Physicochemical characteristics of grease-trap wastewater with different potential mechanisms of FOG solid formation, separation, and accumulation inside grease traps

ABSTRACT

This work investigates the physicochemical characteristics of grease-trap wastewater discharged from a large community market. It proposes potential mechanisms of fat, oil, and grease (FOG) solid formation, separation, and accumulation inside grease traps. Sixty-four samples, i.e., the floated scum, suspended solid-liquid wastewater, and settled sludge, were collected from the grease-trap inlet and outlet chambers. A lower pH of 5-6 at 25- 29 ◦C inside the grease trap than those reported under the sewer conditions (pH 6-7) was revealed. A significant difference in solid and dissolved constituents was also discovered between the inlet and outlet chambers, indicating that the baffle wall could affect the separation mechanism. The sludge samples had 1.5 times higher total solids (TS) than the scum samples, i.e., 0.225 vs. 0.149 g g− 1 TS, revealing that the sludge amount impacted more significantly the grease trap capacity and operation and maintenance. In contrast, the scum samples had 1.4 times higher volatile solids (VS) than the sludge samples, i.e., 0.134 vs. 0.096 g g− 1 VS, matching with the 64.2 vs. 29.7% of carbon content from CHN analysis. About 2/3 of the free fatty acids (FFAs) with palmitic acids were the primary saturated FFAs, while the remaining 1/3 of unsaturated FFAs were found in the solid and liquid samples. Although up to 0.511 g g− 1 FOG can be extracted from the scum samples, none from the sludge samples. More diverse minerals/metals other than Na, Cl, and Ca were found in the sludge samples than in the scum samples. Grease-trap FOG solids and open drain samples exhibited similar physicochemical properties to those reported in the literature. Four potential mechanisms (crystallization, emulsification, saponification, and baffling) were presented. This work offers insights into the physicochemical properties of grease-trap wastewater that can help explore its FOG solid formation, separation, and accumulation mechanisms inside a grease trap.