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			
	Synthetic petrol, Reforming, Knocking, Octane number, Anti-knocking agents, Cetane number	16		Engg. Chemistry (New Age International)	
	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-16 (Unit-II FUEL)

CTL Technology

Synthetic Petrol

- Bergious Method
- Fisher Tropsch Method

CTL

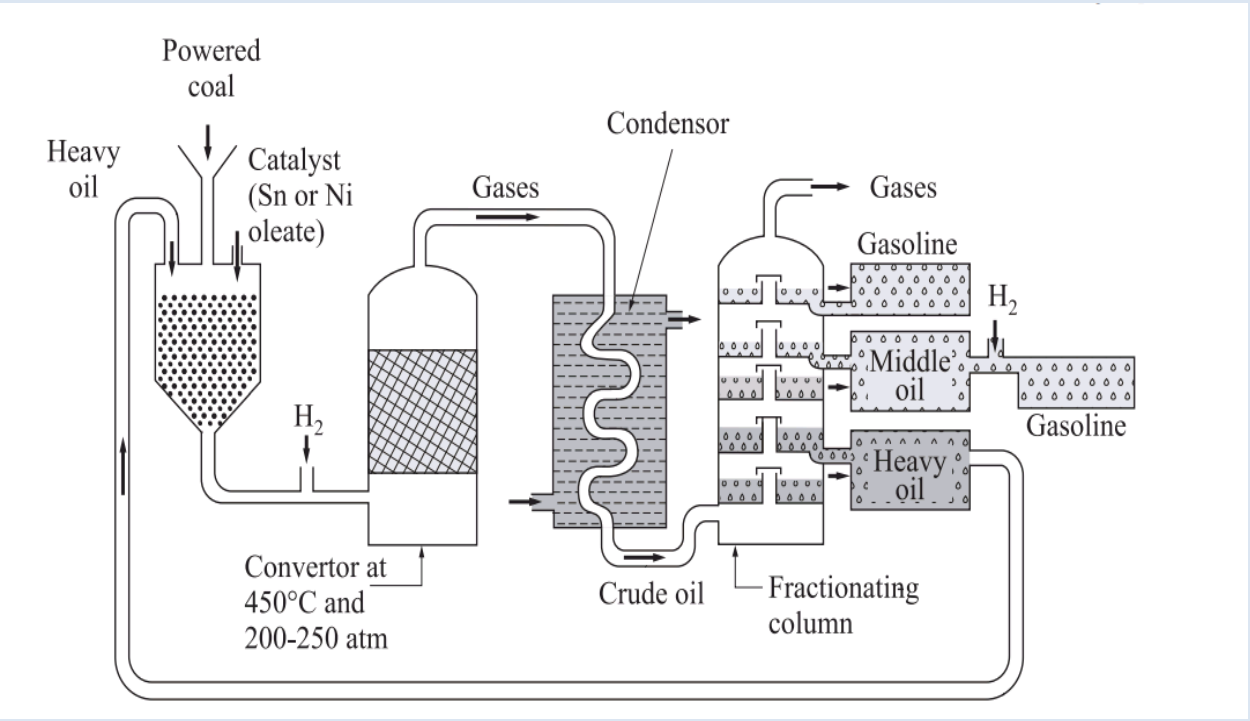
INTRODUCTION :

A process that involve the conversion of a solid fuel (coal) in to a liquid fuel (Gasolene).

Petrol can be synthesized in laboratory by following two method:

Bergious Method

The systematic diagram for Bergius process is as shown in figure below.

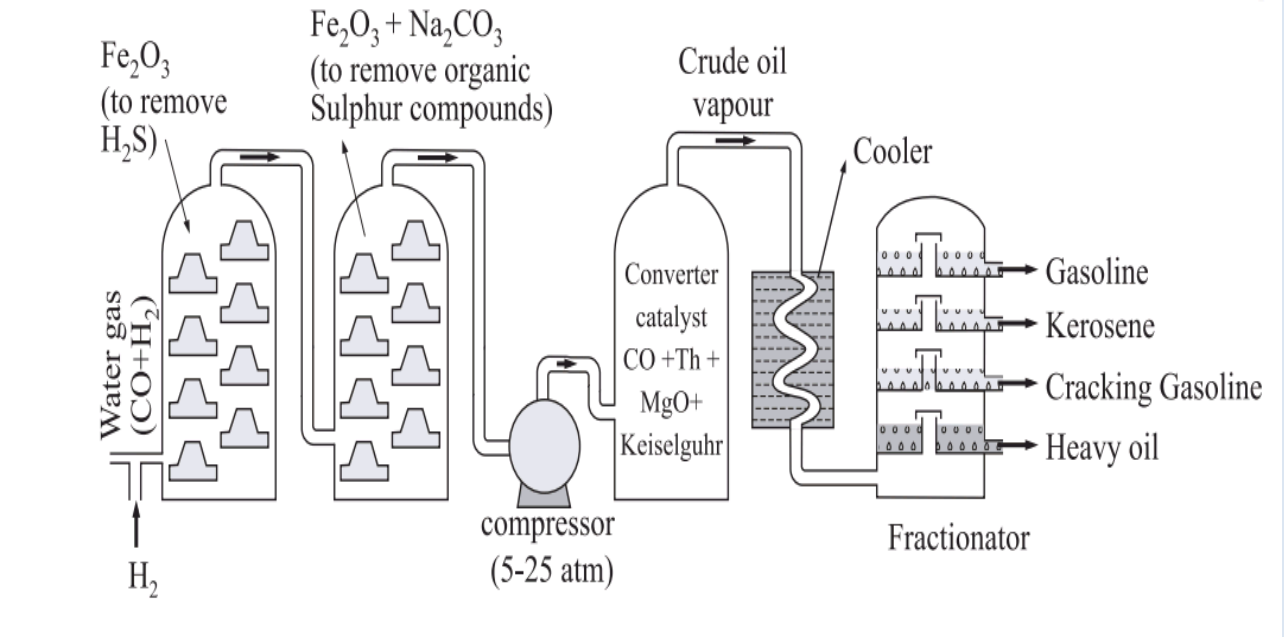


Process

- In this process, finely powdered low ash coal is mixed with heavy oil and a catalyst like tin or nickel oleate. Th e mixture or paste is hydrogenated at high temperature (450 °C) and pressure (250 atm) for about two hours. The process involves mainly three steps:
- (1) Hydrogen is made to react with unsaturated hydrocarbons present in the coal, to form saturated hydrocarbons.
- (2) Catalytic cracking of long chain saturated hydrocarbons to form smaller low boiling liquid, unsaturated and saturated hydrocarbons.
- (3) Hydrogenation of smaller unsaturated hydrocarbons obtained by catalytic cracking to produce saturated hydrocarbons which closely resemble the crude oil. The gases released in reaction vessel are passed through condenser to obtain liquid fraction resembling crude oil.
- The crude oil is subjected again to fractional distillation to recover fractions such as petrol, middle oil and heavy oil. The middle oil is hydrogenated in vapour phase in the presence of catalyst to obtain gasoline, whereas, the heavy oil is reused with coal powder and the process from step-1 is restarted.

Fisher Tropsch Method

The systematic diagram for Fisher Tropsch process is as shown in figure below.



Process

In this process raw material is coke which is converted in to water gas by passing steam over red hot coke.

$$C + H_2O \rightarrow H_2 + CO(\text{water gas})$$

- It is a catalyzed chemical reaction in which water gas ($CO + H_2$) is converted into liquid hydrocarbons of various forms. Figure gives the schematic set up of the process.
- First, the steam is passed over red hot coke to get water gas $CO + H_2$. The gas is purified by removing H2S with the help of Fe_2O_3 and organic sulphur compounds with the help of Fe_2O_3, Na_2CO_3.
- Then, it is mixed with half of its volume of hydrogen and compressed at 5-25 atm pressure. The mixture is heated to 200-300 °C in a convertor in the presence of a catalyst consisting of a mixture of cobalt (100 parts), thoria (5 parts), magnesia (8 parts) and keiselguhar earth (200 parts).
- A mixture of saturated and unsaturated hydrocarbons is formed through exothermic reaction.
- The hot gaseous mixture is passed through cooler where a liquid resembling crude oil is obtained.
- The crude oil obtained is then fractionated to get fractions such as gasoline and heavy oil.
- The gasoline produced generally have low anti-knock value which may be improved by reforming. The heavy oil fraction is recycled. For cracking to produce gasoline.

- Following reaction will take place during the process:

$$(2n+1)\, H_2 + n\, CO \rightarrow C_n H_{(2n+2)} + n\, H_2O$$

Suggested Link

- http://www.netl.doe.gov/research/Coal/energy-systems/gasification/gasifipedia/methanol-to-gasoline

- http://www.netl.doe.gov/research/Coal/energy-systems/gasification/gasifipedia/direct-liquefaction

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