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EVALUATING THE EFFICACY OF ALUM VERSUS FERRIC CHLORIDE IN THE TREATMENT OF MUNICIPAL WASTEWATER

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Structured Abstract

Background: This study evaluates the capacity of ferric chloride and aluminum sulfate to treat municipal wastewater, a critical step in protecting urban aquatic ecosystems from contamination. By determining the ideal molar concentration for each coagulant, the research seeks to optimize pollutant removal while ensuring chemical efficacy and water stability. The sample was collected from Klang River,Selangor (3°04'34.4"N 101°37'18.7"E).

Methods: The experiment utilized a standardized jar test procedure to evaluate the performance of both chemicals. For the Aluminum Sulfate series, dosages of 2.1 mL, 4.2 mL, 6.3 mL, 8.4 mL, and 10.5 mL were applied, while the Ferric Chloride series was evaluated across a molar range of 0.1 mM, 0.3 mM, 0.5 mM, 0.7 mM, and 0.9 mM. The process involved a rapid mixing phase at 200 rpm for 1 minute, followed by slow flocculation at 40 rpm for 20 minutes and a 30-minute sedimentation period. Pollutant removal was quantified using a HACH DR 1900 Portable VIS Spectrophotometer to measure Chemical Oxygen Demand (COD), Total Suspended Solids (TSS), and Color.

Results: The results indicated that both coagulants successfully reduced the pollutant load with spectral absorbance at 600 nm decreasing from an initial baseline of approximately 1.1 A at 200 nm to final readings of 0.05 A for Aluminum Sulfate and 0.1 A for Ferric Chloride at the 600 nm mark.. Aluminum Sulfate demonstrated superior particulate aggregation and faster settling velocities but caused a significant pH drop and a colorless supernatant at the 6.3 mL dosage. Conversely, the Ferric Chloride series, particularly at the 0.3 mM dosage, maintained a stable pH profile despite a yellowish-brown chromatic shift.

Conclusion: In conclusion, Aluminum Sulfate was significantly more acidic (pH 4.67) than Ferric Chloride (pH 6.98), resulting in a pronounced final pH reduction. Both coagulants effectively reduced pollutant loads, with absorbance decreasing from 1.1 A to 0.05 A for Alum and 0.1 A for Ferric Chloride. While Ferric Chloride excelled in aggregation, Aluminum Sulfate provided superior aesthetic clarity despite higher acidity. These findings emphasize balancing removal efficiency against chemical stability for optimized and sustainable urban runoff management.

Keywords: Wastewater Treatment, Coagulation-Flocculation, Aluminum Sulfate, Ferric Chloride, Removal Efficiency

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