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HASIL PENILAIAN SEJAWAT SEBIDANG ATAU PEER REVIEW
KARYA ILMIAH : JURNAL ILMIAH

Judul Artikel Ilmiah : Adsorption of Methyl Orange Dye by Modified Fly Ash-Based Geopolymer – Characterization, Performance, Kinetics and Isotherm Studies

Penulis Artikel Ilmiah : Aprilina Purbasari, **Dessy Ariyanti**, Evi Fitriani

Status Pengusul : Penulis anggota

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Unit kerja : Fakultas Teknik

Bidang Ilmu : Teknik Kimia

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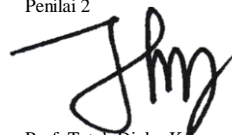
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Nilai pengusul =			(40% x 37,6)/2 =	7,52

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d. Kelengkapan unsur dan kualitas penerbit (30%)	11,00	11,20	11,10
Nilai Total = (100%)	37,00	37,60	37,30
Nilai pengusul = (0,4 x nilai total)/2	7,4	7,52	7,46

Penilai 1

Prof. Dr. Andri Cahyo Kumoro S.T., M.T.
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Semarang,
 Penilai 2

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Adsorption of Methyl Orange Dye by Modified Fly Ash-Based Geopolymer – Characterization, Performance, Kinetics and Isotherm Studies

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¹ Department of Chemical Engineering, Faculty of Engineering, Universitas Diponegoro, Semarang 50275, Indonesia

* Corresponding author's email: aprilina.purbasari@che.undip.ac.id

ABSTRACT

Geopolymer has been widely used as adsorbent for heavy metals and dyes. Modification on geopolymer surface with cationic surfactant can improve the anion exchange capacity of geopolymer. In this paper, fly ash-based geopolymer had been modified with cetyltrimethylammonium bromide (CTAB) which is cationic surfactant and applied as adsorbent of methyl orange (MO) anionic dye. Modified geopolymer had shown better performance as MO dye adsorbent compared to unmodified geopolymer. The adsorption of MO dye showed the best result at low pH and reached equilibrium after 90 minutes. On the basis of kinetics and isotherm studies, MO dye adsorption by modified geopolymer followed pseudo-second-order model and Langmuir model with maximum adsorption capacity of 19.231 mg·g⁻¹.

Keywords: adsorption; methyl orange; modified fly ash-based geopolymer; CTAB surfactant.

INTRODUCTION

Geopolymer is inorganic polymer composed of tetrahedral silicate and aluminate units linked by sharing oxygen atoms. Geopolymer can be prepared from aluminosilicate materials, such as kaolin, fly ash, biomass ash, and slag (Davidovits, 2017; Samadhi et al., 2017). Geopolymer has amorphous to semi-crystalline three-dimensional structures and had been widely used as adsorbent. Many studies have reported that geopolymer can adsorb heavy metals and dyes. In geopolymer, tetrahedral aluminates have negative charge that can be balanced by exchangeable cations. Modification on geopolymer surface with cationic surfactant can improve the anion exchange capacity of geopolymer (Siyal et al., 2018; Selkala et al., 2020; Xu et al., 2022).

One of the most common dyes in textile industries is methyl orange (MO) dye. MO dye is also widely used as pH indicator in titration. MO dye is anionic azo dye that toxic and carcinogenic. Removal of MO dye in wastewater can be carried

out by adsorption. Adsorption is a preferred method to remove MO dye because of its simplicity, high efficiency, and low cost in operation. Adsorbents used for MO dye removal include activated carbon, biochar, biosorbent, clays and minerals, polymers and resins, nanoparticles, and composites (Iwuozor et al., 2021; Wu et al., 2021).

In this paper, fly ash-based geopolymer was modified with cetyltrimethylammonium bromide (CTAB) which is cationic surfactant and applied as MO dye adsorbent. The characterization of modified fly ash-based geopolymer was studied in addition to its performance as MO dye adsorbent with variable of pH, time, and initial concentration. Furthermore, the studies of adsorption kinetics model and adsorption isotherm model had also been conducted.

MATERIALS AND METHODS

The fly ash waste used in this research was obtained from a power plant in East Java, Indonesia, and contained main oxides: SiO₂ (32.4%), Al₂O₃

Pesticides in Small Agricultural Catchments in the Czech Republic

Jana Konečná¹, Antonín Zajíček¹, Milan Sáňka^{2*}, Taťána Halešová³,
Markéta Kaplická¹, Eva Nováková¹

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ABSTRACT

Generally, pesticides are the products containing at least one chemical substance which should protect plant or plant products against pests/diseases. Among them, the most important ones are herbicides, followed by insecticides and fungicides. As a result of intensive agriculture techniques, large amounts of pesticides are applied on agricultural soil. They remain and degrade in soil, but they can enter water bodies and negatively affect water quality and the aquatic ecosystem. The article deals with the level of pesticide load in soil, bottom sediment and surface water in chosen agriculture catchments in the Czech Republic. Results revealed that the main general problem is glyphosate and its metabolite AMPA, although their application has been constrained for several years. Furthermore, the difference in contents of chosen parent pesticide substances and their metabolites in soils and waters were pointed out.

Keywords: soil, sediment, water, glyphosate, AMPA, parent pesticides, metabolites.

INTRODUCTION

Intensive farming in the Czech Republic brings a wide spectrum of pesticides into the arable land. They partly remain in soil, are degraded and partly transported to water bodies. Besides agricultural land, there are also point pesticide sources (e.g. municipalities) as a potential risk of surface waters pollution, but the study aims at agricultural non-point sources. In a catchment, there are two main ways of material transport: water erosion (surface runoff), infiltration and subsequent subsurface runoff. Transport by water erosion is an extensive problem in the Czech Republic. Due to large blocks of arable land, steep slopes and soil erodibility, about 50% of the agricultural land is threatened by the aforementioned soil degradation process. Subsurface runoff can be accelerated on leachy soils and with ameliorative drainage. Subsoil drainage was built in the Czech Republic in the last century to extend agricultural land and obtain higher yield and

consequently, it extends to about 25% of arable land now (Kulhavý and Fučík 2015).

Although the currently used pesticides (CUPs) are not persistent in the environment, they can still accumulate in soil and water, as a result of their repeated use (“pseudo persistence”), since their degradation is slower than their input (Hvězdová et al. 2018). Moreover, the degradation products of CUPs can remain in the soil for a long time and can have similar negative effects on ecosystems as the original substance (Halešová et al. 2021). This happens despite the sophisticated process of risk assessment which must be done for each active substance and product as a part of authorization to ensure compliance with European rules (Regulation EC No. 1107/2009). Since groundwater contamination can pose a direct risk for humans and it is relatively better described (e.g. Kodeš et al. 2016, Syafrudin et al. 2021) than contamination coming in soil, a system of limit values for concentrations of selected CUPs in groundwater has been developed in many countries and also

Assessment of Ultrasound-Assisted Extraction of Caffeine and its Bioactivity

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ABSTRACT

This research focused on using spent coffee grounds as a source of caffeine by ultrasound-assisted extraction technique. Two types of ultrasound techniques (ultrasonic bath and ultrasonic probe) were studied to extract caffeine. The effect of the sonication type sonication power, extraction time, and extraction temperature on the extraction efficiency was investigated. The results demonstrated that extraction by an ultrasonic probe is superior to ultrasonic bath extraction. The highest caffeine recovery was obtained at 55 °C by using an ultrasound bath where caffeine concentration was 795.74 mg/L after 60 min. The bioactivity of extracted caffeine was also studied and compared with the bioactive of standard caffeine against *candida albicans* yeast. The results showed that the minimum inhibition concentration for natural caffeine was 100 mg/L which is half of the minimum inhibition concentration of standard caffeine.

Keywords: sonication, spent coffee grounds, caffeine, *candida. Albicans*.

INTRODUCTION

Coffee has been consumed as a beverage for a long time (Blinová et al., 2017). Coffee beans are the feedstock for producing coffee beverages by soluble coffee industries (Campos-Vega et al., 2015). The making of coffee beverages can take place in houses, cafeterias, restaurants, and cafes. Caffeine (1, 3, 7-trimethyl-3, 7-dihydro-1H-purin-2, 6-dion) is a methyl xanthine alkaloid of chemical formula $C_8H_{10}N_4O_2$. It is essentially obtained from coffee beans and leaves (Musa Ali et al., 2012), and also it can be found in tea leaves (Soni, 2019), cocoa beans (Grassia et al., 2019), and kola-nut (Umeda et al., 2020). This alkaloid is the most valuable, and its value comes from its importance to humans, where it works as a stimulant drug that improves attention (van Dam et al. 2020) (Alsamarrai, 2022). However, the importance of caffeine as a pharmaceutical compound goes beyond just being a stimulant drug (Monteiro et al., 2019), where its effectiveness as a drug was studied for many medical cases to reduce their intensity or their possibility of accruing, such as consuming coffee may stimulate the gallbladder,

which will reduce the risk of gallstones (Grosso et al., 2017). Caffeine could also reduce the development of some diseases like Parkinson's risks by protecting the brain cells (Aaseth et al., 2018), and it can relieve asthma attacks (Wolde, T. 2014, Platritis et al., 2013). Although caffeine has health benefits, some adverse health effects may come along with high consumption rates, such as high incorporation with decreasing bone density, which leads to osteoporosis (Bijelic et al., 2017). It can cause dehydration (Erickson-Levendoski et al., 2011) and affect sleep quality (O'callaghan et al., 2018), it is related to causing strokes seizures when consumed in a certain dosage (Ali, 2019). The bioactivity of caffeine as an inhibitor for pathogenic microorganisms is also important to explore and use in pharmaceutical industries (Han et al., 2016, Raut et al., 2013). Caffeine extraction has been carried out with several extraction techniques, such as Soxhlet extraction (Torres-Valenzuela et al., 2019), solid-liquid, and liquid-liquid extraction (Andrade et al., 2012). These methods are commonly used to extract caffeine from spent coffee grounds. However, these technologies have some disadvantages,