

Treatment of Municipal Landfill Leachate Mixed With Reverse Osmosis Reject Water Using Papaya Seeds as a Coagulant

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Abstract - All waste water contains the high characteristics of Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Turbidity, total suspended solids, total dissolved solids and different other waste particles. Coagulation processes are used to separate these kinds of parameters from the waste water. The particles vary considerably in source, composition charge, particle size, shape, and density. The jar test treatability studies have been conducted to know the optimum dosage of papaya seeds powder on the treatment of leachate mixed with reverse osmosis reject water. The optimum dosage of coagulant gives the removal efficiency of 68%, 63%, 64%, 58% and 54% of COD, BOD, Turbidity, TSS and TDS respectively.

Key Words: Coagulation, papaya seeds powder, Reverse osmosis reject water, leachate.

1. INTRODUCTION

Generation of solid waste is inevitable in the daily activities of humans and animals. A landfill is a site for the disposal of waste materials by burial and is the oldest form of solid waste treatment. Historically, landfills have been the most common method of organized waste disposal and remains so in many places around the world. Generally municipal solid waste is disposed of in low laying areas without taking any precautionary measures. Therefore, municipal solid waste is one of the major environmental problems of Indian issues. Solid waste management involves activities like generation, storage, collection, transfer and transport, processing and disposal of solid waste. But, in most cities, the Municipal solid waste management (MSWM) system consists of waste generation, collection, transportation and disposal. Management of MSW requires proper maintenance, basic facility and upgrading of all the activities (Ayub et al., 2011). Conventionally, landfill is designed to contain or store the waste so that exposure to human and environment can be reduced. In most of the countries municipal solid waste is dumped in a non-regulated landfill and the generated methane is emitted to the environment without any precautionary measures. When methane is emitted to the environment, it has a global warming potentially which pollutes the environment. Sanitary landfills can provide better solutions than open dumping of waste for reducing many of the problems, still there is a potential for improvement. Some of the modern regulated landfills attempt to capture and utilize landfill biogas, a renewable energy source, to generate electricity or heat (Ayub and Khan, 2011). At present, Reverse osmosis

(RO) reject water technology has been applied in the wastewater treatment for sea water desalination, urban wastewater treatment, chemical industry, electric power, metallurgy and other industries, but the actual producing water rate in the RO process is only about 50%, so it still faces serious discharge problems of rejected water (Zhao et al., 2005). It is very meaningful to develop high-effective rejected water treatment process to compensate the deficiencies of RO and realize water saving and wastewater reducing (Reddy et al., 2007 and Wang et al., 2003).

2. PREPARATION OF PAPAYA SEEDS POWDER

About 500 gm of papaya seeds were collected from household sector and after that it was dried for about 2 – 3 days in sunlight. After that it was obtained in powder form by blending with the help of domestic blender.

3. METHODOLOGY

The jar test procedures were adopted for different dilution of leachate mixed with RO reject water, which was taken in a beaker (1000mL). After adding appropriate volume of the papaya seeds powder solution, the wastewater was mixed at 100 rpm for 2 min and 40 rpm for 30 minutes and settled for 30 minutes. Then the top layer of water in each beaker was collected with a Pasteur pipette and measured in terms of COD, BOD, Turbidity, TSS and TDS. The jar testing apparatus containers were filled with sample waste water. One container was used as a control while the other 5 containers were adjusted depending on what conditions are being tested. Different dosage papaya seeds powder was prepared for treatment of different dilution of waste water.



Figure 1: Coagulation Experiment in Standard Jar Set up for diluted samples.

4. RESULTS AND DISCUSSION

The characteristic properties of waste water sample were shown in Table – 1. The waste water is alkaline having high COD, BOD, Turbidity, TSS and TDS values which needs to be treated before being discharged. It was reported that the neutralization of the electrical charges of particles into the water which causes the particles to floc together. The waste water sample has been treated with different concentrations of papaya seeds powder.

Table 1: Initial Characteristics of Leachate.

PARAMETERS	INITIAL CONCENTRATION	CPCB STANDARDS 2016
pH	6.85	7.4
Conductivity(mS/cm ²)	30 - 80	-
Chemical Oxygen Demand(mg/L)	16860.0	50.0
Biological Oxygen Demand (mg/L)	9800.0	10.0
Turbidity (NTU)	619.0	5.0
Total Suspended Solids (mg/L)	1970.0	100.0
Total Dissolved Solids (mg/L)	38980.0	-

3.1 Effect of Dosage of papaya seeds powder as a coagulation on the Removal of COD, BOD, Turbidity, TSS and TDS (0.5 Liters of Leachate and 4.5 Liters of Reverse Osmosis Reject Water)

Figure 3.1 shows the variation in the removal efficiency of COD, BOD, Turbidity, TSS and TDS using papaya seeds powder as a coagulant (2 – 14 gm) at dilution of 0.5 liters of leachate in 4.5 liters of RO reject water was studied. In the experiment by the use of dosage of papaya seeds powder 10 mg/L, the optimum removal efficiency of COD, BOD, Turbidity, TSS and TDS is about 68%, 63%, 64%, 58% and 54%. Further when the dosage was increased to 12 mg/L and 14 mg/L, there was no removal of COD, BOD, Turbidity, TSS and TDS this may be due to with the use of 10 mg/L is sufficient dosage for the treatment of 1L of wastewater.

3.2 Effect of Dosage of papaya seeds powder as a coagulant on the Removal of COD, BOD, Turbidity, TSS and TDS (1 Liters of Leachate and 4 Liters of Reverse Osmosis Reject Water)

Figure 3.2 shows the variation in the removal efficiency of COD, BOD, Turbidity, TSS and TDS using papaya seeds powder as a coagulant (3 – 21 gm) at dilution of 1 liters of leachate in 4 liters of RO reject water was studied. In the experiment by the use of dosage of papaya seeds powder 15 mg/L, the optimum removal efficiency of COD, BOD,

Turbidity, TSS and TDS is about 56%, 58%, 53%, 52% and 50%. Further when the dosage was increased to 18 mg/L and 21 mg/L, there was no removal of COD, BOD, Turbidity, TSS and TDS this may be due to with the use of 15 mg/L is sufficient dosage for the treatment of 1L of wastewater.

3.3 Effect of Dosage of papaya seeds powder as a coagulant on the Removal of COD, BOD, Turbidity, TSS and TDS (2 Liters of Leachate and 3 Liters of Reverse Osmosis Reject Water)

Figure 3.3 shows the variation in the removal efficiency of COD, BOD, Turbidity, TSS and TDS using papaya seeds powder as a coagulant (6 – 42gm) at dilution of 2 liters of leachate in 3 liters of RO reject water was studied. In the experiment by the use of dosage of papaya seeds powder 30 mg/L, the optimum removal efficiency of COD, BOD, Turbidity, TSS and TDS is about 72%, 70%, 73%, 69% and 75%. Further when the dosage was increased to 36 mg/L and 42 mg/L, there was no removal of COD, BOD, Turbidity, TSS and TDS this may be due to with the use of 30 mg/L is sufficient dosage for the treatment of 1L of wastewater.

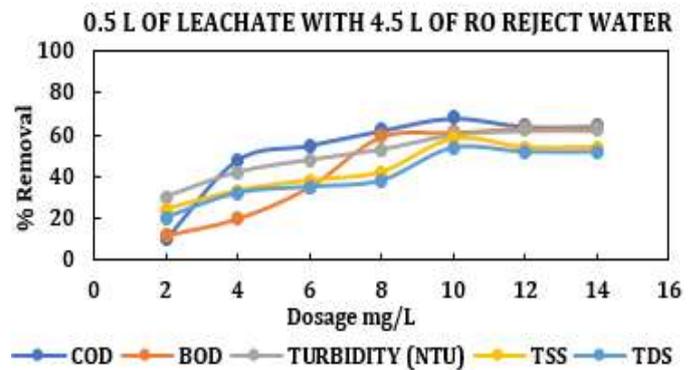


Figure 3.1: Effect of Dosage of papaya seeds powder as coagulant on the Removal of COD, BOD, Turbidity, TSS and TDS (0.5 Liters of Leachate and 4.5 Liters of Reverse Osmosis Reject Water)

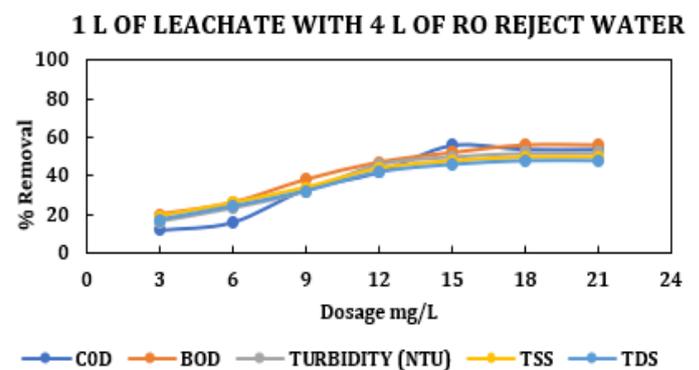


Figure 3.2: Effect of Dosage of papaya seeds powder as a coagulant on the Removal of COD, BOD, Turbidity, TSS and TDS (1 Liters of Leachate and 4 Liters of Reverse Osmosis Reject Water)

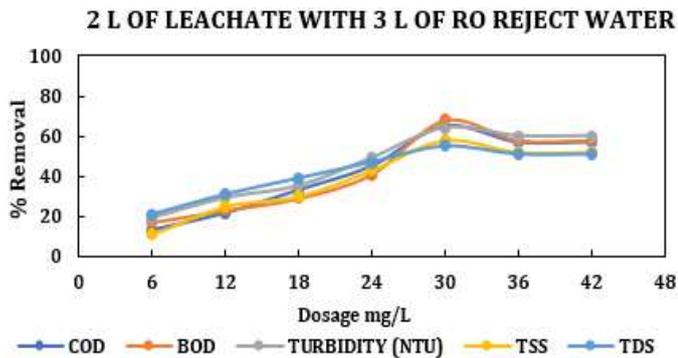


Figure 3.3: Effect of Dosage of papaya seeds powder on the Removal of COD, BOD, Turbidity, TSS and TDS (2 Liters of Leachate and 3 Liters of Reverse Osmosis Reject Water)

5. CONCLUSIONS

- Papaya seeds powder was effective in reducing the strength of the effluent considering the different dilution of municipal landfill leachate mixed with reverse osmosis reject water.
- Percentage removal of waste effluent by using papaya seeds as a coagulant is about 50%-80%.
- Natural coagulant is sustainable and suitable for economical way of wastewater treatment process.
- It is ecofriendly to environment.

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