

Assessment of the efficiency of nitrogen removal from municipal wastewater

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Abstract

One of the biggest risks to surface waters is the deterioration of their quality as a result of eutrophication. The main sources of nutrient loads causing eutrophication are agriculture and municipal wastewater. In small and medium-sized wastewater treatment plants in Poland, achieving normalized concentrations of nitrogen in treated wastewater often creates operational problems. In the article, on the basis of operational data from 6 wastewater treatment plants (WWTP), factors affecting the efficiency of removing nitrogen compounds from wastewater and the impact of these treatment plants on the receiver were analysed.

Keywords: eutrophication, nitrogen removal from wastewater

1. Introduction

Eutrophication is one of the most serious risks to water quality. The phenomenon of eutrophication arises as a result of enriching them with nutrients, in particular nitrogen and phosphorus compounds, which accelerate the growth of algae and other higher plant life forms (Nourmohammadi et al, 2013). The effect of eutrophication is the reduction of the possibility of using water to supply the population, in industry and recreation. The main reason for eutrophication of waters is the local increase in population density, the increasing amount of municipal wastewater as well as the intensification of agricultural production (Smoroń, 2012). According to Klimiuk et al. (1995) it is estimated that about 45% of nitrogen and 70% of phosphorus discharged into waters from Poland is of wastewater origin. It is therefore important to maintain high efficiency in the removal of nutrients from wastewater.

In small and medium-sized wastewater treatment plants in Poland, achieving normalized concentrations of nitrogen in treated sewage often creates problems. This is due to the lack of adequate control of processes and outdated infrastructure. Additional problem is the changing composition of sewage,

associated primarily with the deterioration of the ratio of N/BOD₅. This phenomenon is often noticeable in areas with an extensive sewage network characterized by a large number of pumping stations and low pipeline slopes. The solution for such treatment plants is modernization, which, however, often exceeds the financial capabilities of operators. Often, minor operational changes such as the introduction of an additional carbon source to the wastewater, control of internal recirculation, protection of the reactor against cooling down or optimization of the amount of introduced oxygen significantly improves the efficiency of the process. Identification of all factors affecting the low efficiency of nitrogen removal from wastewater for operated small and medium-sized wastewater treatment plants is important from the point of view of optimization and increasing their efficiency, and thus reducing the environmental pressure.

2. Materials and methods

The analysis of factors affecting the efficiency of removing nitrogen compounds from wastewater will be carried out for 6 operated Polish wastewater treatment plants with different flow rates. The analysis will be based on the

physico-chemical composition of wastewater (BOD₅, COD, TKN, suspension, pH, temperature).

The technology and technical solutions used will also be assessed and analysed.

3. Results

The suboptimal operation of sewage treatment plants is considered a problem worldwide (Nourmohammadi et al, 2013), so we expect that this article will generally show the paths to reduce pollution of water reservoirs in less prosperous countries, as a result of improving the efficiency of currently operating small and medium-sized sewage treatment plants.

References

Klimiuk E, Lossow K, Bulińska M 1995 *Reaction kinetics and modeling of biochemical reactors in wastewater treatment processes* (Olsztyn: ART Publisher)

Nourmohammadi D, Esmaeeli M, Akbarian H, Ghasemian M 2013 Nitrogen Removal in a Full-Scale *Domestic Wastewater Treatment Plant with Activated Sludge and Trickling Filter* Journal of Environmental and Public Health Vol. 2013, p. 6

Smoroń S, 2012 *The risk of surface waters eutrophication in loessial uplands of Malopolska* Water-Environment-Rural Areas Vol.12, p. 10