JECRC Foundation

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

Year & Sem – B.Tech I year I Sem
Subject –Engg.Chemistry
Unit – II
Presented by – Ms.Rekha Vijay
Designation - Asst.Professor
Department - Chemistry

VISION OF INSTITUTE

To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

MISSION OF INSTITUTE

❖**Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.**

❖**Identify, based on informed perception of Indian, regional and global needs, the areas of focus and provide platform to gain knowledge and solutions.**

❖**Offer opportunities for interaction between academia and industry.**

❖**Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders may emerge in a range of profession.**

Engineering Chemistry: Course Outcomes

Students will be able to:

CO1: Explain the impurities of water (mainly hardness) and boiler troubles.

CO2: Describe processing technologies of fuel with numerical aspects of combustion of fuel.

CO3: Describe the engineering material (cement, glass and lubricant) with respect to their manufacturing, composition, classification & properties.

CO4: Explain corrosion with its controlling measures, organic reaction mechanism and synthesis of drugs (Aspirin & Paracetamol) with their properties and uses.

JECRC
Department of Applied Sciences
Lecture Plan (Session- 2020-2021)

Course Name: Engineering Chemistry **Year/Semester: 1st Year/ Semester- I**

Course code: 1FY2-03 **No. of Lecture Req. /(Avl.): /(40/44)**

Semester starting: 21 Sept. 2020 **Semester Ending: 24 Dec. 2020**

Unit No./ Total Lect. Req.	Topics	Lect. No.	Date of Delivery	Book Referred	Pg. No.
Unit-I 10	Introduction to syllabus, Common natural impurities, hardness, Degree of hardness,	1			
	Units of hardness, Determination of hardness by complexometric (EDTA method).	2			
	Municipal water supply, Requisite of drinking water, purification of water, Sedimentation,	3			
	Filtration, disinfection, Breakpoint chlorination.	4			
	Boiler troubles: Scale and Sludge formation, Internal treatment Methods	5			
	Priming and Foaming, Boiler corrosion and caustic embrittlement	6			
	Water softening: Lime-Soda process	7			
	Water softening: Zeolite (Permutit) process, Demineralization process.	8			
	Numerical problems based on Hardness, EDTA,	9			
	Numerical problems based on Lime-Soda and Zeolite process.	10			

Unit-II 10	**2.Organic Fuels: Solids fuels: Coal, Classification of Coal, Proximate analyses of coal and its significance**	**11**			
	Ultimate analyses of coal and its significance,	12			
	Gross and Net Calorific value, Determination of Calorific value of coal by Bomb Calorimeter.	13			
	Metallurgical coke, Carbonization processes; Otto-Hoffmann byproduct oven method.	14			
	Liquid fuels : Advantages of liquid fuels, Mining, Refining and Composition of petroleum, Cracking	15		Engg. Chemistry (New Age International)	
	Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number	16			
	Gaseous fuels; Advantages, manufacturing, composition and Calorific value of coal gas and oil gas	17			
	Determination of calorific value of gaseous fuels by Junker's calorimeter, Numerical problems based on Junkers calorimeter	18			
	Numerical problems based on determination of calorific value bomb calorimeter, /Dulongs formula, proximate & ultimate Analysis.	19			
	Numerical problems based on combustion of fuel.	20			

Unit-III 3	**3.Corrosion and its control: Definition and significance of corrosion, Mechanism of chemical (dry) corrosion**	**21**			
	Mechanism of electrochemical (wet) corrosion, galvanic corrosion, concentration corrosion and pitting corrosion.	22			
	Protection from corrosion; protective coatings-galvanization and tinning, cathodic protection, sacrificial anode and modifications in design.	23			

Unit-IV 10	**4.Engineering Materials: Portland Cement; Definition, Manufacturing by Rotary kiln.**	**24**			
	Chemistry of setting and hardening of cement. Role of Gypsum.	25			
	Glass: Definition, Manufacturing by tank furnace, significance of Annealing	26			
	Types and properties of soft glass, hard glass	27			
	Borosilicate glass, glass wool, safety glass.	28			
	Lubricants: Classification	29			
	Lubricants: Mechanism	30			
	Properties; Viscosity and viscosity index	31			
	Flash and fire point, cloud and pour point.	32			
	Emulsification and steam emulsion number.	33			

Unit-V 7	**5. Organic reaction mechanism and introduction of drugs: Organic reaction mechanism: Substitution; SN1, SN2.**	**34**			
	Electrophilic aromatic substitution in benzene, free radical halogenations of alkanes,	35			
	Elimination: elimination in alkyl halides, dehydration of alcohols,	36			
	Addition: electrophilic and free radical addition in alkenes, nucleophilic addition in aldehyde and ketones	37			
	Rearrangement: Carbocation and free radical rearrangements	38			
	Drugs : Introduction, Synthesis, properties and uses of Aspirin	39			
	Drugs : Introduction, Synthesis, properties and uses of Paracetamol, Revision	40			

Lecture-15 (Unit-II FUEL)

CRACKING

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Thermal cracking

- **Liquid phase**
- **Vapour phase**

Catalytic cracking

- **Fixed bed catalytic cracking**
- **Moving bed catalytic cracking**

Cracking

INTRODUCTION :

Cracking is defined as the decomposition of high boiling point hydrocarbons of high molecular weight into simpler, low boiling hydrocarbons of low molecular weight.

$C_{10} H_{22}$ → $C_5 H_{12} + C_5 H_{10}$

n-decane n-pentane n-pentenen

(boiling point 174 °C) (boiling point 36 °C)

Two kinds of cracking are known, viz. thermal cracking and catalytic cracking.

Thermal cracking

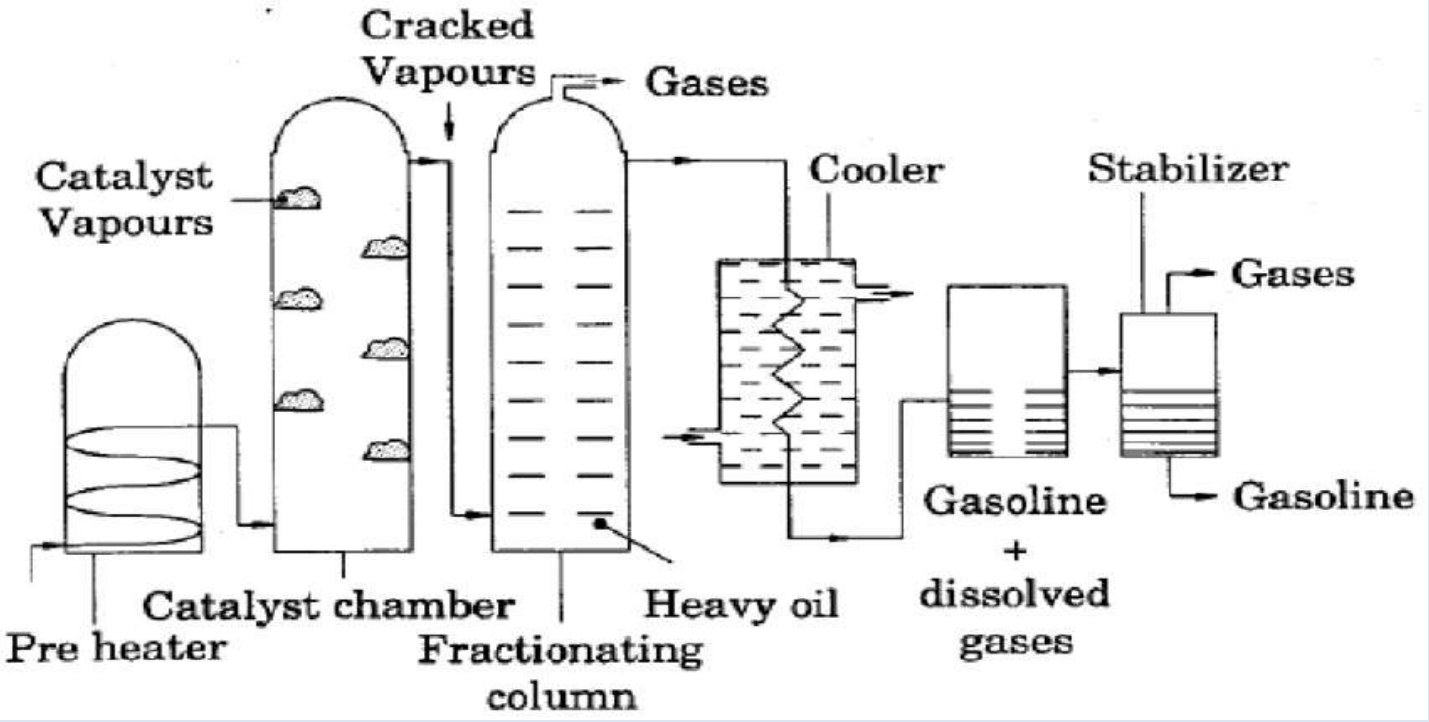
When cracking is carried out without any catalyst, it is called thermal cracking. There are two types of thermal cracking.

- **(i) Liquid Phase Thermal Cracking:** In this method, the heavy oil is cracked at a temperature of 475-530 °C under high pressures (100 kg/cm2) to keep the reaction product in liquid state. The cracked products are then separated in a fractionating column. The yield is about 50-60%.
- **(ii) Vapour Phase Thermal Cracking:** In this method, cracking oil is vaporized and then cracked at about 600-650 °C and under a low pressure of 10-20 kg/cm2. The yield of petrol is about 70%. This process is suitable only for those oils which are readily vaporized. Heavy oils cannot be cracked by this method because these oils cannot be completely vaporized under these conditions.

Catalytic Cracking

In catalytic cracking, cracking is carried out in the presence of a catalyst at much lower temperature and pressures. The catalysts used are aluminosilicates or zeolites. There are two types of catalytic cracking:

(i) <u>Fixed Bed Catalytic Cracking:</u>



Process

- The heave oil charge is passed through a preheater where the oil is vaporized and heated to 400-500 °C.
- The bauxite catalyst is mixed with clay and zironium oxide and packed in the catalyst chamber.
- The hot vapours are passed over a fixed bed of catalyst in the catalyst chamber maintained at 425-500 °C. and 1.5 kg/cm2 pressure.
- During this passage through the chamber, about 40% of heavy oil charge is converted into gasoline and about 2-4% carbon is formed. The carbon gets adsorbed on the catalyst bed.
- The cracked vapours are then passed through the fractionating column when heavy fractions condense.
- The vapours are then passed through the cooler where gasoline condenses along
- with some gases. Then gasoline containing some dissolved gases is then sent to stabilizer where the dissolved gases are removed and pure gasoline fraction is recovered.

Moving bed catalytic cracking

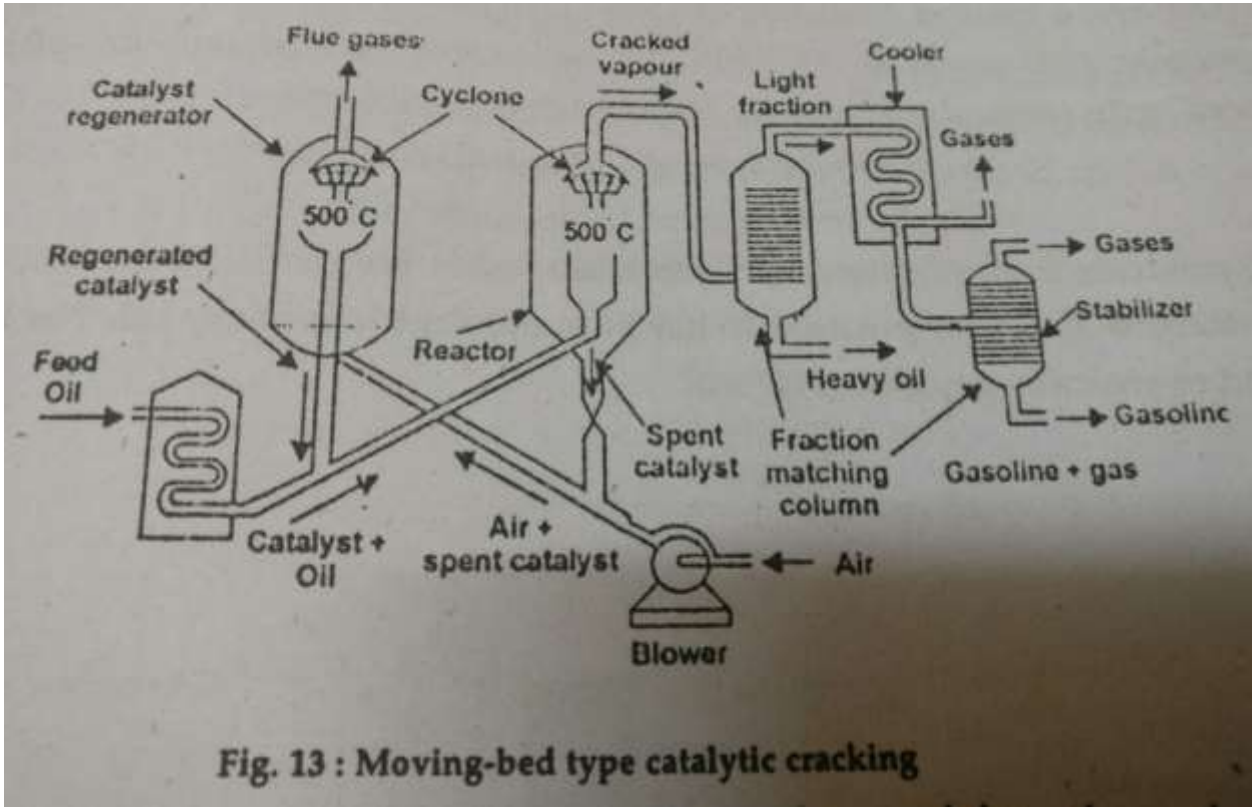


Fig. 13 : Moving-bed type catalytic cracking

Process

- In this process, the solid catalyst is very finely powdered so that it behaves almost as a fluid which can be circulated in gas stream as shown in figure.
- The preheated oil vapours are cracked in a reactor which is maintained at a temperature of 500 °C and at a pressure of 5kg/cm2.
- The catalyst dust is removed by passing the cracked vapours through the catalyst dust separator.
- The cracked vapours are then sent to the fractionating column where heavy oil is separated.
- The vapours are then passed through the cooler where gasoline condenses along with some gases.
- The gasoline containing some dissolved gases is then to a stabilizer where the dissolved gases are removed and pure gasoline is recovered.
- The catalyst powder gradually becomes heavier due to coating with carbon and settles to the bottom. It is regenerated and is again sent to the catalyst hopper through the elevator.

Suggested links from NPTEL

https://nptel.ac.in/courses/103/102/103102022/

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Thank you!