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

Judul Jurnal Ilmiah (Artikel)	:	Effect of vortex limiter position and metal rod insertion on the flow field, heat rate, and performance of cyclone separator
Jumlah Penulis	:	5 orang (**Eflita Yohana,** Mohammad Tauviqirrahman, Bachtiar Yusuf, Kwang-Hwan Choi, Vita Paramita)
Status Pengusul	:	penulis Ke-1 (Bukan Penulis Korespondensi)
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Reviewer 2

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Reviewer 1

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LEMBAR
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b. Ruang lingkup dan kedalaman pembahasan (30%)	12,00			11,50
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Effect of vortex limiter position and metal rod insertion on the flow field, heat rate, and performance of cyclone separator

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Abstract

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Effect of vortex limiter position and metal rod insertion on the flow field, heat rate, and performance of cyclone separator

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ABSTRACT

A cyclone is widely used in the industrial world for the particle separation process. Many geometrical and operational parameters affect the cyclone separator performance. The main aim of the present study is to investigate the effect of the position of the vortex limiter and the insertion of the metal rod on the heat transfer, flow field, and cyclone performance using the computational fluid dynamics (CFD) method. Vortex limiter position varies among 160 mm, 320 mm, and 480 mm. In this work, the Reynolds stress model (RSM) is used to simulate the flow, and the Eulerian-Lagrangian approach is employed to predict the movement of particles in the cyclone. Simulation results show that the insertion of a metal rod increases the heat rate and collection efficiency by about 22% and 13%, respectively. The results also confirm that the vortex limiter position is proven to affect the performance of cyclone significantly.

1. Introduction

A cyclone separator is a tool widely used for the process of particle separation because of its simple design and low cost of construction and operating [1]. When the mixed-phase enters the cyclone separator, the phase will move around and form the outer vortex region (quasi-free vortex). Consequently, the solid phase will separate from the cyclone and collect at the bottom. In contrast, the gas phase will exit through the outlet and form the inner vortex (quasi-forced vortex) [2]. The flow inside the cyclone separator is very complicated because the type of flow is in the form of a double vortex.

The complexity of flow patterns in the cyclone has long been a primary focus in many experimental and theoretical studies. With the advancement of computer technology, the use of CFD (computational fluid dynamics) method has a tremendous potential tool for analyzing the flow behavior during the separation process inside the cyclone separator. It is worth mentioning the early work of Griffiths and Boysan [3], who examined the usefulness of a computational fluid dynamics (CFD) package to model the collection performance of a range of small sampling cyclones. Later, the same efforts were made by Kaya and Karagoz [4]. They investigated the suitability of various numerical schemes for obtaining axial and tangential velocity profiles, pressure drop, and turbulent quantities in the cyclone separator. It is noted that the same conclusion has been obtained by two groups mentioned earlier, i.e., CFD analysis yields a reasonably good prediction of the flow characteristics and the performance and the cyclone separator in comparison with the experimental approach. CFD widens the range of solvable separation process problems and makes the design process of the cyclone more convenient.

The cyclone performance is often assessed by the efficiency of particle collection and pressure drop. This performance depends on the swirling motions of the fluid. For calculation of the swirl flow, there are available methods of numerical methods, including standard k-ε turbulent model, RNG k-ε turbulent model, Reynolds stress model (RSM), and Large Eddy Simulation (LES). Generally, based on the literature survey, only the Reynolds Stress Model (RSM) and Large Eddy Simulation (LES) are recognized to capture the primary features of the highly complicated swirling flow in the cyclone [4–10]. Compared to the standard k-ε and the RNG k-ε turbulence model, the RSM turbulence model gives a more accurate result with respect to the experimental results [4,8]. A very interesting review regarding the existing CFD studies of cyclone separators was obtained in [11]. Nakhaei et al. [11] revealed that the use of the LES model for the prediction of the flow inside cyclones provides more accurate results compared to RSM but with a higher computational cost. Nonetheless, the RSM can give reasonable predictions of cyclone performance at a much lower computational effort (such as a coarser grid) than LES.

Several works on the cyclone aerodynamics and its performance with different geometries of the vortex finder have been carried out. According to Juengcharoensukying et al. [12], the dimensions of the vortex finder have essential influences on flow patterns and pressure drops. Ni

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Hierarchical mesoporous ZIF-67@LDH for efficient adsorption of aqueous Methyl Orange and Alizarine Red S.

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ABSTRACT

Metal-organic frameworks (MOFs) are traditional porous materials considered as efficient and low-cost for the removal of organic dyes from polluted water. In this study, we report a new type of hierarchical porous zeolitic imidazole frameworks —67@ layered double hydroxide (ZIF-67@LDH) consisting of nanocubes decorated with nanosheets. The prepared ZIF-67@LDH contains versatile functionalities which exhibit superior adsorption efficiency and adsorption rate for Methyl Orange (MO) and Alizarine Red S (ARS). The influence of pH, temperature, and contact time were analyzed in detail. The kinetics study revealed that the adsorption of MO and ARS over ZIF-67@LDH followed pseudo-second order (PSO) kinetic model, and adsorption isotherms were best described by the Langmuir isotherm model. Adsorption isotherms confirm the monolayer adsorption of MO and ARS over ZIF-67@LDH. The prepared material also shows outstanding recyclability with negligible loss. Thus ZIF-67@LDH presented a promising candidate for treating MO and ARS containing wastewater.

1. Introduction

The increase of textile industries generates a significant amount of dyes in water after coloring their products [1,2]. It is estimated that, annually, 700 kt of dyes stuff are produced, and 5–10% of these dyes are wasted in industrial effluents [3]. The majority of these dyes are soluble in water and very durable pollutants [4,5]. MO is a water-soluble azo dye and extensively used in textile, pharmaceutical, and printing papers [6]. ARS is a kind of anthraquinone water-soluble dye that is also very durable. These azo dyes contain complex molecular structures and intense color pigments due to the azo group [7,8]. The discharge of toxic industrial wastewater into the environment cause toxicity to an organism. The release of such wastes containing dyes without treatment is hazardous because of their mutagenic and carcinogenic effects. They also prevent the sunlight through water, which leads to slow down the photocatalysis process and low dissolved oxygen level affecting the entire aquatic life. These dyes in the effluents can cause severe harm to the environment, aquatic life as well as humans, even if their presence is less than 1 mg/L [9–11].

Various techniques like photocatalysis [12–14], biological treatment [15], ion exchange method [16], coagulation, ozonation [17], and adsorption [18,19] are employed for the adsorption of aromatic dyes, but all of these have their own limitations. Among these techniques, the adsorption process is considered economical and reliable among these techniques because of high productivity, recycle and reusability, and the vast choice of adsorbent materials [20–22]. For wastewater treatment, a lot of adsorbents have been utilized. Activated carbon is a famous adsorbent, but it is not economical [23]. Other alternate adsorbents are polymers [24,25], clays [26], fly ash [27] zeolites [28].

Layered double hydroxides (LDHs) are receiving considerable attention among all the adsorbents having high anion exchange properties, higher adsorption capacity, and economic feasibility [29,30]. LDHs are 2D structured positively charged brucite like layers widely used in anion exchangers [31], drugs, catalysts [32], and adsorbents [33]. The chemical structure formula is written as $[M^{2+}_{(1-x)}\ N^{3+}_{(x)}\ (OH)_2]^{x+}\ [A^{n-}]_{x/n}$. yH_2O, where M^{2+} is a divalent metal cation, and N^{3+} is a trivalent metal cation and A^{n-}indicates active anion, e.g. (NO_3^-, SO_4^-, CO_3^-, Cl^-) [34,35]. LDHs can be synthesized by ultrasonic irradiation [36] and hydrothermal method [37]. The LDHs are widely acknowledged as potential adsorbents in wastewater treatment applications, which is mainly attributed to their interlayered anionic exchange property, and tunable interior structure [38,39]. Despite the efficiency of LDHs towards anionic dyes, they have some limitations. Since LDHs is two-dimensional materials, the size and stacking of their nanosheets greatly decrease their surface area. Due to the lower surface area and the smaller interlayer distance, they do not have enough active sites for MO and ARS ions, which hinders the molecular diffusion of these ions. Furthermore, LDHs get agglomerate easily due to the stacking of their dense, layered nanosheets. And many small agglomerated particles with poor morphology will lower the reusability of LDHs [40–42]. To resolve these problems, it is necessary to fabricate a kind of three dimensional (3D) LDHs to avoid stacking of nanosheets between the layers and aggregation. ZIF-67 was a feasible template due to its 3D zeolite topological

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Photoprotection and release study of spinosad biopolymeric microparticles obtained by spray drying

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ABSTRACT

Microparticles containing the photosensitive spinosad (SP) were obtained using a combination of chitosan (CH) and sodium lignosulfonate (SL) as encapsulating materials to develop a photoprotective system for intake administration. The microparticles were obtained by a spray drying technique and were characterized in terms of morphology (scanning electron microscopy - SEM) and particle size. *In vitro* release studies showed an initial burst effect that fits very well with the zero order kinetic model and then a slow release of the bioinsecticide, which fits best with the first order model. The results of this work demonstrate that the bioinsecticide carrier system developed with natural polymeric materials presents high stability to photodegradation and adequate insecticide release for use as a strategy to reduce negative impacts on the environment in agronomic practices.

1. Introduction

Despite the existence of efficient sustainable alternatives, the agriculture industry is still using organic chemical pesticides for pest control [1]. Undoubtedly, the integrated pest management used in agriculture with a traditional approach seems to be insufficient, since these practices involve the indiscriminate application of pesticides, which might have many losses due to leaching, deposition, hydrolysis, photodegradation and microbial activity [2]. Also, due to the inherent toxicity of pesticides, the health of animals, humans and the entire environment is at risk [3]. On the other hand, various vector species have developed resistance to synthetic pesticides [4].

In this context, the use of pesticide carrying systems on a micro and nanometric scale provides a competent alternative for pest management, thus avoiding various negative impacts associated with conventional pesticide management [5–8]. These systems can be produced from biodegradable materials and can slowly release the functional molecules that they contain, which reduce the frequent applications. Moreover, they have a small size, large load capacity and surface area, and greater stability and solubility when compared with their bulky equivalents [9,10]. Hence, given the growing global demand for food and the urgency to develop sustainable strategies for pest control, one of the alternative solutions is the use of encapsulated biopesticides, which include pheromones of insects, entomopathogenic nematodes, baculovirus, and natural pesticides derived from plants and microorganisms [11].

Spinosad (SP) is a bioinsecticide product obtained from the fermentation of actinomycete *Saccharopolyspora spinosa* [12] that acts primarily by disrupting nicotinic acetylcholine receptors [13]. It is considered an environmentally safe insecticide and constitutes an alternative to broad spectrum insecticides due to the low toxicity in mammals and the low doses required [14]. Nonetheless, these and many other bioinsecticides are photodegradable and are rapidly affected by biodegradation [15,16], which limits their use in agriculture. Regarding this particular lability, the work of Cleveland et al. [16] showed that SP photolysis in aqueous solution caused a half-life of 1 to 2 days in summer sunlight (unmonitored irradiation) and that this pathway (photolysis), mainly due to the loss of forosamine sugar and reduction of the 13, 14 bond in the macrolide ring in the SP structure, is the main route of dissipation, above hydrolysis and other mechanisms. On the other hand, the work of Adak and Mukherjee [17] revealed that exposure of SP to UV light has more severe photodegradation results, compared to exposure to sunlight.

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