

Biological Treatment of Pulp Mill Wastewater-Effect of pH and Temperature of the Influent on the Microbial Ecology and Reactor Performance

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ABSTRACT

Relatively large wastewater discharge and accompanied release of high pollution load in the environment are the sequel of high water consumption and pollution generation in the process of pulp and paper making in India. Sustained and all-round efforts are being exerted in the mills to reduce the water consumption and restrict the discharge of pollution load in the receiving aquatic body to the minimum level. Aerobic biological treatment for degradation of biodegradable organic components in the wastewater of the pulp and paper mills occupies a dominant role in the clean-up process. Continuous shifting of the boundary conditions on environmental compliance and paradigm change of process technology in the pulp and paper mills bring a new challenge in the age-old, too familiar and convenient wastewater treatment process.

The removal of biodegradable organic substances; both soluble and finely dispersed is accomplished by biological oxidation with the help of microbial consortia principally bacteria. The ecology of microbial species, in activated sludge process is having the significant role in the bio-oxidation and subsequent clarification. The microorganisms; bacteria, protozoa, fungi, and rotifers exist in the activated sludge reaction vessel and clarifier as floc. The activated sludge process works well as long as the consortia of microorganisms, typically termed as sludge, grows in a healthy way, and settles and compacts in the secondary settling tank.

A long term research project is being carried out in the Centre to address the bio-oxidation of the pulp mill wastewater in the aerobic treatment process with change of dominant and significant operating parameters and environmental conditions. The present paper is based on the research findings on the effect of two operating conditions viz., pH and temperature on the operation of activated sludge process. The study has been carried out with the laboratory scale reactors operated under specified conditions with diluted pulp mill effluent having $C_pE_{op}DD$ bleaching sequence. Aerobic biological process can be operated within the pH range of 5-9.5 without any compromise on COD and AOX reduction which are 65-71 and 37.5-43% respectively; microbial consortia is well structured and settles rapidly (SVI : 28.5 ml/g). The aerobic reactor can be operated even at pH of 9.5-11.5 with some compromise on AOX reduction (20-25%) and COD reduction (60-65%).

Activated sludge process can comfortably be operated between 30-40°C without any difficulty in operation and compromise on reactor performance, and yield COD and AOX reduction of 68 and 37% respectively though there is some pin point floc formation; SVI of the sludge is 50 ml/g.

The study indicates the importance of equalization and cooling of pulp mill influent before it is fed to the aerobic bioreactors for effective and higher pollutants removal.

Key words: Activated sludge process, pulp and paper mill wastewaters, filamentous organisms, floc forming bacteria, CODs reduction