

## SUMMARY

Municipal facilities such as wastewater treatment plants and landfills must make efforts to prevent excessive odor emissions. In this aspect, it is necessary to take actions to reduce emissions and deodorize the resulting gases, which is usually a challenge for most facilities of this type. This is primarily due to the high costs of the project, but also to the difficulty of skillfully integrating such an installation into the existing infrastructure of a municipal facility. Moreover, the deodorization method used should be characterized by high efficiency, lack of generation of harmful by-products, while maintaining reasonable investment and operational costs. Equipment that meets these requirements and at the same time have great implementation potential are Compact Trickle Bed Bioreactors (CTBB).

The subject of the research was the adaptation of odor and volatile organic compounds (VOCs) removal technology in Compact Trickle Bed Bioreactors to the municipal sector, in particular to wastewater treatment plants. The influence of operating parameters of Compact Trickle Bed Bioreactors on the efficiency of  $H_2S$ ,  $NH_3$  and VOCs biodegradation was analyzed. The main criterion was the influence of parameters such as: the flow of the gas and liquid phases, which made it possible to assess the impact of retention time on the removal of contaminants, different pH values of the circulating medium, as well as the variability of contaminant concentrations in the emitted gases. The technology was tested on a pilot scale in two municipal wastewater treatment plants, which allowed for a real assessment of the implementation possibilities of the technology and its adaptation to full technical scale. Knowledge was obtained about the response of Compact Trickle Bed Bioreactors to sudden changes in pollutant concentrations, as well as variable operating parameters, which allowed the establishment of limit operating parameters while maintaining high air purification efficiency. The technology of Compact Trickle Bed Bioreactors was also checked in terms of the reliability of the installation operating in real conditions, often extremely unfavorable for the process, such as: variable humidity and pH of purified gases, periodic overloads with pollutants resulting from sudden changes in the concentration of odorous pollutants, high and low temperatures, gas contamination with solid particles or temporary power supply. The ranges of optimal operating parameters of Compact Trickle Bed Bioreactors in real conditions of wastewater treatment plants, at which microorganisms are most effective, were also determined. The obtained test results in two different wastewater treatment plants, characterized by different odor emission issues, confirmed the high efficiency of odor degradation, including volatile organic compounds, as well as the universality and high adaptation and implementation potential of the Compact Trickle Bed Bioreactors technology, and thus the possibility of implementing to full technical scale in this type of municipal sector plants. The results of the presented doctoral thesis will be the basis for developing designs and implementing Compact Trickle Bed Bioreactors, both in wastewater treatment plants and in the broadly understood municipal sector.