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Algae Removal from Petrochemical Industry Wastewater Using Biocide: Factorial Analysis

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Extended Abstract

The petrochemical industries have high potential in the creation of environmental impact. The water from industry is mostly containing toxic pollution [1]. Lagoon system is one of the most popular methods for wastewater treatment. Lagoons are in-ground earthen basins used for the treatment of industrial wastewater by natural process involving the use of algae and bacteria [2]. However, excessive algae growth can cause algae blooms. In wastewater treatment, algae blooms are one of major problem that can cause high pH value in the wastewater plant. There are dozens of alternatives for algae removal such as sand filtrations, chlorination and others. Thus, biocide was used in this study to remove algae in petrochemical wastewater. By using biocide, it has the advantage of producing a high quality effluent for a reasonable operating and maintenance costs. Four independent factors such as type of biocide, ratio of biocide and synthetic wastewater volume (B/W), agitation rate, and hydraulic retention time (HRT) were investigated. A two level factorial design was used to investigate the effect of the independent factors as well as the interaction factors on the pH and reduction of algae mass (%). The experiment was conducted by adding certain amount of salt into certain amount of synthetic wastewater. Shake flask method was applied to study the reaction. The initial and final mass of algae was determined by using dry weight measurement method. The reduction of algae was calculated in Equation 1.

$$\text{Reduction of algae mass} = \frac{Initial - fina}{Initial} \; x\; 100\% \quad \text{(Equation 1)}$$

From the result, some of the independent factors were shown to have significant effect on both pH and reduction of algae mass (%). For pH, the result was shown in Pareto Chart in Figure 1. The order of significance were HRT > agitation > type of biocide > B/WW ratio. It showed that the interaction factor of agitation *HRT had the strongest effect on the pH value. For reduction of algae mass (%), the result was shown in Pareto Chart in Figure 2. The order of significance were HRT > B/WW ratio > agitation > type of biocide. It showed that interaction factor of agitation*HRT had the strongest effect on the reduction of algae mass (%). From analysis, the selected best condition by Design Expert was table salt as biocide with 3:2 B/W ratios at 15 hours reaction time with 100 rpm agitation rate. The results showed that factorial design was suitable in investigating the effect of large number of factors with a minimum number of experiments. Thus, the objective of this research to remove algae from petrochemical industry wastewater using salt as biocide was successfully achieved.

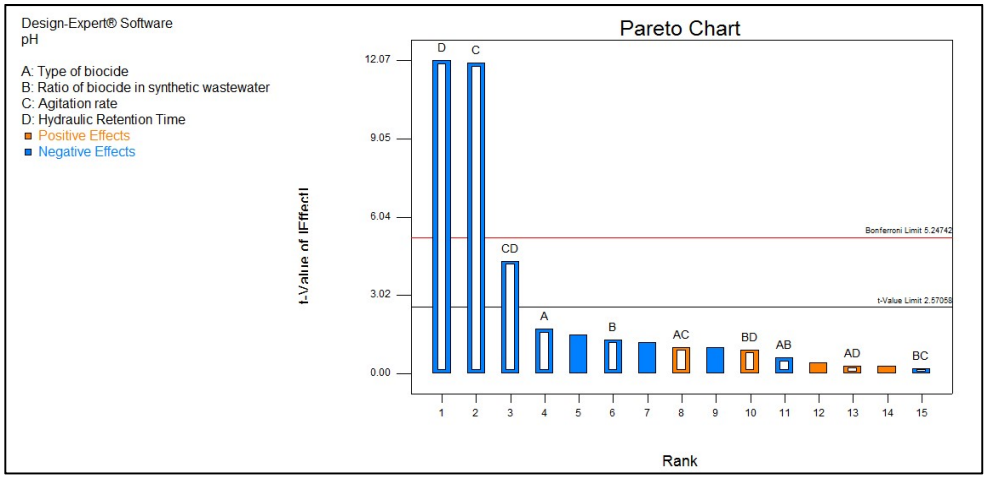

Figure 1: Contribution of independent and interaction effect to pH value.

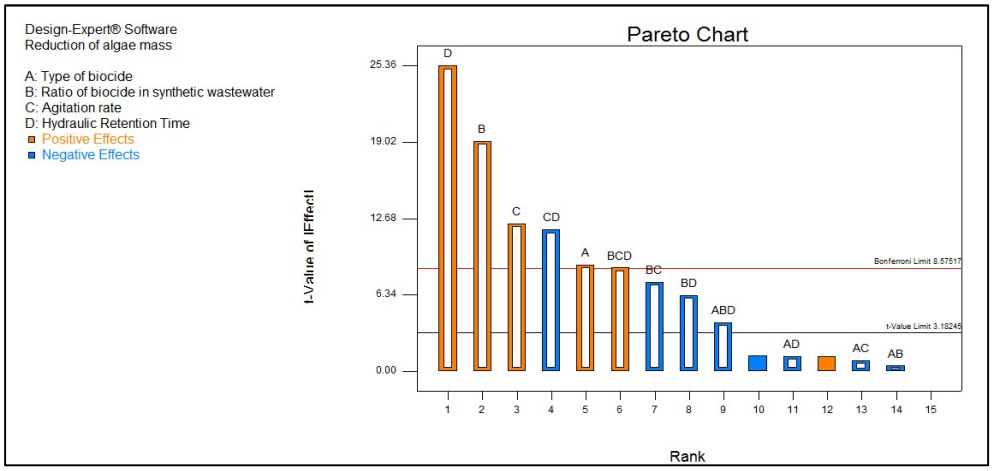

Figure 2: Contribution of independent and interaction effect to reduction of algae mass (%)

Keywords: Fractional analysis; pH; reduction of algae mass; synthetic wastewater; biocide; salt

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