Comparative assessment of different advance technologies for treatment of landfill leachate

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Landfilling is one of the most common method used for scientific disposal of municipal as well as industrial solid waste, round the globe. The major concern related with solid waste landfilling is to ensure leachate collection and it's treatment. Leachate formation in landfill takes place when moisture or free liquid available in waste percolates through the layers below and reaches to the landfill bottom. Due to slow seepage of liquid through all the waste layers, the leachate produced acquires all the toxicity from the parent waste material and is characterized by high concentration of organic and inorganic pollutants and appears to be a dark coloured (brown or black) thick liquid [Ishak et al (2021)].

Being a highly toxic liquid, poor management of leachate pose a serious concern on environment and globally, researchers have been working to develop sustainable treatment options for landfill leachate. Gautam et al (2019) and Teng et al (2021) have revealed the transition of treatment methodologies for leachate from biological and chemical based processes to advance oxidation processes. Several studies are available focusing on treatability of leachate through different processes including activated sludge process [Setiadi and Fairus (2003)], MBR technology [Ahmed and Lan (2012)], fenton process [Jung et al (2017)], integrated air-stripping, MBR and nanofiltration [Amaral et al (2016)], Reverse osmosis process [Chen et al (2020)], Photo-Fenton process [Zazouli et al (2012)], various photocatalytic processes, Electrochemical oxidation processes, Coagulation-Flocculation processes and Electrocoagulaion processes [Gautam and Kumar (2021)].

This research delves into a comparative assessment of various advance processes through bench-scale experimental setup. Different experiments were conducted to treat hazardous waste landfill leachate through advance processes like fenton process, electro-fenton process, coagulation-flocculation process and electrocoagulation process. It was observed that comparative to chemical based treatment processes, electrochemical processes provide better treatment efficiency and under optimized conditions, more than 80% reduction in chemical oxygen demand (COD) and more than 85% reduction in colour can be achieved with significant reduction in the concentration of other pollutants including total organic carbon (TOC) and phenolic compounds.

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