

CH-202: Organic & Biochemistry

Credit Hours: 3-1

Pre-requisites: None

Course Objectives

- Use the fundamental principles of organic chemistry to predict the physicochemical properties of organic compounds.
- Explain the basic concepts related to chemistry of major classes of bioorganic compounds such as carbohydrates, proteins, lipids and enzymes.

Course Contents

a. Organic Chemistry

- i. Structure and bonding
- ii. Acids and bases
- iii. Introduction to organic molecules and functional groups
- iv. Chemistry of Hydrocarbons (alkanes, alkenes, alkynes)
- v. Physico-chemical Properties of hydrocarbons
- vi. Stereochemistry
- vii. Understanding organic reactions, Alkyl halides and nucleophilic substitution
- viii. Alkyl halides and elimination reactions
- ix. Oxidation reduction reactions,
- x. Benzene and aromatic compounds
- xi. Polymer chemistry

b. Biochemistry section

- i. Fundamentals of biochemistry.
- ii. Chemistry, Structure and function of important biomolecules such as carbohydrates, amino acids, proteins, enzymes and lipids.
- iii. Introduction to Fermentation process.

Course Outcomes

Upon successful completion of this course students will be able to show a basic mastery of:

- Structure and properties of organic compounds
- Stereochemistry: stereoselective and stereospecific reactions
- Alkanes, Alkenes and Alkynes
- Free-radical addition and substitution reactions

- Nucleophilic addition and substitution reactions
- Alkyl halides
- Alcohols, Ethers
- Conjugation and resonance
- Cyclic Aliphatic compounds
- Aromatic compounds
- Demonstrate an understanding of organic molecules, their structures and effects on physical properties and chemical reactions.
- Carbohydrates
- Amino acids and proteins
- Enzymes
- Lipids
- Synthesize representative organic compounds in the laboratory
- Purify laboratory products by distillation and recrystallization.
- Determine theoretical and percent yields of laboratory products.

List of Practicals

- i. Synthesize Dibenzalacetone by aldol condensation reaction, analyze your product by its physical appearance and compute its actual and theoretical yield. Also compare your results with literature.
- ii. Synthesize the crystals of dibenzalacetone by recrystallization of crude product and estimate its melting point and purity by any suitable method of analysis. Also compare your findings with literature.
- iii. Compute the R_f value of unknown samples by Thin Layer Chromatography method and identify the samples by comparing your results with literature.
- iv. Synthesize Bio Diesel by transesterification reaction and separate the products by using separating funnel. Analyze your product by its physical appearance, also compute its actual and theoretical yield.
- v. Perform the FTIR analysis of the products of transesterification reaction for the confirmation of biodiesel synthesis and prediction of its purity, also interpret the byproducts of the reaction by comparing the graphs with literature.
- vi. Synthesize soap by saponification reaction and separate the products by using vacuum filtration technique. Analyze your product by its physical appearance, also compute its actual and theoretical yield.

- vii. Perform the FTIR analysis of the products of saponification reaction for the confirmation of soap synthesis and prediction of its purity, also interpret the byproducts of the reaction by comparing the graphs with literature.
- viii. Synthesize Dibenzalacetone by aldol condensation reaction, analyze your product by its physical appearance and compute its actual and theoretical yield. Also compare your results with literature.
- ix. Synthesize 2,5-Dimethyl benzene by sulphonation reaction, analyze your product by its physical appearance and compute its actual and theoretical yield. Also estimate its melting point and purity by any suitable method of characterization.
- x. Synthesize nitrobenzene by nitration of benzene, analyze your product by its physical appearance and compute its actual and theoretical yield. Also predict its purity by any suitable method of analysis.
- xi. Extract caffeine from coffee or tea and analyze your product by its physical appearance, also predict its melting point and purity by any suitable method of characterization.
- xii. Synthesize 2,4,6-Tribromoaniline by nucleophilic substitution reaction and analyze your product by its physical appearance. Also, predict its purity by any suitable method of analysis.
- xiii. Compute its actual and theoretical yield of 2,4,6-Tribromoaniline and estimate the melting point of sample by using melting point apparatus. Also compare your findings with literature.
- xiv. Identify the unknown sugar samples by Osazone formation and compare your results with literature. Also compute the purity of samples by any suitable method of characterization.

Suggested Books

- Smith, J. G. (2019). Organic Chemistry. McGraw Hill; 6th edition.
- Finar, I. L. (2016). Organic Chemistry (Vol. 4). The Longman Group.
- Glasstone, S. (2014). Textbook of Physical Chemistry. Macmillan and Co. Limited; 6th Ed.
- Brown, P. (2012). Biochemistry. W.H. Freeman; 6th edition.
- Atkins, P. W. (2018). Physical Chemistry. W.H. Freeman and Co.; 5th edition.