POPULAR SCIENCE ABSTRACT

Due to decreasing water resources and dwindling natural resources, wastewater treatment technologies must be improved. This is especially important in agriculture, where fertilizers are used. Much cultivation has begun to be carried out in greenhouses in a soilless system. Due to the method of plant fertilization used in such facilities, wastewater from greenhouses contains very large levels of biogenic compounds (oxidized forms of nitrogen and phosphorus). Often untreated wastewater is discharged into the ground (contaminating groundwater) or into surface waters. Due to their composition, they are a major threat to aquatic ecosystems, causing the unwanted phenomenon of eutrophication. In view of the existing regulations on the quality of wastewater, which must be met before it is discharged into the environment, wastewater from soilless crops should be treated before it is released into the environment.

Biological wastewater treatment is based on processes carried out by microorganisms that can remove pollutants under suitable conditions (including the availability of organic carbon). The specific characteristics of greenhouse wastewater (low concentrations of organic carbon and high concentrations of nitrogen and phosphorus) do not allow treatment by conventional methods involving activated sludge microorganisms. It proves necessary to add organic carbon from external sources. Liquid substrates (methanol, ethanol, sodium acetate) are mostly used for this purpose, but recently attention has also turned to solid carbon sources such as wood chips or biodegradable polymers. One of the developing technologies is anaerobic Bio-Electro Sequencing Biofilm Batch Reactor (BESBBR) with discs in which the conditions allow for parallel autotrophic (hydrogenotrophic) and heterotrophic denitrification, electrochemical nitrate reduction (where nitrogen is removed) and electrocoagulation (where phosphorus is removed).

To create the conditions for effective treatment of greenhouse effluents, it is necessary to add a carbon source to the BESBBR. In this study, solid substrates will be used: beech wood chips, *Paulownia Clon* in vitro 112® (Oxytree) chips, polybutylene succinate (PBS). The main advantage of the above materials is that they are released during the entire treatment cycle. There is no risk of over- or under-dosing as with liquid substrates.

The aim of the project is to investigate the effects of the type and degree of reactor filling with solid carbon sources (SCS) – including beech wood chips, *Paulownia Clon* in vitro 112® (Oxytree) chips and polybutylene succinate (PBS) – and the surface area of the discs on the efficiency of nitrate (N) and phosphorus (P) removal in the anaerobic Bio-Electro Sequencing Biofilm Batch Reactor (BESBBR).

The measurement of pollutant concentrations in the influent and effluent of the reactors will help to determine the effectiveness of the treatment in the BESBBR depending on the availability of carbon. Physicochemical analysis of the biofilm will include quantitative and qualitative analysis of the biomass removed from the reactor and the biological membrane covering the discs, the beech wood chips, the *Paulownia Clon* in vitro 112® chips and the PBS fill, as well as analysis of the basic components such as carbon, nitrogen and phosphorus. In addition, the power consumption during reactor operation will also investigated. The anaerobic sequencing bio-electro biomass reactor (BESBBR) with a solid carbon source is a promising solution that can achieve high efficiency removal of nutrients from wastewater, not only greenhouse wastewater.

The research results described in this project suggest that the use of an external solid carbon source and electric current in an anaerobic Bio-Electro Sequencing Biofilm Batch Reactor (BESBBR) is a promising solution that can provide high efficiency in nutrient removal from low C/N ratio wastewater, not only from greenhouse wastewater.