**Assessment of wastewater plant serving a paper industry: performances evaluation and proposal treatment for the reduction of freshwater consumption**

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The paper industries release wastewaters that requires adequate treatment for sustainable development. This work presents a case study of a wastewater plant serving a paper industry. A global approach has been adopted, taking into account the interactions between the production plant and the wastewater plant. The main objectives were the assessment of the current state of the plant for the aspects related to the production and the treatment of wastewater streams, as well as the feasibility study for the reuse of the purified water. Based on monitoring data the correlation between the characteristics of the wastewater and the quality of the raw materials used in the production plant was evaluated. Moreover, the trends of the main parameters (COD, SST, starch, Ntot, Ptot, pH) for all the sections of the wastewater plant were determined through a specific intensification of monitoring activity. In this way, the overall performances of each section of the plant have been evaluated. More in details, the abatement efficiency of the three oxidation sections is decreasing, MBBR abates about 54% of the COD, the second section about 32% and finally the third removes about 11%, for a total COD removal of 97%. The concentration of dissolved oxygen detected in the second and third oxidation sections is higher than the range of optimal values, which confirms the possibility of decreasing energy consumption by intervening on the regulation of the aeration system. The monitoring data have been used to perform a preliminary study to evaluate the technical feasibility and the limits of reusing wastewater in production, in order to decrease the withdrawal of freshwater and/or face situations of scarcity of water resources. In the present study has been proposed to treat the polluted water by reverse osmosis: the permeate is recirculated to the production plant while the retained is sent to the oxidation sections of the treatment plant. The addition of the reverse osmosis section decreases the wastewater flow rate to treat and, consequently increases the COD concentration and conductivity. Different scenarios have been considered as a function of reducing freshwater withdrawal (15%, 25%, and 40% from current withdrawal). For each scenario the main parameters (flow rate, conductivity, starch, COD) of the streams have been calculated and the preliminary sizing of the reverse osmosis section (membrane surface, energy consumption) have been described.