

Model analysis and controller design for aeration of textile industry effluent

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ABSTRACT

The textile industry uses a number of dyes, chemicals and other materials to impart desired quality to the fabrics. These units generate a substantial quantity of effluents, the quality of which in most of the cases are unsuitable for further use and can cause environmental problems. Disposal and control of textile effluents has been a serious challenge to researchers. Aeration being the primary step in effluent treatment, effluents from textile industry was aerated in a Tokyo Rikakikai fermentor at 300K till saturation. The progress of aeration was monitored with time.

The data which was sigmoidal in nature was fitted to various models by regression analysis. The data was best fitted to a First Order plus Dead Time (FOPDT) model with an error of less than 5 percent. The model was used to design closed loop controllers which perform well for both regulator and servo problems. Various controllers based on conventional Proportional Integral Derivative (PID), Internal Model Controller (IMC) and Genetic Algorithm based PID controller were simulated using MATLAB. The performance was analyzed using criteria such as rise time, settling time, percentage overshoot, IAE, ISE, ITAE. It was found that FOPDT model with PID controller based on GA ranked topmost followed by IMC.

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