Preliminary Experiment of EM Technology on Waste Water Treatment

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Abstract

The objective of the experiment was to investigate the effect of EM4 on improving the quality of waste water. The experiment was conducted in two locations of candy factory, viz Nestle and Trebor Companies in Jakarta. The EM4 was treated in laboratory condition to the effluent of waste water of non adjusted pH (pH 4.0) and adjusted pH (pH 7.44) in concentration of 1mL/L of waste water. During 11 days after treatment, the chemical oxygen demand(COD) of waste water was decreased by 31%, 80%, and 76% for the treatment of control, non adjusted pH and adjusted pH of waste water respectively. The EM4 treatment in the aeration tank was also conducted in order to know about the continuous application of EM4. The EM4 treatment was applied periodically every 10 days. The data of (COD), biological oxygen demand (BOD), suspended solid (SS) and pH of the waste water were collected daily until 40 days. The treatment of EM4 tend to decrease COD, BOD and SS but did not affect the pH of waste water. The COD, BOD and SS increased 11 days after EM4 treatment.

Introduction

Improper management of industrial waste water can create some environmental problems, because it contain large amount of carbohydrate, protein, fat, mineral salt and chemical compounds. The content of high organic matter in the waste water can be used as a source of energy for the growth of microorganisms (Betty and Winiarti, 1991). The lack of diluted oxygen in the waste water due to the high content of organic matter can create malodor and muddy water. High content of protein, sulphur and phosphate will result in the formation of hydrogen sulphide which can cause malodor and make the surrounding building black. Most of the malodor arises from the degradation of nitrogen, sulphur, phosphate, protein and organic matter in the waste water.

The high content of biological oxygen demand (BOD) and chemical oxygen demand (COD) in the effluent of waste water is very strongly caused by water pollution. The water pollution is responsible for the disturbance of ecological balance in the waste water that can cause death of fish and other biotic component of water. The high content of nitrogen and phosphate in the effluent of waste water also create muddy water and high sedimentation. Rapid growth of algae create malodor because of the decaying of dead algae and anaerobic condition in the waste water that consequently cause death of fish and other biotic component of water (Ronald and Richard, 1981). In general, the industrial waste water management consist of physical, chemical and biological management. It was combined together in order to achieve a high quality of waste water effluent.

Especially for the biological management, microorganisms (algae, bacteria, protozoa) is utilized to degrade the organic compounds of waste water to be simple organic compounds (Ronald and Richard, 1981). EM4 is a mix culture of microorganisms consisted of

Lactobacillus, lactic acid producing bacteria, yeast and fungi that have the potential to increase the biological reaction for the management of industrial waste water (Higa 1994a). The objective of this experiment is to investigate the effect of EM4 on increasing waste water quality.

Materials and Methods

Experiment 1

This experiment was conducted in collaboration with the candy factory of Nestle Company, located in Jakarta, during September 1994 to October 1994. Two liters of waste water collected from the effluent was filled into a glass beaker. The pH of the waste water were measured. Each treatment was aerated by blowing oxygen to the waste water with blower equipment. Data of the experiment was established as follows:

Control: Waste water treated with Super Growth Bacteria (SGB) and Starbio Microorganisms in the dosage of 1g/L of waste water.

EM4(pH 4.0): Waste water treated with 1mL EM4/L waste water without adjusting pH (pH 4.01).

EM4(pH 7.0): Waste water treated with 1mL EM4/L waste water with adjusting pH (pH 7.44).

Experiment 2

This experiment was conducted in collaboration with the candy factory of Trebor Company, located in Jakarta during September to October 1994. EM4 was applied in the amount of 50 mL to the aeration tank of 84 m^3 in size or in the concentration of 0.57 mL/L of waste water. Furthermore the EM4 treatment in the same dosage was applied periodically every 10 days. Data of the suspended solid (SS), chemical oxygen demand (COD), biological oxygen demand (BOD) and pH of waste water was collected after management in Trebor Company and aeration tank are shown in Fig. 1 and 2.

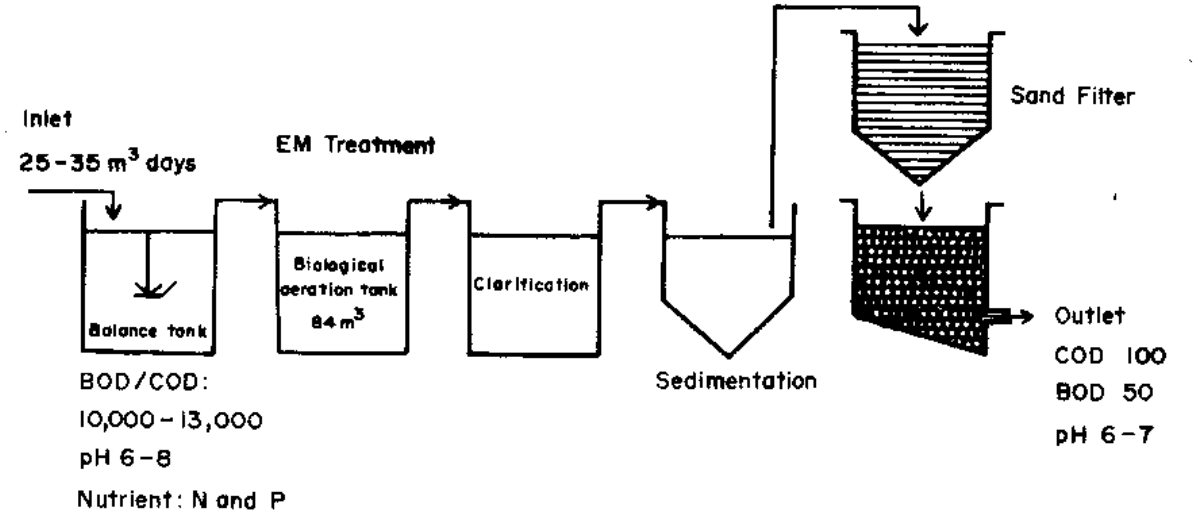

Figure 1. Scheme of waste water management

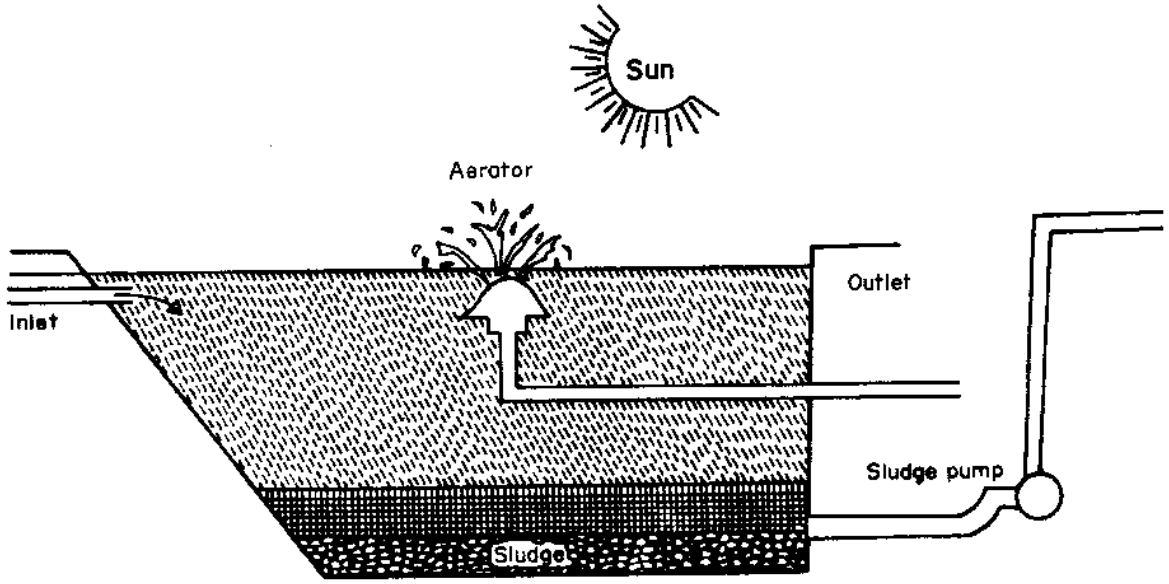

Figure 2. Aeration tank

Results and Discussion

The experiment 1 showed that the inoculation of EM4 to the waste water both on the adjusted pH (pH 4.0) and non adjusted pH (pH 7.44) tend to decrease COD. During 11 days after treatment, the treatment of EM4 decreased COD of the waste water from 7,250 ppm to 1,430 ppm (80.3% reduction) and from 7,250 ppm to 1,740 ppm (76% reduction) for the non adjusted pH and adjusted pH of waste water respectively. On the other hand the control treatment showed various change of COD concentration. In the first and sixth day after treatments, the COD concentration of the control tend to increase while on other days, it tends to decrease. At 11 days after treatment the COD of the control treatment changed from 7,250 ppm to 5,000 ppm (31% reduction). The adjustment of pH in the waste water could not affect the action of EM4 on decreasing of COD. See Fig. 3.

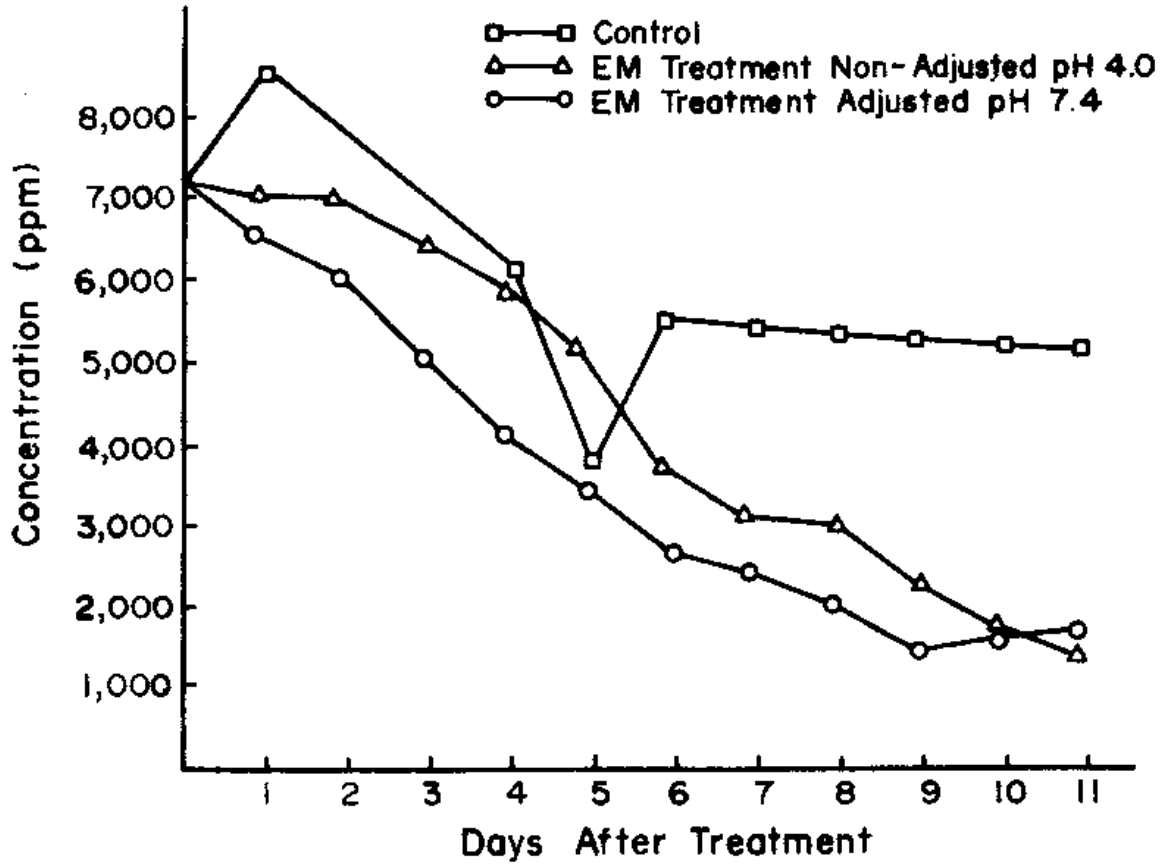

Figure 3. Effect of EM treatment on the reduction of COD

The fermentation of organic compounds in the waste water conducted by EM4 decrease COD gradually. It means that the biochemical reaction in EM4 treated-waste water is increasing due to the higher concentration of oxygen in the waste water than those in control.

Chemoheterotrophic and photosynthetic bacteria have important role for the waste water management to degrade each organic compounds. They also oxidize NH_3 and uses sunlight as source of energy and CO_2 as source of carbon. The mix culture of microorganisms is more effective to degrade various compound than those of single culture of microorganisms due to the complex of organic and inorganic compounds in this waste water (Betty and Winiarti, 1990).

Experiment 2 showed the EM4 treatment affecting COD, BOD and SS but not the pH of waste water (Fig. 4 and Fig. 5). During first to ten days after treatment of EM4 the COD, BOD and SS decreased to 40%-55%, 42%-55% and 44%-71% respectively. Continuous application of EM4 every 10 days showed decreasing concentrations of COD, BOD and SS. The action of EM4 to degrade the organic compounds in waste water was proposed by Higa (1994a), who reported that EM4 was applied successfully for the recycling of organic compounds of sewage and kitchen garbage. The result of fermentation by microbes was the formation of simpler organic compounds, such as amino acids, alcohol, sugars, organic acids and ester. It was also assumed that the fermentation process released active oxygen diluted in the waste water that consequently activate the biochemical reaction (Higa, 1994 b).

Organic compound consisting of carbon, hydrogen, and oxygen with additive element of nitrogen, su]phur, phosphate, etc. tend to absorb oxygen. The available oxygen in the waste water is consumed by the microorganisms to degrade organic compounds. Finally the oxygen concentration in the waste water decreases, indicated by increases in COD, BOD, SS, and the waste water also became muddy and releases foul odor. The higher concentration of COD indicates that the high content of organic compound could not be degraded biologically. The treatment of EM4 after 10 days in the aeration tank should be continued due to the increase in COD concentration. This phenomenon indicated that the EM4 cannot exist well in the condition of this waste water, because of the strong pollution and the low number of microorganisms in the waste water.

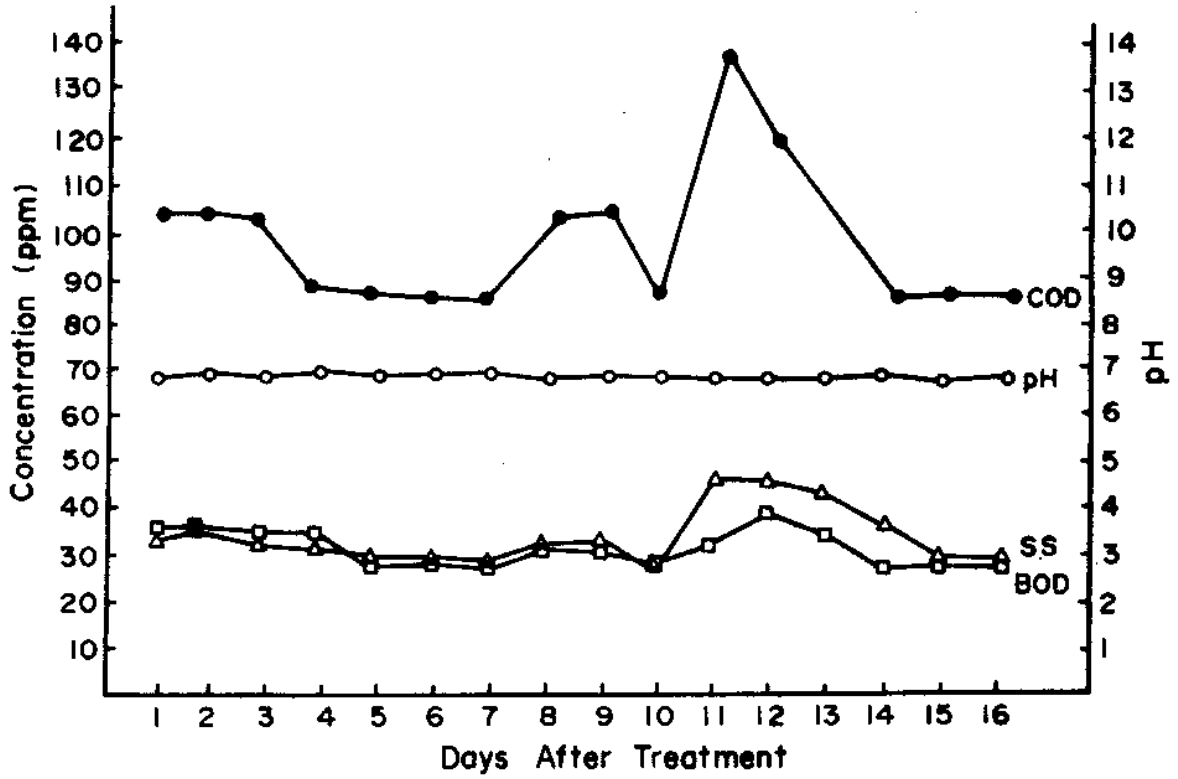

Figure 4. Effect of treatment on the reduction of COD, BOD, SS and pH

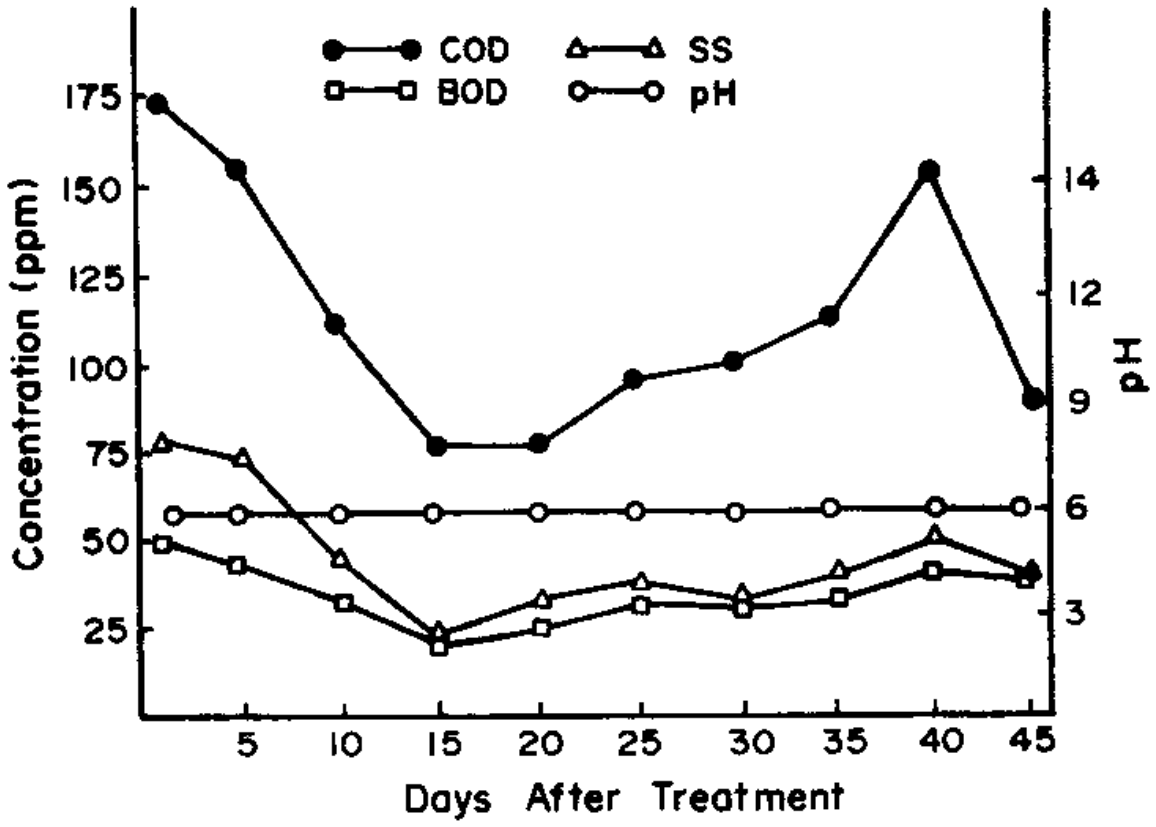

Figure 5. Effect of continued EM treatment on the reduction of COD, BOD, SS and pH

Conclusion

1. Adjustment of pH of waste water is not required before EM4 treatment.
2. EM4 do not affect the pH of waste water.
3. The treatment of EM4 decreases COD, BOD and SS of the waster water.
4. The treatment of EM4 on decreasing COD was more effective then those of control.
5. Continuous application of EM4 was needed due to the low number of microorganisms in waste water and continuous pollution from the waste water.

References

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