical Director, Euressia Polymers, Mumbai.
- Feb 1, 2010 to - May 2012 - Director, Shroff S R Institute of Chemical Technology, Vataria, Taluka Valia, Bharuch, Gujarat, India
- Aug 1, 2011 to Dec. 2012 - Visiting Professor, IIT Gandhinagar
- Jan 1, 2006 to Dec 31, 2008 - Advisor, Reliance Industries Ltd.
- Jan. 31, 1991 - Nov 30, 2005 - Professor of Polymer Technology, Head, Plastics and Paints Technology Division UICT, University of Mumbai.

AWARDS AND HONORS:

1. Elected as a Fellow of Maharastra Academy of Science (1998)
2. Received the Teaching Services Award (Best Teacher) of Mumbai University, 2003-2004
3. Received the Prof. K. S. Armugam National Award for Innovative Research in the Field of Engineering and Technology by the Indian Society for Technical Education (ISTE) New Delhi (2004)
4. Received 'Life Time Achievement Award' from Color Society, (2015)

OTHER INFORMATION:

*Editor 'Chemical Engineering Journal' published by I.I.Ch.E. (1992 – 94)
*Designed course work for
(i) Plastics for non-plastic personnel,
(ii) Flexible packaging
(iii) Coloration of plastics
(iv) Chemical Engineering for plant personnel

*Headed the Knowledge Management group of I.P.I.

*Member of Board of Studies for Polymer Engg. Course of many Universities.

Has organized more than 10 Refresher Courses for Industry on behalf of Professional Bodies like IPI, SPE, Indian Institute of Chemical Engineers, Indian Small Scale Paint Association.

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THANK YOU

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