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Resource-efficient ferritization treatment for concentrated wastewater from electroplating production with aftertreatment by nanosorbents

ABSTRACT. Currently, much attention is paid to the treatment of industrial wastewater, which would provide the necessary degree of decontamination for organizing a recycled water supply and further disposal of the treatment-generated by-product. The paper presents an advanced technology using a new nanomaterial that decreases initial concentrations of heavy metal ions in electroplating production wastewater from 25 g/L to less than 0.6 mg/L. An integrated process of wastewater treatment consists of two stages: energy- and resource-efficient ferritization followed by sorption onto suspensions of nanopowders of polyvalent iron oxides. The advantages of an electromagnetic pulse method for achieving ferritization at frequencies up to 0.9 kHz in comparison with expensive thermal treatment at temperatures up to 75 °C are demonstrated. The polyvalent iron oxide nanosorbents were obtained by electroerosion dispersion. The result of the integrated treatment is that the purified water meets the requirements for water reuse in electroplating production. The treatment-generated by-product has high chemical stability and a significant content of magnetic ferrite phases, thus having a high potential for further utilization. In contrast to the widely used reagent-based treatment of concentrated wastewater contaminated by heavy metals (> 25 g/L), the integrated method developed here prevents environmental contamination by toxic effluents and ensures the rational use of water and energy inputs in the system of industrial production.

Keywords: electroerosion dispersion, electromagnetic pulse activation, ferritization, nanopowders, suspended polyvalent iron oxides, wastewater treatment

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