



POLYMER FLOCCULANT FOR WASTE WATER TREATMENT

Prepared & Conducted by

PROF. (DR.) MAMTA SAIYAD

B.Tech., M.Chem.Engg.,
Ph.D.

PROF. (DR.) NIMISH SHAH

B.Tech., M.Chem.Engg.,
Ph.D.

ADDRESS:

1001/1002, Lodha Supremus,
Opp 'The World Towers' Senapati Bapat Marg,
Lower Parel (West), Mumbai - 400013,
Tel: (91-22) 61772000 (25 Lines)

SUMMARY

Water Treatment

Water is the lifeblood of the environment, essential to the survival of all living things. This Course covers the water quality aspects in respect to its suitability for a particular purpose and acceptable values for each of the parameters; characteristics of water; various pollutants affect the water quality; coagulation and flocculation treatments as a part of “Water treatment”.

Flocculants

Flocculants are the major constituents for any water treatment to remove contaminants from the waste water. As a part of “Flocculants”, it discusses about functions of flocculants; its chemistry and mechanisms; its performance, and selection criteria. Now a day’s natural and synthetic polymers flocculants are preferred with many advantages. This course covers various types of flocculants including natural and synthetic; starch-based biodegradable polymer flocculant and its advantages over synthetic polymers.

Altogether, this course helps to understand about water treatments using polymer flocculants for the industrial wastewater, which can make our environment clean.

I N D E X

1. Basics of Water Treatment
2. Characteristics of Wastewater
3. Coagulation
4. Why is flocculation important?
5. What is flocculation?
6. Performance of flocculants
7. Factors affecting coagulation & flocculation
8. Steps to efficient flocculation process
9. Selection criteria for flocculants
10. Flocculants features/types
11. How to use flocculants
12. Chemistry and Mechanism
13. Advantages of Polymer flocculants over conventional flocculants
14. Advances in coagulation/ flocculation

Lecture 1

Lecture 1 deals with the water quality aspects that are determined by the types and amounts of substances suspended and dissolved in the water and their effects on the inhabitants of the ecosystem. Physical and chemical criteria are fixed to the maximum amount of pollutants, acceptable ranges of physical parameters, and the minimum amount of desirable parameters, which are reasonable for public health and established values.

Lecture 2

Lecture 2 discusses all those parameters and their sources. Certain parameters decide the characteristics of the water quality. During water treatment, all these parameters are taken into account to keep within the specified limits.

Lecture 3

Lecture 3 discusses the coagulation process. The filterable solid elements consist of colloidal and dissolved solids. The colloidal fraction does not settle and causes turbidity. The dissolved solids consist of organic & inorganic molecules and ions that are present in water. Generally, biological oxidation or coagulation, followed by sedimentation, is required to remove these particles from suspension.

Lecture 4

Lecture 4 gives general guidelines concerning the initial selection of flocculants, how to choose an optimum Flocculant, and the factors that affect its performance. Economic aspects are also considered in the selection of flocculants.

Lecture 5

Lecture 5 gives information on the flocculation process with some basic mechanisms of wastewater treatment. The function of a flocculant is to bring together coagulated particles into larger aggregates and settle them. Various flocculants are used for these applications.

Lecture 6

Lecture 6 discusses In water treatment, coagulation and flocculation are treatments that aim to optimize the removal of suspended particles by decantation and filtration processes. These treatments favor the aggregation of the colloidal particles into broad and dense aggregates. They take place in two main stages, namely the destabilization of the particles and the collision of the destabilized particles to form bulky aggregates.

Lecture 7

Lecture 7 discusses the main factors that affect coagulation/ flocculation are particle size, surface charge, and water chemistry. The smaller the particle size, the greater the total surface area per unit weight of solids, so it is not atypical to see an increase in the dose required to coagulate fine particles. This increase is not linear as small decreases in particle size can result in dramatic increases in coagulant requirements. The lecture will discuss the effect of factors on flocculation, primarily polymer type, ionic strength, water pH, slurry solids, flocculant dilution, shear, molecular weight, and process conditions. These factors, individually and collectively, have a great influence on the type of flocculant that will provide optimum performance, its optimum dose, and additional points.

Lecture 8

Lecture 8 discusses the process parameters and downstream performance. Flocculation is an important unit operation, which needs to be developed and optimized to run cost-effectively. Whether the objective is to flocculate cell fragments, suspended particle matter, fibers, fillers, or precious metals, the steps to develop efficient flocculation processes are important to know.

Lecture 9

Lecture 9 discusses the selection of coagulation/ flocculation. It is one of the most important decisions for wastewater treatment, but the different coagulation works in the different quality parameters of water. Several studies have been reported on the examination of coagulation-flocculation for the treatment of industrial waste-water treatment, aiming at performance optimization, i.e. selection of the most appropriate coagulant, determination of experimental conditions, and assessment of pH effect and investigation of flocculants addition. This process is divided into different categories, according to their application and nature.

Lecture 10

Lecture 10 discusses salts, such as ferrous (III) or aluminum salts, which were used as flocculants in the past, have many drawbacks such as high demand for salt, and the formation of small, unstable flocs, and a large volume of sludge. Therefore, they were replaced by water-soluble polymers (or were used in combination with them). Small polymer concentrations can produce large aggregates that can be separated easily.

Lecture 11

Lecture 11 discusses an effective system, the application parameters have to be optimized (e.g. polymer type, concentration, charge, molecular weight). Therefore, direct and efficient methods for the characterization of the flocculation behavior (sedimentation velocity, packing density of the sludge, particle size distribution) are necessary and will be described. Finally, the most advanced applications for PECs

Lecture 12

Lecture 12 discusses before diving into the details of the treatment processes, it can be beneficial to discuss the overall philosophy of conventional drinking water treatment. Drinking water treatment plants are unlike most businesses that make products or provide services for consumers because the production of clean drinking water has a direct impact on the health of the consumers. If the plant is operating properly, no one gets sick from drinking the water, but if the plant does not perform well then people can get sick and even die. The first code of ethics for civil and environmental engineers is to “hold paramount the safety, health, and welfare of the public,” which has implications for the design of drinking water treatment plants. For this chemistry and mechanism are discussed. The stability of a suspension depends on the number, size, density, and surface properties of the solid particles (internal or dispersed phase) and the density of the external phase or dispersion medium.

Lecture 13

Lecture 13 discusses starch-based biodegradable polymer flocculants to gain both the advantage of natural as well as a synthetic polymer, for the industrial wastewater and also the advantages of Polymer flocculants over synthetic flocculants.

Lecture 14

Lecture 14 discusses advancements in this field of flocculation/ coagulation. Biocoagulants/ flocculants can be an alternative solution to minimize the environmental pollution and health risks caused by the use of chemical coagulants/flocculants. Biocoagulants and flocculants come from living things or their parts and are organic and biodegradable; therefore, they are environmentally friendly and have minimal impacts on human health. Research related to biocoagulants and flocculants has undergone many stages until their application to treatment processing units. Some biocoagulants and flocculants obtained from various sources have already been analyzed and have been proven efficient for application to treatment processes as a substitution for the currently widely used chemical coagulants and flocculants.



PROF. (DR.) MAMTA SAIYAD

B.TECH., M.CHEM.ENGG., PH.D.

Dr. Mamta is currently working as Associate Professor at Chemical Engineering Department, Nirma University.

She has obtained her Ph.D. in Technology on Radiation Hardened Polymer Composites. She is devoted to teaching with a distinguished career of over 25 years comprising teaching, research, and administration. In Addition, she possesses more than 7 years of Industrial experience. She has published a book on Polymer Flocculants with international publishers and has also published and presented several Research and Management papers with peer-reviewed journals. She has one Indian Patent published in her credit. She also serves as a reviewer in various Indian and International Journals.

Dr. Mamta was awarded for Academic excellence with Best Polytechnic Teacher Award in 2008 by ISTE. She has received PLASTICON Award for Developing “Radiation hardened polymer composite” in the Category of Innovative use of Polymer in Defense and Aerospace - by PlastIndia Organisation in 2018.

She presented her idea at NASA on “Radiation Hardened Nuclear Coat for Astronauts” in October 2019.

Her areas of interest are Polymer Microstructure analysis, Awareness of Plastics in Society and Students Mentoring.



PROF. (DR.) NIMISH SHAH

B.TECH., M.CHEM.ENGG., PH.D.

Dr. Nimish Shah is currently working as Associate Professor at Chemical Engineering Department, Nirma University.

He has obtained his Ph.D. in Technology in Polymer Synthesis, characterization, and exploring their pharmaceutical applications. He is devoted to teaching with a distinguished career of over 22 years, comprising research and administration. In Addition, he possesses more than 4 years of Industrial experience.

He has published a book on Polymers in Modified Drug Delivery Systems with international publishers. He has published and presented no. of research papers with peer reviewed journals. He is also serving as a reviewer in various Indian and International Journals.

Dr. Shah was awarded for Academic excellence with Best Polytechnic Teacher Award in 2009 by ISTE. His areas of interest are Polymers in an interdisciplinary area like drug delivery, Awareness of Plastics in Society and Students Mentoring.



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