FEED INLET DESIGN

It is important to establish optimum contact between the sludge available inside the reactor and wastewater admitted to the reactor. The channeling of the wastewater through sludge bed or formation of dead pockets in the reactor should be avoided. The danger of channeling becomes bigger at lower gas production rate, lower than 1 m^3/m^3.d [Lettinga and Hulshoff, 1991], and while treating very low strength wastewater due to lower applicable loading conditions. Hence, proper design of inlet distribution system is necessary to establish optimum contact between sludge and wastewater. Depending on topography, pumping arrangement, and likelihood of blocking of inlet pipes, one could provide either (i) gravity feed from top (preferred for wastewater with high suspended fraction), or (ii) pumped feed from bottom through manifold and laterals (preferred in case of soluble industrial wastewaters). The rough guidelines for the number of feed inlet points required in UASB reactor is presented by Lettinga and Hulshoff [1991] for different concentration of the sludge inside the reactor and applicable loading rates. In general, the area to be served by each feed inlet point should be between 1 and 3 m^2. Lower area per inlet point is to be adopted for reactor designed for lower loading (about 1 kg COD/m^3.d) and higher area per inlet point can be provided for higher loading conditions.

Apart from the number of feed inlet points, the minimum and maximum outflow velocity through the nozzles should also be given due consideration while designing. This outflow velocity through nozzles can be kept between 0.5 and 4.0 m/sec. The clogging of the nozzles may represent serious problem, particularly when treating partially soluble wastewater. The clogging of the nozzles may result in uneven distribution of the wastewater over reactor bottom. Hence, arrangements should be made for cleaning or flushing the inlet system.

Guidelines for number of feed inlet points required in UASB reactor

Type of Sludge Present	Area per Feed Inlet Point (m^2)
Dense Flocculent Sludge (>40 kg TSS/m^3)	0.5-1 at loads <1kg COD/m^3.d 1-2 at loads 1-2kg COD/m^3.d 2-3 at loads >2kg COD/m^3.d
Medium thick flocculent sludge (20-30 kg TSS/m^3)	1-2 at loads <1-2kg COD/m^3d 2-5 at loads >3kg COD/m^3.d
Granular Sludge	0.5-1 at loads up to 2kg COD/m^3.d 0.5-2 at loads 2-4kg COD/m^3.d >2 at loads >4kg COD/m^3.d

Source: Lettinga and Hulshoff, [1991]