

Evaluation of Pre-Oxidation Strategies for Surface Water Treatment: A Case Study of Dry Aru, Kilinochchi District, Sri Lanka

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This study assesses the comparative evaluation of ozone and chlorine treatment for improving the physicochemical and microbiological quality of surface water from Dry Aru, Sri Lanka. Bench-scale experiments were conducted with chlorine (0.1–4.0 mg/L) and ozone (0.1–0.5 mg/L), and treatment performance was evaluated through removal of turbidity, color, iron, manganese, Biochemical Oxygen Demand (BOD), Chemical Oxygen Demand (COD), organic matter, algae, and microbial indicators such as Total coliform (*T. coli*) and *Escherichia coli* (*E. coli*), alongside ORP response. Ozonation achieved high removal efficiencies at low doses (0.5 ppm), including turbidity (38%), color (61%), iron (57%), manganese (5%), Chemical Oxygen Demand (COD) (89%), algae (86%), Biochemical Oxygen Demand (BOD) (33%). However, ozone treatment showed limited effectiveness in bacteriological removal under the tested conditions, despite only a marginal Oxidation Reduction Potential (ORP) increase. In comparison, chlorine treatment at the same low dose (0.5 ppm) resulted in lower removal efficiencies, including turbidity (18%), color (50%), iron (20%), manganese (2%), Chemical Oxygen Demand (COD) (54%), algae (32%), and Biochemical Oxygen Demand (BOD) (33%). Chlorine treatment exhibited gradual improvement with increasing dosage and was highly effective in microbial disinfection. At

dosages ≥ 1 ppm, complete removal of total coliform and *E. coli* was achieved. Additionally, higher chlorine dosages (4 ppm) resulted in significant reductions in turbidity, color, iron, and algae due to the presence of residual chlorine, with maximum removal efficiencies of 69.71%, 87.12%, 100%, and 94.5%, respectively. COD and BOD reductions were moderate compared to ozone. Chlorination exhibited a strong correlation between ORP elevation (>500 – 600 mV). The results demonstrate that ozone is more efficient for reducing organic load and algae, while chlorine was superior for bacteriological disinfection and removal of certain physicochemical parameters. The findings suggest that a combined treatment approach may provide an optimized solution for treating organic-rich surface waters such as Dry Aru.

Keywords:

Chlorine Treatment; Ozone Treatment; Surface Water; Oxidation Reduction Potential (ORP)