



# **ENHANCING ANAEROBIC DIGESTION RATE BY PEROXONE PRETREATMENT OF HIGH ORGANIC STRENGTH WASTEWATERS**

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## Abstract

In the present study, the effects of peroxone process as a pretreatment for anaerobic digestion in treating high organic strength effluents was investigated with synthetic wastewater that characterize food industry effluents. The  $H_2O_2/O_3$  combination known as peroxone process is one of the Advanced Oxidation Processes (AOP), where most reactive  $^{\circ}OH$  radicals are formed.

First, the effective  $H_2O_2$  concentration on COD reduction was investigated with three different concentrations of 600mg/l, 3000mg/l and 6000mg/l. The 600mg/l concentration gave the most effective COD reduction with no residue at the end of 24 hr retention time. Subsequently, 600 mg/l of  $H_2O_2$  added synthetic wastewater was subjected to ozonation for time durations of 30 min, 60 min and 90 min. The pH of the solutions increased from 7 to 8.05, 8.13 and 8.17 respectively with ozonation due to the degradation of protein! nitrogenous organic compounds and due to the release of  $CO_2$ . With peroxonation the Volatile Fatty Acid (VFA) concentration increased from 1200 mg/l to 1293 mg/l, 1875 mg/l and 2356 mg/l and soluble COD (SCOD) decreased from 8663 mg/l to 7189 mg/l, 6267 mg/l and 5530 mg/l after 30 min, 60 min and 90 min of ozonation respectively.

Then the effect of peroxone pretreatment on anaerobic digestion kinetics was investigated with 4 No. of laboratory scale anaerobic batch reactors. The control reactor was loaded with 400ml of raw synthetic wastewater and 200ml of sludge; the second one was loaded with 400ml of 30min peroxonated synthetic wastewater and 200ml of sludge; the third reactor was loaded with 400ml of 60min peroxonated synthetic wastewater and 200 ml of sludge; the last one was loaded with 400ml of 90min peroxonated synthetic wastewater and 200ml of sludge. During first 4 days of anaerobic digestion, pH decreased gradually with VFA increment and SCOD increment due to hydrolysis of organic matter. It was shown that peroxone pretreatment enhanced the rate of anaerobic digestion. However care should be taken in selecting  $H_2O_2$  dosage and ozonation time. If  $H_2O_2$  is added in excess, un-reacted



$\text{H}_2\text{O}_2$  will scavenge the  $^{\circ}\text{OH}$  radicals and thus lower the COD removal. Further, longer ozonation time can increase VFA accumulation and inhibit the methanogenesis process.