EFFICIENCY OF EFFECTIVE MICROORGANISMS (EM) IN MUDBALLS AS BIOREMEDIATOR OF WASTEWATER

BY

NORIELLE C. DE OLON

An undergraduate thesis presented to the faculty of the College of Fisheries in partial fulfilment of the requirements for the degree of

BACHELOR OF SCIENCE IN FISHERIES

Department of Aquatic Resources, Ecology and Management
COLLEGE OF FISHERIES
CENTRAL LUZON STATE UNIVERSITY
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EFFICIENCY OF EFFECTIVE MICROORGANISMS (EM) IN MUDBALLS AS BIOREMEDIATOR OF WASTEWATER[1/]

ABSTRACT

The study focused on the effect of EM mud balls and liquid EM in water quality parameters such as dissolved oxygen, pH and level of ammonia. The study had 4 treatments, each replicated three times. The treatments were: Treatment 1 (control), Treatment 2 (mud ball with no EM), Treatment 3 (mud ball with EM) and treatment 4 (Liquid EM mixture). The experiment has been done in plastic buckets with the area of 0.12 square meter and the volume of 60 liters (Fig. 1). Three inches of the bucket height is filled with pond bottom soil. The plastic buckets is filled with 50 liters of water to artificially create a pond condition and then applied 5 kilograms of chicken manure. The treatments and their replicates will be arranged randomly following a completely randomized design. The experiment lasted for 30 days.

On the mean of the result in all parameters, most of the water parameters have improve in quality however, only pH and Un-ionized ammonia showed a significant difference after the conduct of the experiment.

From this study it can be concluded that EM mud ball and EM in liquid both can enhance some of the water parameters in such exact concentration prior to the toxicity/level of pollutant of the water.

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LITERATURE CITED

Canadian Council of Ministers of the Environment. 2010. Canadian water quality guidelines for the protection of aquatic life. Retrieved from file:///C:/Users/User/Downloads/Canadian%20Ammonia%20(en).pdf on June 05, 2018.

Diver, S. 2001. Nature farming and effective microorganisms. Retrieved fromhttp://ncatark.uark.edu/~steved/Nature-Farm-EM.html on November 20, 2016.

Dubon, M. 2014. Promoting Canadian agrifood exports, effective microorganisms (EM) for accelerating composting. Retrieved from file:///E:/thesis%20mudball/newpdfthesis/Dubon-Madeline-.pdf on October 11, 2017.

EM Technology. 1998. Effective microorganisms for a sustainable agriculture and environment. Retrieved from: http://emtech.org/prod01.html on February 8, 2017.

EMRO. undated. How EM works. Retrieved from https://emrojapan.com/how/ on November 20, 2016.

Evans J. and D. Pasnik. 2006. Un-ionized ammonia exposure in Nile tilapia: toxicity, stress response, and susceptibility to *Streptococcus agalactiae*. Retrieved from https://digitalcommons.unl.edu/cgi/viewcontent.cgi?article=1536&context=usdaarsfacpub on June 05, 2018.

da Silva, F.J.R., F.R.S. Lima, D.A. do Vale and M.V. do Carmo e Sá. 2013. High levels of total ammonia nitrogen as $NH4^{+}$ are stressful and harmful to the growth of Nile tilapia juveniles. Maringá, 35(4): 475-481.

Higa, T. undated. Effective microorganisms for sustainable community. Retrieved from http://www.envismadrasuniv.org/pdf/Effect%20Microorganisms.pdf on March 14, 2017.

Higa, T. and N. Chinen. 1998. EM treatments of odor, waste water, and environment problems. Retrieved from http://www.scienzaegoverno.org/sites/default/files/file_attach/Relazione%20Dr%20Higa.pdfon March 14, 2017.

Rao, S.M. and P. Mamatha. 2004. Water quality in sustainable water management. Current Science, 87(7): 942-947. Retrieved from file:///C:/Users/User/Desktop/USBFILES/thesis%20mudball/rao%20and%20mamatha.pdf on September 20, 2017.

Sekeran, V., C. Balaji and T.B. Pushpa. 2005. Evaluation of effective microorganisms (EM) in solid waste management. Retrieved from https://escholarship.org/uc/item/56q5g376#page-1 on September 25, 2017.

Seng, H., S. Dokkratoom and N. Pijarn. 2015. Effect of EM ball on DO, BOD and COD of wastewater treatment plant in Bangkokthonburi University, Thailand. Retrieved from: http://www.isaet.org/images/extraimages/P615284.pdf on January 13, 2017.

Szymanski, N. and R.A. Patterson. undated. Effective microorganisms (EM) and waste water systems. Retrieved from file:///C:/Users/User/Desktop/USBFILES/thesis%20mudball/P53-03-Szymanski-Patterson.pdf on September 25, 2017.

The Goa Foundation/Green Goa Works. Undated. Effective microorganisms brochure. Retrieved from http://www.goafoundation.org/images/em_brochure.pdfon May 16, 2017.

The Recycle Works, Ltd. undated. What are effective microorganisms (EM's) and using the EM activator?. Gardening woks in harmony with nature-brochure. Retrieved from file:///C:/Users/User/Desktop/USBFILES/thesis%20mudball/Using_the_Garden_Yoghurt_Maker.pdf on October 6, 2017.

Wahid, W. and S. Azman. 2005. Improvement of water quality using effective microorganisms. Retrieved from http://civil.utm.my/wp-content/uploads/2016/12/Improvement-of-Water-Quality-using-Effective-Microorganisms.pdf on November 11, 2017.

Zacharias, I., E. Dimitriou and T. Koussouris. 2005. Integrated water management scenarios for wetland protection: application in Trichonis Lake. Environmental Modeling and Softwares, 20(2): 177–185.

Zakaria, Z., S.Gairola and N. Mohd.Shariff. 2010. Effective Microorganisms (EM) technology for water quality restoration and potential for sustainable water resources and management. Retrieved from https://scholarsarchive.byu.edu/cgi/viewcontent.cgi?article=2493&context=iemss conference on September 20, 2017.

http://www.em-la.com/what_is_the_em_technologyyy_en.php?idioma=2 Retrieved on February 08, 2017.

https://www.yokogawa.com/library/resources/application-notes/ph-in-fish-farming/ Retrieved on June 05, 2018.