Food & Starch Industry Wastewater

The feasibility of UASB process (35^{O}C) for the anaerobic treatment of high-strength (up to 77 g COD/L) cheese-whey wastewaters was demonstrated by Martinez *et.al.,* [1996], with the treatment efficiencies higher than 95 and 90% on the basis of dissolved and total COD of the effluent, respectively. Fang, *et.al.,* [1994a] effectively treated wastewaters with hydrolyzed proteins in a UASB reactor and reported 84% COD removal for loading rates up to 32 kg COD/m^3.d, corresponding to a food-to-microorganism ratio of 0.81 g COD/g VSS.d, at 37^{O}C and a hydraulic retention time of 9 h. Of all the COD in wastewater, about 74% was converted to methane, 16% was unhydrolyzed proteins, which remain refractor to degradation, and 10% converted to biomass.

Wastewater containing high concentrations of cornstarch was treated by Kwong and Herbert [1996], in two 8.5 L UASB reactors and a modified anaerobic filter (AF). Results showed that, in spite of having different sludge concentration profiles, both reactors, with 12 h of hydraulic retention time, removed an average of 95.3% of COD from wastewater up to 45,000 mg COD/L.

A lab scale, UASB reactor was used for anaerobic treatment of coffee wastewater by M.Vins *et.al.,* [1988]. The coffee waste was proved to be totally biodegradable by means of anaerobic treatment, resulting an effluent with low VFA and phenol compounds. At laboratory scale satisfying organic and hydraulic loading rates could be applied, up to 15 kg COD/ m^3.d and 1 m^3/d resulting in COD treatment efficiencies of 75-80%. The UASB reactor could handle the organic loading rates from 7.5 to 20 kg COD/m^3.d. The average sludge yield was 0.12 kg VSS/ kg COD removed. The COD removal was 72 to 93% and the highest methane yield reached 5.09 m^3 CH_4 / m^3 reactor.d.

Dinsdale *et.al.,*[1997] successfully treated instant coffee production wastewater in mesophilic and thermophilic UASB reactors. Stable anaerobic digestion of settled instant coffee wastewater was achieved for over 100 days in mesophilic (55^{O}C) UASB reactors. Thermophilic UASB reactors were seeded with mesophilic granules and converted to thermophilic operation by raising the temperature to 55^{O}C in one step. Successful thermophilic operation was achieved within 28 days. Both mesophilic and thermophilic UASB reactors achieved stable digestion at OLR up to 10 kg COD/m^3.d and at HRT of 24 h.

Ciftci *et.al.,*[1993] have reported the anaerobic treatment of the high strength wastes from the yeast industry by UASB process. Effective treatment of fruit juice industry wastewater by UASB-reactor has been reported by Haun *et.al.,* [1997]. A pilot-scale upflow anaerobic sludge blanket (UASB) digester was used to treat nitrogen supplemented sweet whey (SW) and lactic acid casein whey (LACW) at stable loading rates (OLR) up to 16.0 and 9.0 kg COD/m^3.d, respectively, and COD reduction ranged from 72-99%, and biogas yield reported was 570 L /kg COD fed. [Clark, 1988].

A modified UASB reactor was suggested by Lui-Kai-Li *et.al.*, [1985], for starch wastes. The result showed that the UASB reactor possessed high treatment efficiency for more than 1 year associated with increase in organic loadings from 1.3 g/L.d to 0.2 g/L.d when detention time reduced from 2.7 days to 1.8 days, the gas production rate increased from 1 L/L.d. to 8.1 L/L. d. The COD removal efficiency reached to 92%, and methane content of the biogas produced was over 69.2%.

Feasibility of mesophilic anaerobic treatment of edible oil refinery wastewater in UASBR is discussed by Rinzema *et.al.*, [1985]. A high rate anaerobic treatment of palm oil mill effluent was achieved in a two- stage UASB reactor. The acidogenic reactor acclimated rapidly to the wastewater and was tolerant to a suspended solids (SS) concentration of 5.4 g/L in the influent wastewater [Borja *et.al.,* 1996].

Ozturk *et.al.*, [1993] carried out treatability studies for treating dairy effluents from a large industry with a maximum production capacity of 500 tons of milk per day using a laboratory-scale hybrid UASB reactor. The reactor was operated for more than 270 days under mesophilic conditions and it was fed with the combined effluents from the investigated dairy industry. The hydraulic retention times ranged from 0.21 to 0.96 days under normal operating conditions after the start up. COD removal efficiencies of more than 87% were achieved at an organic loading rate (OLR) of 8.5 kg COD/m^3. d.