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KINETICS PARAMETERS ANALYSIS OF BIOFLOCCULANT PRODUCTION FROM *Alcaligenes latus* ON THE SUBSTRATE OF HYDROLIZATE OF SOLID WASTE FROM PULP AND PAPER INDUSTRY AND ON GLUCOSE

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ABSTRACT

There are two kinds of waste being discharged in the pulp and paper industry, namely wastewater and solid waste which contains lignocellulosic materials. Lignocellulosic materials are potential to be used as substrate for microbial bioconversion. During the study *Alcaligenes latus* used the hydrolizate of solid waste from pulp and paper industry to produce bioflocculant, which could flocculate wastewater that contained suspended solids. For all the experiments *A. latus* grew well on solid waste hydrolizate, giving about 2.21 g product/g substrate and 1.09 g biomass/g substrate. Cultivation on glucose yielded about 4.42 g product/g substrate and 2.84 g biomass/g substrate. The specific growth rates of bacteria on the substrate of hydrolizate of solid waste from pulp and paper industry and glucose were 0.0527/h and 0.0237/h, respectively.

Keywords: *Alcaligenes latus*, bioflocculant, solidwaste, wastewater

Pulp and paper industry has been one of the industrial activities that attract a lot of environmental concerns, due to the pollution that might be generated. During the process, solid and liquid wastes are discharged, which need further treatment to avoid environmental pollution. One of the way to treat wastewater from pulp and paper industry is flocculation. Flocculation could reduce suspended solids in wastewater and perform suspended solids and colloid to become big particles which are easy to separate with precipitation.

However, studies indicated that the monomers of acrylamide being used to flocculate wastewater is both neuro-toxic and strongly carcinogenic in human body (Kurane & Nohata, 1994). The use of these flocculating agents is therefore harmful to the environment and may be a dangerous source of pollution that can adversely affect the future generations. Thus, a safe biodegradable flocculant that is produced on substrate of hydrolizate of solid waste from pulp and paper industry by microorganisms is expected to minimize environmental and health risks. This study observed the kinetics process during the production of bioflocculant by *Alcaligenes latus* grown on the hydrolizate of solid waste of pulp and paper industry.

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MATERIALS AND METHOD

Microorganism

A. latus which is capable of producing a new bioflocculant was used. Solid waste was obtained from PT. Kertas Bekasi Teguh (KBT), Bekasi-Indonesia. The material was dried to 10% moisture content, grounded and then sieved to pass a 40-60 mesh sieve.

Hydrolysis with Diluted Acid

Alkali treatment was applied to the solid particles of waste using sodium hydroxide 1 N (1 : 20 (b/v)). The solution was mixed for 2 hours then autoclaved at 121°C for 15 minutes (Anis *et al.*, 1994). Hydrolysis of the solid waste was performed using sulfuric acid 0.3 M (256 g/l) at 96°C for 5 hours. The mixture was then filtered, washed and neutralized.

Cultivation of the Microorganism

Composition of the medium was as follows: 15 g glucose or 10 g/l hydrolizate of solid waste, 6.75 g K_2HPO_4, 2.25 g KH_2PO_4, 0.3 g $MgSO_4.7H_2O$, 0.15 g NaCl, 1.5 g urea, 0.75 g yeast extract, and 1.5 destiled water, adjusted to pH 7.2. Cultivation was carried out in a bioreactor (Mini Jarfermentor M-100) at 30°C for 7 days with 6 blade turbines operated at 150 rpm (Kurane & Nohata, 1994). Samples were analyzed every 12 hours for biomass, product (bioflocculant), reducing sugar, viscosity and pH values.

Purification of Bioflocculant

The culture broth was diluted with ten volumes of distilled water, and NaOH (0.02-1%) was added to dissolve the bioflocculant. The broth was then heated and maintained at 121°C for 10 min, following which the cells were removed by centrifugation (40 000 g x 30 min). The liquid sample was concentrated with a membrane filter (0,2 µm pores) after removing the cells.

Kinetic Parameters

Kinetics parameters of bioflocculant production was estimated from logistic equation for cells growth,

$$dx/dt = \mu x(1.0-x/x_{max}) \ldots\ldots\ldots (1),$$