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Research Article

Feasibility of treating the wastewater from herbs and rose water extraction factories and choosing the appropriate method (case study of Kashan Industrial Towns Company)

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Extended Abstract

Introduction

The production of rose water and herbal distillates generates significant amounts of wastewater, which poses environmental challenges due to its high organic content. This study focuses on the treatment of wastewater from rose water and herbal distillate factories in the Borzok Industrial Estate, Isfahan Province, Iran. The primary objective is to evaluate the effectiveness of various treatment methods, including coagulation, advanced oxidation processes (AOPs), and anaerobic digestion, to reduce the chemical oxygen demand (COD) and other pollutants in the wastewater. The study aims to identify the most efficient and economically feasible treatment method for this specific type of industrial wastewater.

Materials and Method

The study involved field visits, sample collection, and laboratory analysis of wastewater from rose water and herbal distillate production processes. The wastewater samples were analyzed for parameters such as COD, total suspended solids (TSS), and pH. Coagulation experiments were conducted using aluminum sulfate (Al2(SO4)3), ferric chloride (FeCl3), and polyaluminum chloride (PAC) to remove suspended solids. Advanced oxidation processes, including ozonation and UV treatment, were also evaluated for their effectiveness in reducing organic pollutants. Additionally, anaerobic digestion was tested as a potential treatment method. A pilot-scale system combining ozonation and UV treatment was constructed to assess the feasibility of these methods on a larger scale.

Results and Discussions

The results indicated that the wastewater from rose water and herbal distillate production had a high COD, ranging from 13,000 to 35,000 mg/L. Coagulation experiments showed that PAC was the most effective coagulant, achieving over 70% COD removal at optimal pH levels (pH 9 for maximum COD removal and pH 11 for best sedimentation). Ozonation alone was insufficient for significant COD reduction, but the combination of ozonation and UV treatment (AOP) proved highly effective, achieving up to 83.5% COD reduction within 120 minutes. Anaerobic digestion was also tested, but it required long retention times (up to 72 days) to achieve significant COD reduction, making it less feasible for large-scale applications. The study concluded that a combination of coagulation and AOP (ozonation + UV) is the most effective method for treating this type of wastewater, although it may not be economically viable for small-scale factories due to high operational costs.

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Conclusion

The study demonstrated that wastewater from rose water and herbal distillate production is highly organic and difficult to treat using conventional methods. Coagulation with PAC effectively removes suspended solids and reduces COD, while advanced oxidation processes (ozonation + UV) significantly degrade organic pollutants. However, the high cost of ozonation equipment and energy consumption may limit its application in small-scale industries. Alternative solutions, such as evaporation ponds or the separation of industrial and sanitary wastewater, were proposed as more economically feasible options for small factories. For larger facilities, a combination of anaerobic digestion, ozonation, and filtration could achieve complete wastewater treatment to meet environmental discharge standards. This study provides valuable insights into the treatment of high-organic industrial wastewater and offers practical recommendations for the rose water and herbal distillate industry.

Keywords: Wastewater treatment, Rose water extraction, Coagulation, Anaerobic treatment, Ozonation, Advanced oxidation