

Abstract

The Pharmaceutical industries contain high level of toxic pollutants and chemicals that are complex and persistent in nature and cannot easily degrade. These chemical pollutants deteriorate the water bodies as well as have adverse effect on human health. Therefore, an efficient and effective technique is required to remove organic pollutants. Advanced Oxidation Processes (AOPs) are considered as very effective and efficient for the removal of toxic; organic and inorganic pollutants that cannot be degraded by other treatment methods. AOPs produced hydroxyl radical which can degrade organic pollutant from wastewater. Catalytic ozonation technique is considered as the most effective and reasonable to remove organic pollutants from wastewater among AOPs. Taking this into account, this study was made to develop different catalysts for catalytic ozonation of pharmaceutical wastewater to improve COD removal and for sustainability of water resources. The catalysts used in this study were impregnated by salts of iron, nickel and cobalt on natural zeolites (NZ). The current study investigated the comparative effectiveness of single ozonation and catalytic ozonation by using (Fe-Z, Ni-Z, Co-Z) as catalysts for the COD removal from pharmaceutical wastewater. This study was intended to explore the most efficient catalyst by varying dosages (1g, 1.5g, and 2g) for the removal of COD from wastewater, alongside other parameters such as pH, TDS, DO, EC and turbidity. Results showed 66.6% removal after single ozonation treatment. Fe-Z demonstrated the highest COD removal rate of 88% at a 2g dosage, followed by Ni-Z with a maximum removal of 85.3% at 1.5g, and Co-Z, which achieved 83.2% removal at 1g. The study also found that all catalysts improved turbidity and DO levels, with pH values remaining within permissible limits. However, Ni-Z and Co-Z treatments resulted in slightly elevated EC and TDS levels. These findings suggested that iron based catalysts are more efficient for the COD removal from wastewater. Hence, the results proposed the efficiency, applicability and sustainability of catalytic ozonation for the treatment of pharmaceutical wastewater and further lead to the reuse and recycling of treated water within the industry.