

Kinetics Modeling of Straw Bioremediation as Nutrition in Processing Liquid Waste of Oil and Gas

Ninin Asminah¹, Ismiyati^{1*}, Nurul Hidayati Fithriyah¹, Athiek Sri Redjeki¹

¹Department of Chemical Engineering, Faculty of Engineering, Universitas Muhammadiyah Jakarta, Jakarta, 10510Indonesia

Abstract : Processing performance of hazardous wastes in Indonesia, mainly produced in mining, energy and mineral industries, is well below target. One suitable technique for processing such waste is bioremediation which utilize microorganism activities. Waste rice straw is one potential substrate which carries and supports the bioremediation microorganisms. Lignin in the straw provides nutrients for bacteria and fungi which enable the production of enzymes to degrade pollutants in the waste. Lignin can also increase interfacial surface tension between hydrophobic and hydrophilic fractions in the waste mixture to facilitate their separation. The objective of this study is to model the kinetic of bioremediation which represent the relation between bioremediation period and reduction rate of Total Petroleum Hydrocarbon (TPH). The model utilized characterization results of retentate from waste filtration in terms of water content and pH. The bioremediation process involved mixing of waste rice straw and processed liquid waste from a petroleum refinery plant at 1:20 (m/v) ratio for varied duration of 10, 15, 20, 25, and 30 days. Results showed that the formation rate of water (measured as moisture content in retentate) which indicate the reduction rate of TPH follows 1.2 order of reaction at rate constant of 0.594 day⁻¹. Prediction of Michaelis-Menten model was also performed. The pH of retentate was 8, and organoleptic test observed the turning of color from turbid yellow into dark brown as well as the disappearance of petroleum oil smell, which demonstrated that the processed waste is safe for the environment.

Key words: bioremediation, rice straw, nutrient, petroleum refinery waste, total petroleum hydrocarbon (TPH).

Ismiyati *et al* /International Journal of ChemTech Research, 2020,13(4): 357-363.

DOI= <http://dx.doi.org/10.20902/IJCTR.2019.130404>
