The effect of untreated and Fenton-treated acid dyes (C.I. Acid Red 183 and C.I. Acid Orange 51) and a reactive dye (C.I. Reactive Blue 4) on aerobic, anoxic and anaerobic processes was investigated. The optimum Fe2+:H2O2 molar ratio was selected as 1:5 (4:0.25 mM:20:0.25 mM) for 10 min Fenton treatment at pH 3, resulting in reduced chemical oxygen demand and dissolved organic carbon removal efficiencies; only acetate was detected as a stable dye oxidation end product. During anaerobic digestion, 100, 29% and no inhibition in methane production was observed for the untreated blue, red and orange dyes, respectively. The inhibitory effect of the blue reactive dye on methane production was ∼21% after Fenton treatment. Neither untreated nor treated dyes exhibited an inhibitory effect on denitrification. Aerobic glucose degradation was inhibited by 23-29% by untreated dyes, whereas Fenton-treated dyes had no inhibitory effect on aerobic glucose degradation.