Evaluation of Advanced Chemical Oxidation Process for the Pretreatment of Mixed Agro-Food Industrial Wastewaters in Nablus, Palestine

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Abstract

Public sewerage and municipal wastewater treatment plants face operational challenges due to discharge of industrial wastewater, partially treated or untreated. Municipal bylaws and cabinet resolutions set strict quality limits for the industrial wastewater and require permits for legal connection of industrial effluent. Non-compliance of agro-food industries with local municipal bylaws, as the case in Nablus city, urges policy and decision makers to search for feasible treatment technologies to reduce industrial pollution loads into Wadi Zaimer. This study investigated the reduction of organic loads from mixed agro-food industrial wastewaters (dairy and slaughterhouse) of Nablus city using advanced oxidation process (AOP), a high-rate chemical oxidation reaction. Bench scale Jar tests using an advanced oxidation process (AOP) were performed as a pretreatment stage. Direct applications of classical Fenton's process on mixed raw agro-food wastewater samples (COD: 15400-18200 mg/l) revealed unsatisfactory results. The performance of Fenton process was evaluated using three mixed samples with different pre-treatment trials: (A) coagulant ($FeCl_3.6H_2O$) addition, (B) settling (2h) allowed and use of flocculent (lime $Ca(OH)_2$) in sample (C). Compared with other partial treatments, sample (C), Fenton`s process lime preceded, was the most effective in the removal of organic (89% COD; 80% TKN) and inorganic loads (91% TSS; 62% TS) under H_2O_2/COD (w/w ratio 2:1), H_2O_2/Fe^{+2} (w/w ratio 10:1) and acidic conditions (pH =3). Obtained results comply with Nablus municipal by-law (COD below 2000 mg/l), which help decision makers within the agro-food industries install pollution reduction systems. Investment in Fenton-based peroxidation process allow agro-food industries obtain connection permits to sewage networks. The potential challenges facing the scale-up the Fenton process are discussed with recommendations for future research.

Keywords: advanced oxidation process; Fenton reaction; industrial wastewater; municipal by-laws; sewer connection permit.

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