

漁產廢水生物膠凝吸附與沉澱處理程序之研究

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摘要

本研究採用生物膠凝吸附(bio-flocculation-adsorption)沉澱程序取代傳統二級處理的初沉池，改善漁業廢水的處理效率。生物膠凝吸附沉澱程序的影響參數包括曝氣時間與混合液懸浮固體濃度(MLSS, mixed liquor suspended solids)。最佳條件的曝氣時間與混合液懸浮固體濃度分別為0.5立方公尺/小時/立方公尺(20分鐘)，4公克/公升。沉澱時間則為1.5小時。本研究顯示生物處理前生物膠凝吸附沉澱程序的總懸浮固體去除率為84.64%，而單純沉澱51.43%，硫酸鋁化學沉澱86.29%。但就全處理系統(含活性污泥程序)而言，生物膠凝吸附沉澱程序BOD(5天)去除率93.8%，優於單純沉澱64.36%與硫酸鋁化學沉澱73.54%。推斷生物膠凝吸附過程具有污泥馴化與生物降解的功效。基於廢水處理效率與成本考量，生物膠凝吸附沉澱程序與活性污泥系統的組合是處理漁業廢水的可行方案。

關鍵詞：生物膠凝、生物吸附、活性污泥、漁業廢水

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參考文獻

1. El-Gohary, F. A., Abo-Elala, S. I., Shehata, S. A., El-Kamah, H. M. (1991). Physicochemical-biological treatment of municipal waste water. *Water Sci. Technol.* 24, 285-292.
2. Gambrell, M. P., Mara, D. D., Silva, S. A. (1992). Physical-chemical treatment of tropical wastewater, production of microbiologically safe effluents for unrestricted crop irrigation. *Water Sci. Technol.* 26 7-8, 1449-1458.
3. Ardenn, E., Lockett, W. T. (1914). Experiment on the oxidation of sewage without the aids of filters. *J. SOC. Chem. Ind.* 33, 523-539.
4. Wahlberg, E.J., Keinath, T.M., Parker, D.S. (1994). Influence of activated sludge flocculation time on secondary clarification. *Water Environ. Res.* 66, 6, 779-786.
5. <https://www.cia.gov/library/publications/the-world-factbook/geos/vm.html>
6. Dan Nguyen, C. and C.T. Environmental management strategies for seafood processing industries in Vietnam.
7. Pankaj Chowdhury, T. V, A. Srinivasan (2010). Biological treatment processes for fish processing wastewater – A review, *Bioresource Technology* 101 (2010) 439 – 449.
8. Amit Bhatnagar, Mika Sillanpaab (2010). Utilization of agro-industrial and municipal waste materials as potential adsorbents for water treatment—A review. *Chemical Engineering Journal* 157, 277 – 296.
9. Olivier Lefebvre, Rene ' Moletta (2006). Treatment of organic pollution in industrial saline wastewater: A literature review. *Water Research* 40, 3671 –

3682. 10.S.D. Faust, O.M. Aly (1987). Adsorption Process for Water Treatment. Butterworths, Publishers, Stoneham. 11.The thesis of Mr. Somsanith Duangpaseuth, et al.. Seafood Processing, ED78.20 Industrial Waste Abatement and Management, Asian Institute Technology (AIT). 12. FAO Fisheries Technical Papers, V9922/E, Wastewater treatment in the fishery industry, 1996, ISBN92-5-103788-4. <http://www.fao.org/docrep/003/V9922E/V9922E00.HTM> 13.Claudia V. G. and Gonzalez J.F. (1998). Solids removal by coagulation from fisheries waste waters. Water SA Vol. 24 No. 4, 371-372. 14.Tchobanoglous, G., Burton, F. (1991). Wastewater Engineering: Treatment, Disposal and Reuse. Metcalf and Eddy Inc, New York. 15.L.Semerjian, G.M.Ayoub (2003). High-pH – magnesium coagulation – flocculation in wastewater treatment. Advances in Environmental Res. 7, 389 – 403. 16.Peter Spencer Davies (2005). The Biological Basis of Wastewater Treatment. Ph.D, Strathkelvin Instruments Ltd. 17.Zumriye Aksu (2005). Application of biosorption for the removal of organic pollutants: A review. Process Biochemistry 40, 997 – 1026. 18.The thesis of Suleman Qaiser (2009). Mechanism of Heavy Metal Removal by Agro Fibers. Pakistan Research Repository: <http://eprints.hec.gov.pk/4039/1/3428H.htm> 19.N. T. Abdel-Ghani, et al. (2007). Influence of operating conditions on the removal of Cu, Zn, Cd and Pb ions from wastewater by adsorption. Int. J. Environ. Sci. Tech., 4 (4): 451-456 20.S. S. Ahluwalia & D. Goyal (2007). Microbial and plant derived biomass for removal of heavy metals from waste water. Bioresour Technol, 98, 2243-2257. 21.Nilanjana Das, R. Vimala and P. Karthika (2008). Biosorption of heavy metals – An overview. Indian Journal of Biotechnology Vol 7, pp 159-169. 22.The thesis of Nur Suhada Binti Sulaima (2005). Biosorption of Coppre (II) From Aqueous Solution by Using Dried Water Hyacinth (Eicchornia Crassipes). Faculty of Chemical & Natural Resources Engineering, Universiti Malaysia Pahang. 23.T.V. Ramachandra, N. Ahalya & RD. Kanamadi. Biosorption: Techniques and Mechanisms. CES Technical Report 110. 24.APHA, (1998): Standard Methods for the Examination of Water and Wastewater, Edition. 25.Jenny Poland and Todd Pagano. Jar testing. Water treatment primer <http://www.webapps.cee.vt.edu/ewr/environmental/teach/wtprimer/jartest/jartest.html> 26.Richard I. Dick and P. Aarne Vesilind (1969). The Sludge Volume Index – What is it? Journal Water Pollution Control Federation. 27.Lin Wei, Tianqiu Hong (2010). Biosorption of Organic Pollutants by ActivatedSludge: Equilibrium and Kinetic Modeling. Bioinformatics and Biomedical Engineering (iCBBE). 28.Nayef Z. Al-Mutairi (2005). Coagulant toxicity and effectiveness in a slaughterhouse wastewater treatment plant. Civil Engineering Department, Kuwait University.