



Enhanced Biological Phosphorus Removal

Introduction

Phosphorus is the key element to remove from aquatic environments to limit the growth of aquatic plants and algae, and thus, to control eutrophication. Unlike nitrogen that can be fixed from the atmosphere which contains about 80% nitrogen gas, phosphorus (P) can only come from upstream of aquatic systems (neglecting atmospheric deposition). Diffuse sources of phosphorus, e.g. from agricultural fields, is best controlled by proper fertilisation plans, while point sources of phosphorus, like from wastewater treatment plants, can be removed by chemical or biological processes. Considering the benefit to aquatic environments, stricter regulations are being applied for phosphorus removal from wastewaters.

The enhanced biological phosphorus removal (EBPR) phenomenon, insofar as it pertains to phosphorus removal in activated sludge systems was noted first in the late 1950s. In the five decades since, understanding, conceptualization and application of the phenomenon have grown from the initial incidental observations to well structured biochemical and mathematical descriptions that are applied in design and control of major full-scale works. The impetus for these developments did not stem from a pure scientific interest; but almost wholly from the recognition, albeit slowly, in the 1960s of the pivotal role that phosphorus plays in eutrophication of aquatic environments. This recognition, together with the massive increase in phosphorus loads to the aquatic environment since 1950, gave rise to an urgent need to develop effective countermeasures to limit the discharge of phosphorus, such as EBPR.

This lecture consists of a voice-over PowerPoint presentation and is supplemented by 4 video lectures on Enhanced Biological Phosphorus Removal (EBPR) recorded by Prof. Yves Comeau, from Ecole Polytechnique Montreal, Canada, and Dr. Carlos Lopez-Vazquez, from UNESCO-IHE Institute for Water Education in Delft, The Netherlands. The lecture presents the mechanisms of biological P-removal and introduces the fundamental concepts for the design and operation of activated sludge systems achieving enhanced biological removal of phosphorus.

Aims of the Course

- To present the mechanisms of the biological phosphorus removal process in activated sludge wastewater treatment systems
- To describe the characteristics of different wastewater treatment plant configurations for biological phosphorus removal.
- To set out basic guidelines for the design of biological phosphorus removal systems.

Learning Objectives

After the completion of this chapter, the participant will be able to:

- Apply the knowledge on biological wastewater treatment processes and engineering on the design and critical assessment of wastewater treatment systems and configurations performing biological phosphorus removal as a function of the environmental, operating, and wastewater conditions and characteristics.