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Assessment of Electroplating Wastewater Quality and Its Influence on Soil Physico-Chemical Characteristics in Haldia Industrial Region

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Abstract: *Haldia, a major industrial region in Purba Medinipur district, West Bengal, is characterized by petrochemical and allied industrial activities, low-lying riverine terrain, and mixed soil types including alluvial soils. The Haldia industrial belt is geographically influenced by the Hooghly, Haldi and Rupnarayan river systems, while the wider district economy remains strongly agriculture-dependent, making wastewater-soil interactions an important environmental concern.*

This study assesses the physico-chemical quality of electroplating effluents and evaluates their influence on nearby soil properties in the Haldia industrial region. Electroplating wastewater is known to contain toxic heavy metals (e.g., Cr, Ni, Cu, Zn, Cd, Pb), dissolved salts, surfactants, and process additives that increase conductivity and chemical oxygen demand (COD), and complicate conventional treatment. The study framework includes sampling of electroplating effluents and soils at varying distances from discharge/irrigation channels, followed by analysis of pH, electrical conductivity (EC), total dissolved solids (TDS), total suspended solids (TSS), COD, biochemical oxygen demand (BOD), oil and grease, and selected heavy metals in effluent, and pH, EC, organic carbon, available nutrients, and metal accumulation in soil.

The interpretation is benchmarked against Indian discharge standards for electroplating/anodizing industries under the Environment (Protection) Rules, 1986 (e.g., pH 6.0–9.0, oil & grease 10 mg/L, suspended solids 100 mg/L, total metal 10 mg/L; and process-specific limits such as Ni 3 mg/L, hexavalent Cr 0.1 mg/L, total Cr 2 mg/L, Cu 3 mg/L for nickel/chrome plating streams). Based on prior studies, the study expects acidic-to-neutral variability in untreated effluent, elevated metal concentrations, and measurable deterioration in soil quality near discharge points, including changes in pH/EC and reductions in biological/soil fertility indicators under chronic contamination. The article provides a locally relevant framework for monitoring, regulatory compliance, and soil protection in Haldia's industrial-agricultural interface.

Keywords: Electroplating effluent; Haldia; Soil physico-chemical properties; Heavy metals; Industrial wastewater; Environmental monitoring; West Bengal

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