VIGYAN ASHRAM

Internship Project Report

Submitted to

Design Innovation Center,

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Community project conducted under the auspices of	:	Vigyan Asharam, Pabal
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Comparative Study of Natural and Aeration-Based Techniques for COD Reduction in Wastewater

Detailed Project Report

1. Project Overview

Wastewater generated from households and small industries contains various organic and inorganic pollutants that affect water quality and create environmental problems. If untreated wastewater is released into rivers, lakes, or soil, it can reduce oxygen levels in water bodies and harm aquatic life. Therefore, proper wastewater treatment is necessary before disposal or reuse.

Chemical Oxygen Demand (COD) is one of the important parameters used to determine the level of organic pollution in wastewater. COD represents the amount of oxygen required to chemically oxidize the organic matter present in water. A higher COD value indicates a higher concentration of pollutants and poor water quality.

This project focused on studying and comparing different natural and aeration-based techniques for COD reduction in wastewater. Different treatment methods such as sedimentation, bubbling aeration, sprinkler aeration, and photosynthesis using Azolla were studied and compared to determine their efficiency in reducing COD.

Along with wastewater treatment techniques, silver sulphate was also synthesized from silver and used during the COD determination process. This provided practical laboratory experience in chemical synthesis and handling procedures.

2. Objectives

- To study COD reduction in wastewater samples.
- To compare natural and aeration-based wastewater treatment methods.
- To analyze the effectiveness of sedimentation, bubbling, sprinkler aeration, and photosynthesis using Azolla.
- To understand the role of aeration in wastewater treatment.
- To synthesize silver sulphate from silver for use in COD analysis.
- To gain practical experience in laboratory analysis and wastewater treatment techniques.

3. Activities Undertaken

1. **Day 1 - 4:** Different greywater samples were collected from nearby locations. COD of each sample was measured to understand the pollution level and select suitable samples for further experimentation.
2. **Day 5 - 8:** Different wastewater treatment techniques were studied. Information about aeration methods, natural treatment systems, COD reduction mechanisms and silver sulphate preparation from silver was collected. Materials and chemicals required for the experiment were arranged.
3. **Day 9 -12:** Experimental setups for sedimentation, bubbling aeration, sprinkler aeration, and Azolla-based treatment were prepared. Proper arrangements were made to ensure equal conditions for all treatment methods. Also, Setup for silver sulphate preparation was made.
4. **Day 13 - 15:** Synthesized silver sulphate from silver. COD values were measured after treatment and compared to evaluate the efficiency of different methods. Observations and results were recorded carefully.

4. Experimental Methodology

Sedimentation

The wastewater sample with alum and polyelectrolyte added was kept undisturbed for a fixed duration so that suspended particles could settle naturally under gravity. This method mainly reduced suspended impurities.

Bubbling Aeration

Air was supplied into the wastewater using an air pump and diffuser. Bubbling increased dissolved oxygen in water, helping in partial oxidation of organic matter.

Sprinkler Aeration

Wastewater was exposed to air through a sprinkler setup. This method increased the contact area between air and water, resulting in better oxygen transfer and higher COD reduction.

Photosynthesis Using Azolla

Azolla was placed in the wastewater sample to study natural treatment through photosynthesis. The process increased oxygen availability and contributed to pollutant reduction.

5. Synthesis of Silver Sulphate

Silver sulphate was synthesized from silver and later used as a catalyst during the COD determination process. The preparation involved dissolving silver using nitric acid and converting it into silver sulphate through further chemical reactions.

The synthesis process required careful handling of chemicals and proper laboratory safety measures. During washing and transfer of silver sulphate crystals from one container to another, some amount of material loss occurred. Some crystals remained attached to the walls of the containers and filter paper, reducing the final yield.

This activity helped in understanding practical aspects of chemical synthesis, purification, crystal handling, and laboratory procedures.

6. Observation Table

Treatment Method	Initial COD (mg/L)	Final COD (mg/L)	% Reduction in COD
Bubbling Aeration	300	280	6.67
Sprinkler Aeration	300	176	41.33
Photosynthesis Using Azolla	300	288	4
Sedimentation	300	224	25.33

7. Results and Discussion

The experiment showed that all treatment methods reduced COD to some extent, but their efficiencies were different.

Among all the techniques tested, sprinkler aeration showed the maximum COD reduction. The COD decreased from 300 mg/L to 176 mg/L, indicating that better air-water contact significantly improves oxidation of organic pollutants.

Sedimentation also showed noticeable COD reduction because some suspended organic matter settled naturally at the bottom of the container.

Bubbling aeration reduced COD only slightly compared to sprinkler aeration. This may be due to lower oxygen transfer efficiency and smaller contact area between air and water.

Photosynthesis using Azolla showed the least COD reduction among the methods tested. Although Azolla contributes to oxygen generation naturally, the process is slower and requires more time for significant pollutant reduction.

8. Lessons Learned

- Aeration plays an important role in reducing COD by increasing dissolved oxygen levels in wastewater.
- Sprinkler aeration was found to be more effective because it provided better mixing and oxygen transfer.
- Natural treatment methods are environmentally friendly but generally require more time for effective treatment.

- Accurate COD measurement requires careful handling of chemicals and proper laboratory techniques.
- The project provided practical experience in wastewater treatment and chemical synthesis.

9. Challenges Faced

- Collecting and transporting wastewater samples without contamination was challenging.
- Maintaining equal aeration conditions for all setups required continuous monitoring.
- Repeated transfer of silver sulphate crystals caused some material loss during handling.
- Proper handling of strong acids and chemicals required extra safety precautions.

10. Conclusion

The comparative study demonstrated that different wastewater treatment methods reduce COD at different levels. Among all the techniques studied, sprinkler aeration gave the best performance by reducing COD from 300 mg/L to 176 mg/L. Sedimentation also showed good COD reduction, while bubbling aeration and photosynthesis using Azolla were comparatively less effective. The experiment clearly showed that treatment methods providing better air-water interaction result in faster breakdown of organic pollutants and improved COD reduction. The successful synthesis and use of silver sulphate in COD determination also provided valuable practical laboratory experience.

11. Future Scope

- Combination of different aeration techniques can be studied for achieving higher COD reduction efficiency.
- Advanced wastewater treatment methods such as activated carbon filtration and biological treatment can be compared with the current methods.
- Natural treatment systems using Azolla can be optimized by increasing treatment time and improving environmental conditions.
- The experiment can be scaled for larger wastewater treatment applications in households and small industries.
- Automation of aeration systems using sensors and microcontrollers can improve treatment efficiency and monitoring.
- Further research can be carried out to reduce chemical usage and make wastewater treatment more sustainable and cost-effective