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Use of Acid Mine Drainage as a Source of Iron to Initiate the Solar Photo-Fenton Treatment of Municipal Wastewater: Circular Economy Effect

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Abstract : Untreated Municipal Wastewater (MWW) is renowned as the utmost harmful pollution caused to environmental water due to the high presence of nutrients and organic contaminants. Removal of Chemical Oxygen Demand (COD) from synthetic as well as municipal wastewater is investigated by using acid mine drainage as a source of iron to initiate the solar photo-Fenton treatment of municipal wastewater. In this study, Acid Mine Drainage (AMD) and different minerals enriched in iron, such as goethite, hematite, magnetite, and magnesite, have been used as the source of iron to initiate the photo-Fenton process. Co-treatment of real municipal wastewater and acid mine drainage /minerals is widely examined. The effects of different parameters such as minerals recovery from AMD, AMD as a source of iron, H_2O_2 concentration, and COD concentrations on the COD percentage removal of the process are studied. The results show that, out of all the four minerals, only hematite (1g/L) could remove 30% of the pollutants at about 100 minutes and 1000 ppm of H_2O_2. The addition of AMD as a source of iron is performed and compared with both synthetic as well as real wastewater from South Africa under the same conditions, i.e., 1000 ppm of H_2O_2, ambient temperature, 2.8 pH, and solar simulator. In the case of synthetic wastewater, the maximum removal (56%) is achieved with 50 ppm of iron (AMD source) at 160 minutes. On the other hand, in real wastewater, the removal efficiency is 99% with 30 ppm of iron at 90 minutes and 96% with 50 ppm of iron at 120 minutes. In conclusion, overall, the co-treatment of AMD and MWW by solar photo-Fenton treatment appears to be an effective and promising method to remove organic materials from Municipal wastewater.

Keywords : municipal wastewater treatment, acid mine drainage, co-treatment, COD removal, solar photo-Fenton, circular economy
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