Improving the treatment train of a liquid waste treatment plant: actions' assessment

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Plants for the treatment of liquid waste are key facilities for the correct disposal of lots of industrial waste and environmental protection. The management of such facilities is not an easy matter because of the number and high variability of the received waste. Industrial wastes contain a large number of compounds, of organic and inorganic nature, with different biodegradability.

This study deals with the technical and economic optimization of a liquid waste treatment plant, that, in the last years, has shown some criticalities concerning the removal of organic substances and nitrogen. The plant includes the traditional treatments of preliminary screening, liquid waste homogenization, removal of metals through physic-chemical processes (coagulation-flocculation-sedimentation), intermediate temporary storage, biological treatment in a conventional activated sludge tank, filtration in sand-coal granular filters.

Data concerning the contaminant removal efficiency before and after both the intermediate temporary storage and the biological section were collected and analyzed for more than two years. The performances of the biological section in the removal of organic substances and nitrogen have been analyzed by using oxygen utilization rate (OUR), ammonia utilization rate (AUR) and nitrate utilization rate (NUR) protocols.

The analysis of the collected data and the outcomes of the lab tests revealed that the main shortcomings of the plant were: (i) the low capacity of the air diffusion system to provide oxygen to the biological reactors; (ii) the presence of foam and bulking phenomena related to a suffering condition of microorganisms; (iii) the low kinetic of the autotrophic microorganisms involved in ammonia nitrogen oxidation.

Improvements in the treatment train of the liquid waste treatment plant has been proposed and evaluated, such as either the introduction of an anaerobic section, in order to reduce the load of the organic substances entering into the aerobic tank, or the introduction of an anoxic section, in order to improve nitrogen removal.