Example 3.3

What is the value of the per capita reactor volume for an activated sludge system operating at a sludge age of 10 days and a sludge concentration of X_v = 3 g VSS.l^{-1}, if a per capita contribution of S_{hab} = 75 g COD.inh^{-1}.d^{-1} is assumed? Evaluate for both raw (f_{ns} = 0.10; f_{np} = 0.10) and settled sewage (f_{ns} = 0.10; f_{np} =0.01).

Solution*:*

In the case of raw sewage, Fig. 3.9a is used to determine the reactor volume. For R_s = 10 d and a volatile sludge concentration of 3 g VSS.l^{-1} one has v_r = 0.72 m^3.kg^{-1} COD.d^{-1}. For the per capita contribution of 75 g COD.inh^{-1}.d^{-1} or 1000/75 = 13.3 inh.kg^{-1} COD.d^{-1}, the per capita volume V_{inh} =0.72/13.3 = 54 l.inh^{-1}. Similarly, in the case of settled sludge one has in Fig. 3.9b for R_s = 10 and X_v = 3 g VSS.l^{-1} a volume of v_r = 0.59 m^3.kg^{-1} COD.d^{-1}.

Hence for the same per capita contribution (i.e. 13.3 inh.kg^{-1} COD.d^{-1}) the per capita volume V_{inh}= 0.59/13.3 = 44 l.inh^{-1}. In practice the COD contribution per capita is of the order of 35 (slums) to 100 g COD.inh^{-1}.d^{-1} (middle class). It can be noted that the reactor volume is independent of the sewage concentration.