International Journal of Applied Engineering Research ISSN 0973-4562 Volume 12, Number 17 (2017) pp. 6821-6831
© Research India Publications. http://www.ripublication.com

A Parabolic-Curvilinear Reverse-Flow Air-Flotation System (PAF) for Removal of Suspended Solids in Sago Starch Production Wastewater Effluents

Oon Yin Wee[1,*], Law Puong Ling[1], Kopli Bujang[2] and Lim Soh Fong[1]

[1] *Faculty of Engineering, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia.*

[2] *Faculty of Resource Science and Technology, Universiti Malaysia Sarawak, 94300 Kota Samarahan, Sarawak, Malaysia.*

[1]*ORCID iD: 0000-0001-8651-2880*

Abstract

A Parabolic-Curvilinear Reverse-Flow Air-Flotation Treatment System (PAF) was recently developed for the removal of total suspended solids from sago starch production wastewater effluents. The primary components of the system consist of a parabolic-curved plate, a series of water pumps, an air curtain and valve-froth collection plates to repeat bubbling treatment in a gradually increasing movement flow. Performance tests were carried out by using synthesized sago wastewaters. Performance tests were carried out to determine the total suspended solids and turbidity removal efficiencies. Total suspended solids of the synthesized sago wastewaters ranged from 95 to 515 mg/L, 86.9 to 413 NTU for turbidity and 5.44 to 7.43 for pH. The total suspended solids and turbidity removal efficiencies of this system were found to be proportional to residence time, and inversely proportional to influent flowrate. The highest achievable total suspended solids and turbidity removal efficiencies for this treatment system recorded 85.63% and 77.89%, respectively. The presence of parabolic-curved plate in the system could improve the removal efficiencies as high as 34.22% for total suspended solids and 37.82% for turbidity. The system performance can further be improved by 13.65% for total suspended solids removal and 24.49% for turbidity removal with the installation of air curtain whilst 9.04% for total suspended solids removals and 6.03% for turbidity removals with the installation of water pumps in the system. Additional 17.2% of total suspended solids and 3.1% of turbidity level removals could be achieved by application of chemicals, i.e., alum and sodium aluminate.

Keywords Air Flotation, Total Suspended Solids, Sago Factory Wastewater Effluents

Nomenclature :

AC	Air curtain
PAF	Parabolic-curvilinear reverse-flow air-flotation treatment system
PC	Parabolic-curved plate
Pa	Water sample taken at the inlet of PAF system
Pb	Water sample taken before the air curtain zone and after the water pump zone of PAF system
Pc	Water sample taken at the outlet of PAF system
Pd	Water sample taken on water surface of froth collection corner of PAF system
WP	Water pump

INTRODUCTION

Sago palm (*Metroxylon Sagu*) was found to be the premier starch producer among the starchy crops of the world, especially in tropical countries [1;2]. Due to good market price (US$ 500 /tonne) for sago starch, more sago processing operations are expected and wastewater effluents (200,000 to 300,000 tonnes per annum globally) generated are magnificently folded [3;4]. Wastewater effluents generated from a sago factory that operating 6-7 days per week and 24 hourly are voluminous with an average effluent discharge rate of approximately 30 L/min (1.8 tons/hr) [5]. Rapid development in sago and starch production industries has left various environmental impacts, especially water pollution problem to the environment. However, only few of the factories have implemented wastewater treatment facilities for environment conservation purposes as this is most probably due to high energy/cost input (20% to 50% of the total starch production cost) and unreliable treatment efficiency although they are aware of the need for such measures [6;7;8;9;10;11;12;13;14]. High concentration of total suspended solids (66 to 12,936 mg/L), biochemical oxygen demand (900 to 3,444 mg/L) and chemical oxygen demand (780 to 12,409 mg/L) are found in raw sago factory wastewater effluents [7;11;15;16;17;18;19;20]. Literature reviews stated that sago wastewater contains massive amount of very fine/light suspended matters, protein, ash and fat/lipid contents which demonstrated floating behaviour in nature with specific gravity of nearly 1.0 or less than 1.0 [21;22;23]. Removal of fine suspended particles (< 30 µm) which possesses low settling velocities are impractical by using gravitational sedimentation pond or mechanical filtration methods [24]. These floating or slow settling constituents (such as protein, lipids and carbohydrates), together with