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Synergistic optimization of electrocoagulation process parameters using response surface methodology for treatment of hazardous waste landfill leachate

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Leachate treatment is an essential and integral part of solid waste management system, and its efficient treatment becomes more crucial when the leachate is produced from industrial or hazardous waste landfills (HWLs), as it is multi-fold more toxic than the leachate produced from municipal solid waste landfills (MSWLs). Electrocoagulation has appeared to be a promising technology for treating complex wastewater including MSWL leachate, but specific treatability studies dedicated to HWL leachate are rarely available, and thus pose a demand for fundamental and advance research in this area to bridge the existing gap. The current study delves into systematic design of experiments to check the treatability of HWL leachate through electrocoagulation, considering reduction (maximum) in chemical oxygen demand (COD) as a response variable. Response Surface Methodology (RSM) was used for design of experiments and process optimization and threedimensional surface response was also created to understand the relationship among process parameters and response variables. After extensive experimental trials and data analysis, it was observed that electrocoagulation can be used as a potential treatment technology for leachate with Galvanized Iron (GI) as preferable electrode material and it resulted up to 90% reduction in COD under optimized condition. Significant reduction in other parameters was also observed with a removal efficiency of 58.1%, 63.6%, 42.4%, 52.5%, 54.7% and 84% for cadmium, zinc, phenolic compounds, lead, TOC, and colour, respectively. The results showed that Electrocoagulation can be used as a replacement of currently practised energy extensive treatment technologies like multiple effect evaporators, which are used by landfill operators for managing their HWL leachate. The methodology and results from this research may be utilized by the researchers and operators of HWL landfills to decide the treatment trail for HWL leachate.

Biography

Dr. Pratibha Gautam is Assistant Professor and Head of Department of Environmental Science &Technology at UPL University of Sustainable Technology, Ankleshwar (Gujarat), India. As head ofdepartment she is handling diploma, UG and PG course in Environment Engineering. Additionally,she is working as an environmental auditor (schedule-1), recognized by Gujarat Pollution ControlBoard (GPCB). Dr. Gautam is also QCI-NABET approved Functional Area Expert (FAE) for Airpollution monitoring, prevention, and control (AP). She is also designated as Technical Manager(TM) for NABL accredited Environmental Laboratory. In total, she has more than 10 years ofindustrial as well as academic experience.