Investigation of Effective Microorganism (Em-Mudball) in Raw Water Treatment

Muhammad Ariff Azwan Bin Azmi[1], Mohd Najib Bin Razali[2*], Najmuddin Bin Mohd Ramli[2], Nasreldeen Ishag Obi[2], Amira Ermafiqka Anuar[3]

[1]Chemical Engineering Department, College of Engineering, Universiti Malaysia Pahang, 26300 Gambang, Pahang, MALAYSIA.
[2]Faculty of Chemical and Process Engineering Technology, Universiti Malaysia Pahang, 26300 Gambang, Pahang, MALAYSIA.
[3]MNR Multitech Sdn Bhd, K02, Ground Floor, Kompleks UMP Holdings, 26300 Gambang, Pahang, MALAYSIA.
[*]najibrazali@ump.edu.my

Abstract: EM-mudball is a green technology product used to treat raw water by using effective microorganisms. The use of EM-mudball can alter the compositions of prop- erties in raw water and improve water quality. Three different EM-mudball ratios were created out of soil/clay, Bokashi compost, and EM 1 compositions in 1:1:1, 1:2:1, and 1:2:2 ratios, respectively.The mudball undergoes the characterization test to observe the presence of fungi and bacteria. Additional 2 different ratios of EM-Mudball were bought from the market as to compare its performance. This mudball was tested into two different raw water samples, taken from a river and a well. Two liters of each raw water types were put in a plastic container and tested with the EM-mudball. Then, the mudball was set in the raw waters for 14 days for the effective microorganisms to react. The best result from the analysis of well water is from Industrial B and simula- tion 1 EM-mudball based on 6 parameters and the biochemical oxygen demand (BOD) value reduction is 3.92 mg/L and 4.68 mg/L respectively, chemical oxygen demand (COD) at 38 mg/L and 44 mg/L respectively, turbidity were 7 and 9 NTU respectively and the pH value was maintained at the optimum value of 7.32 and 7.41 respectively. However, the EM-Mudball is unable to reduce the ammonia Cal nitrogen (AN) and total suspended solids (TSS) and maintain its initial state. In conclusion, as an overall result, this water treatment method is able to improve the quality of water by treating thoseparameters.

1. Introduction

Clean water is very important to all as dirty water is dangerous to human body. There are many studies been conducted on wastewater related problems in developed areas like housing, river, and industrial area. The adoption of chemical and toxic substance in treat- ing water would bring negative effects to the environment. In most towns, the concentrated wastewater will be treated prior to discharge into drains, rivers and sea and eventually result in pollution to the environment in all areas (Karia & Christian, 2017).

Sewage pollution is a rising concern for many developing nations; in undeveloped nations, 80% of waste is dumped untreated and it will pollute the rivers. In 2013, 72% of the 473 rivers in Malaysia monitored by the Department of Environment Malaysia ('the DOE') were found to be contaminated with 25 rivers rated as severely polluted. The high demand for biochemical oxygen demand (BOD) impacts all of these waters and is usually polluted with ammoniacal nitrogen (NH3-N) and suspended solids (SS) (Azman & Shamila, 2015).

Effective Microorganisms (EM), a coexisting population of beneficial microor- ganisms consisting mainly of beneficial bacteria such as lactic acid bacteria, photosyn- thetic bacteria, yeast, fermenting fungi and actinomycetes, are used to increase the mi- crobial turnover of the soil and thereby increase the soil's macronutrients and increase the yield and treatment of sewage or effluent. EM Mudballs can be produced by formu- lating the EM solution, using soil, Bokashi and water at the right ratio. In this state, as EM Mudballs (EM high density aggregates) are introduced into wastewater, became lodged in the sludge surface, and fermenting bacteria present in the sludge will begin to decom- pose the sludge. Phototrophic bacteria ingest toxic gasses at the same time, containing foul odors (Zakaria.z, 2016). Amino acids and saccharides are formed as fermentation decomposition advances. A portion of them dissolves in the water and when sunlight is available, phytoplankton increases, making use of this nutrition. The activities of phyto- plankton will increase the oxygen presence in water, allowing bacteria that need oxygen to be more active in oxidative decomposition. As a result, sludge decomposition is accelerated. Zooplankton will increase around EM Mudballs, converting sludge into detri- tus, an organic sediment consisting of organic matter and bacteria, and it will no longer be a toxic sludge. The advantage of this method is that it is effective in both wide and small areas, and it will remain at the intended spot because of its mudball form (Tan Cheng Li, 2018).

EM technology is widely used nowadays but there are only a few studies were done in seeking the best formulation to enhance the effectiveness of the EM-Mudball. There were a lot of EM Mudball products in the market but there were no scientific evi- dence that the mudball can treat raw and wastewater. In this paper the formulation and characteristics of EM-mudball were tested to validate its effectiveness.

The objective of this study was to develop a raw water treatment based on green technology using effective microorganism in the form of mudballs. Three types of for- mulated and characterized mudballs and two types of mudballs for the available market will be tested in two different raw water sources which are from a river and from