Phosphate removal from wastewater: An overview

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Abstract

Wastewater containing large quantities of nutrients poses a risk to the environment causing an eutrophication and pollution of aquatic habitat all over the world. Phosphate loading of water bodies generates excessive algae growth, reduce or eliminate oxygen and generally deteriorate water quality and it is of a high importance to remove phosphorus from wastewater. On the other hand, for the last 20 years, phosphorus is deemed a recoverable product rather than a pollutant. This paper presents an overview of recent research articles related to the solutions for phosphate biological and chemical removal from wastewaters as well as methods and possibilities for phosphorus recovery.

Introduction

Plenty open water sources are presently confronted with excess of phosphorus, mainly caused by effluent discharge from wastewater treatment plants (WWTPs) and anthropological activities, such as agriculture and industry. Reduction or/and elimination of phosphorus from wastewater can be achieved through ion exchange, adsorption, chemical precipitation with Fe^{3+}, Al^{3+} or Ca^{2+} salts or via biological methods. Nowadays wastewater has been acknowledged as an alternative source of phosphorus and newest trends in wastewater treatments are now oriented on phosphate recovery and reuse. Recovered phosphorus products may be applied as fertilizers to improve soil fertility.

Methodology

The review was undertaken following PRISMA guidelines.

Key words

wastewater

phosphate removal

biological treatment

chemical treatment

phosphorus recovery

Databases

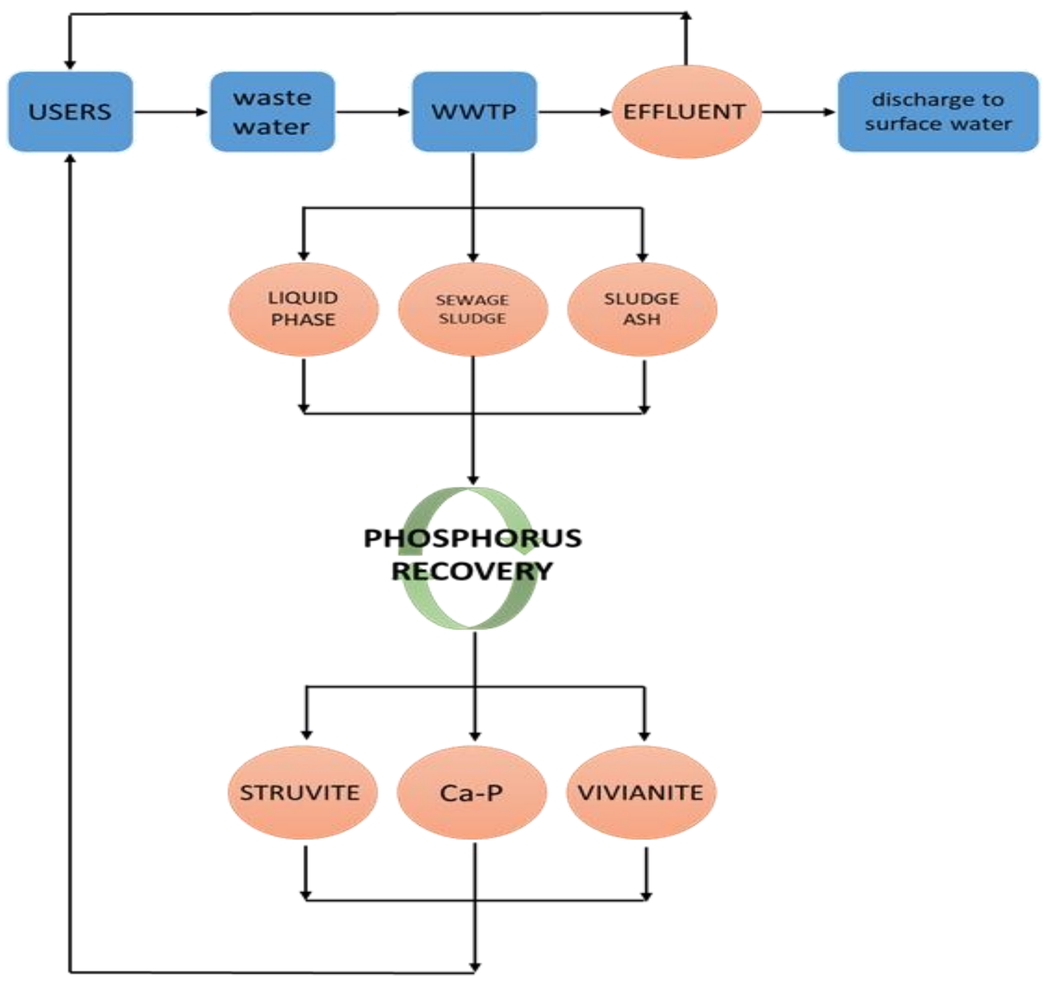
ScienceDirect

Scopus

WEB OF SCIENCE

the international water association

CABI



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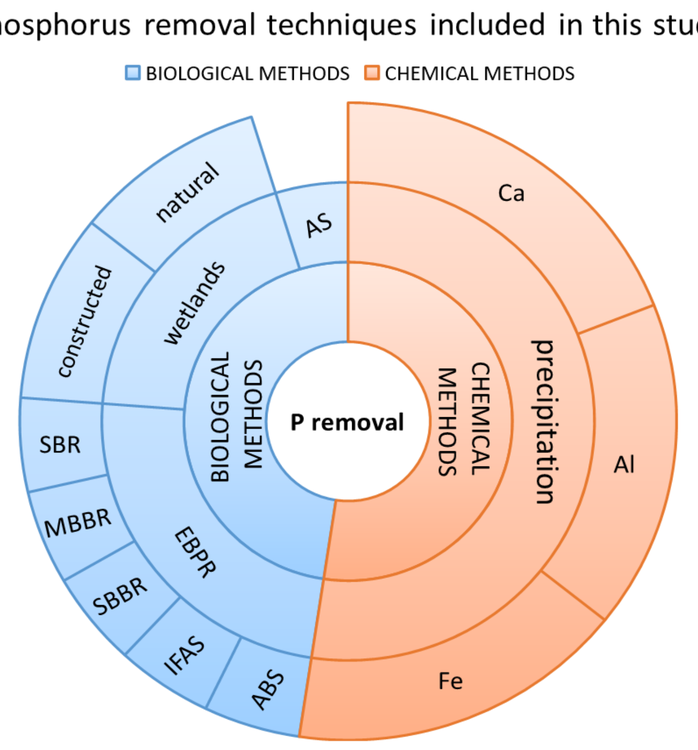

Conclusion

Among all reviewed studies of biological phosphorus removal, EBPR technology is considered the most attractive with highest phosphorus removal efficiency. Chemical precipitation using ferric as well as aluminium salts is the most frequently used technique for phosphorus removal from wastewater due to its easy operation and low cost. Presently, struvite precipitation is the most recommended method in the literature for phosphorus recovery from wastewater since struvite may be recovered up to 97%, but limited to WWTPs using EBPR. The highest recovery rates are achieved when recovering phosphorus from sludge ashes, but recovery from the liquid phase generates less emissions and demands less energy.