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Effect of trace metals addition on food waste anaerobic digestion

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This study presents the impact of trace elements supplementation (TEs: Fe [50-400 mg/L], Ni [0.5-20 mg/L], Co [0.1-5 mg/L], Se [0.005-0.8 mg/L] and Mo [2-20mg/L]) individually as well as in mixtures on the specific methanogenic activity (SMA), maximum specific methane production rate ($SMPR_{max}$) and apparent hydrolysis rate constant (K_h) of food waste (FW) anaerobic digestion. Series of batch anaerobic digestion tests with kitchen FW as substrate were performed at various concentrations of different TEs under mesophilic conditions using Fe-rich inoculum (≈ 1.7 g/L). The results of this study revealed that addition of TEs adversely impacted methanogenic activity especially at the maximum concentrations of Fe, Ni, Co and Se by 47%, 70%, 33% and 37%, respectively. The effect of Mo on the methane production and SMA rate was neutral. Fe, Ni, and Co significantly affected the methane productions at elevated concentrations unlike Se and Mo. Impacts of individual supplementation of Fe, Co, Ni, Se and Mo on the $SMPR_{max}$ and K_h were negligible except for Fe (400 mg/L) which moderately reduced the $SMPR_{max}$ by 24%. Similar results to the control (no TEs addition), were also observed for the K_h when different mixtures of TEs were used, however, unlike the K_h , positive impacts on the $SMPR_{max}$ (12%-22% enhancement) were obtained, possibly indicating the synergy. It is postulated that the high concentration of Fe in the used inoculum played an indispensable role in reducing the bioavailable fraction of metals in the form of free metal via precipitation, co-precipitation and adsorption in both single and multiple TEs addition forms.

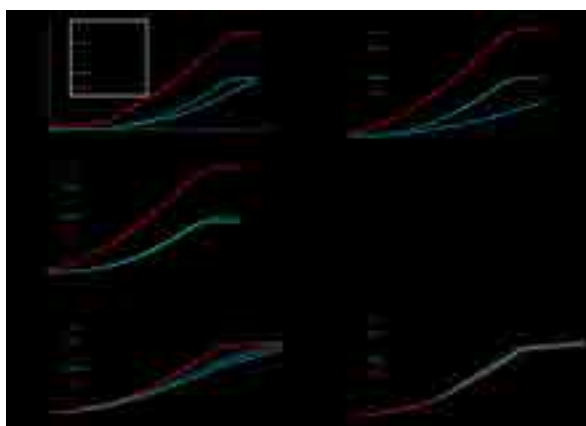


Figure.1: Effect of different TEs addition at different concentrations on mesophilic SMA tests, using acetate as a substrate at COD of 2 g/L (working volume of bottles containing Fe, Ni and Co was 400 mL while for Se and Mo was 200 mL).

Biography

DR NAKHLA'S research interests lie in the general area of environmental engineering and water and soil pollution control. The main areas of expertise are biological municipal and industrial wastewater treatment, biological nutrient removal processes, biological detoxification of hazardous contaminants, soil and ground water bioremediation, and landfill leachate treatment.

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