The Effect of Nutrients on Extracellular Polymeric Substance Production and its Influence on Sludge Properties

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Abstract

The effect of nutrients on extracellular polymeric substance (EPS) production and its impact on sludge properties and removal efficiencies was investigated in an in-depth field survey of wastewater treatment plants. Thereafter, laboratory studies were performed to evaluate the effect of a combination of nutrients, nitrogen and phosphorus, and operational conditions on EPS production and sludge settling and dewatering characteristics.

Multiple regression analysis was used to identify the importance and dependence of EPS and sludge properties on variables in nutrients operational conditions. The field survey revealed that although filamentous microorganism was found in most sludge samples, they did not always cause sludge bulking. Further, it was observed that EPS production was lower in anaerobic as opposed to aerobic processes. An evaluation of the effect of the deficiency and excess of nitrogen and phosphorus was conducted in batch experiments on synthetic wastewater with glucose as the carbon source. The study revealed that EPS components: protein and carbohydrate had a more profound effect on sludge properties as opposed to total EPS, with protein being

more significant than carbohydrate. Both nitrogen deficiency (COD: N < 100:2) and nitrogen excess (COD: N > 100:10) improved sludge properties. The optimum phosphorus ratio determined was COD: P ranging from 100:3 to 100:5 at which sludge properties including settling, dewatering and clarification were improved.

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