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Synergistic effect of adsorption and Fenton-like oxidation processes for Methylene blue removal using Na-P1 zeolite prepared from pumice

Vicky Prajaputra[a,b], Zaenal Abidin[b,*], Sri Budiarti[c], Dyah Tjahyandari Suryaningtyas[d]

[a]*Study Program of Natural Resources and Environmental Management, Bogor Agricultural University, Bogor 16144, West Java, Indonesia*
[b]*Department of Chemistry, Bogor Agricultural University, Bogor 16680, West Java, Indonesia, email: abidinzed@apps.ipb.ac.id (Z. Abidin)*
[c]*Department of Biology, Bogor Agricultural University, Bogor 16680, West Java, Indonesia*
[d]*Department of Soil and Land Resources, Bogor Agricultural University, Bogor 16680, West Java, Indonesia*

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ABSTRACT

The most problem in the combination of adsorption and Fenton oxidation processes is the low ability of sorbents to degrade organic pollutants. Therefore, the sorbents need to be modified by adding metal salt compounds, especially those containing iron. In this study, we investigated the use of natural pumice to prepare zeolites with high catalytic properties without adding iron sources. Pumice-based zeolite was prepared through simple hydrothermal alkaline treatment and used to remove Methylene blue (MB) from aqueous solution. The characterization results confirmed that the mineral phase of pumice was successfully transformed to GIS-NaP1 zeolite. The maximum value of adsorption capacity increased highly from 7.80 to 35.33 mg g^{-1} after the treatment process. Adsorption isotherm showed a better fit to the Langmuir model with a high correlation coefficient value (R^2 = 0.999) compared to the Freundlich model (R^2 = 0.882). This means the interaction between zeolite and MB followed the assumption of monolayer adsorption on homogeneous surfaces. Interestingly, the synergistic effect of adsorption and Fenton oxidation processes enhanced the ability of zeolite to remove MB with efficiency from 60.92% to 99.99%. Furthermore, zeolite can also be reused several times without reducing its performance significantly after regeneration.

Keywords: Catalytic; Environmental sciences; Equilibrium study; Materials; Methylene blue

* Corresponding author.