

HYDRAULIC RETENTION TIME

Effect of Hydraulic Residence Time (HRT)

Selection process imposed on the sludge is one of the crucial factors in the granulation process. The selection process is based on differences in settling properties of dispersed and granular sludges. Very long HRT may allow dispersed bacterial growth and be less favorable for granulation. A short HRT, especially if combined with a high upflow velocity, could cause wash out of dispersed bacterial matter and promote granulation [Alphenaar *et al.*, 1993]. Thus, very long HRT is less favorable for granulation process.

The role of organic loading rate is also important in this case. For constant organic loading rate, decrease in COD removal efficiency was reported with decrease in HRT for high strength wastewater [Jawed and Tare, 1995]. Also, the requirement of bicarbonate alkalinity considerably decreases with increase in HRT at same OLR. Reduction in methanogenic activity from 0.32 to 0.11 g CH₄-COD/ g VSS.d was reported when the HRT was reduced from 14 to 5 h for domestic wastewater. The domestic wastewater can be successfully treated at HRT of 4.7 h and at low temperature (25-13⁰C) with COD removal efficiency about 70% [Shigeki and Hideki, 2000]. Successful operation of UASB reactor had been reported even for the HRT as short as 2 h [Fang and Chui, 1993]. Hence, combine effect of HRT, upflow velocity, and organic loading seems to be important. But in general, for the start-up of the reactor the best HRT was found to be around 12 h.

In the study of effect of HRT on bacterial population in CSTR anaerobic digester with starch as organic carbon, it was found that HRT does not have much effect on the population levels of hydrolytic bacteria and H₂-producing acetogens. However, HRT has a considerable effect on the population levels of methanogens, homoacetogens, as well as, sulphate-reducing bacteria and on the composition of fermentative products. The populations of H₂-utilizing methanogens and homoacetogens increased when HRT decreased from 244.8 to 6 h, and the maximum levels of these bacteria were 7.9 x 10⁹ MPN/mL at a HRT of 6 h and 3.5 x 10¹⁰ MPN/mL at a HRT of 12 h, respectively. In contrast, acetate-utilizing methanogens and CH₃-OH-utilizing methanogens were washed out at HRT of 12 and 4.2 h, respectively. Even at a HRT of 1.5 h, methane can be produced by H₂-utilizing methanogens [Zhang and Tatsuya, 1994].

