1. A wastewater treatment has the following process train: bar screen, grit chamber, primary sedimentation basin, activated sludge system, and secondary sedimentation basin. Using average percent removal efficiencies given in Table 4.2 of your text book for various units, estimate the effluent quality in terms of BOD5, COD, TSS, TP, ON, NH3-N, and NO3-N. The influent quality after mixing with the return flows from the sludge processing areas is as follows: BOD5 = 220, COD = 450, TSS = 255, TP = 9, ON = 8, NH3-N = 21 and NO3-N = 0. All units are in mg/L.
2. A primary sedimentation basin has an influent flow of 20 000 m3/d with an influent TSS concentration of 250 mg/L and a BOD5 concentration of 220 mg/L. In sedimentation basin, the TSS removal is 60 % and BOD5 removal is 35 %. If the primary sludge has 4.5 % solids with a specific gravity of 1.03:
3. Estimate the primary sludge volume (m3/d).
4. Estimate the effluent flow in terms of m3/d.
5. Estimate the effluent TSS and BOD5 concentrations.
6. The sludge processing train of a wastewater treatment plant includes gravity thickener and centrifuge. Calculate the volume of sludge cake (m3/d) and TSS concentration in the overflows from the thickener and centrifuge. Use the following data: Combined sludge is 500 m3/d at 1.2 % solids (sp. gr. = 1.01), solids capture efficiencies of the gravity thickener and the centrifuge are 85 % and 90 %, respectively. The thickened sludge has 4 % solids (sp. gr. = 1.03). The sludge cake has 25 % solids with a specific gravity of 1.06.
7. The effluent discharge permit of a wastewater treatment facility is 5/5/10/2 (BOD5/TSS/TN/TP). The average BOD5, TSS, TN, and TP are, respectively, 220, 250, 40, and 12 mg/L (assume TN = 50 % ON + 50 % NH3-N). Draw a process diagram using proper treatment processes to meet the permit discharge limits. There could be numerous process combinations to achieve the same objective. You should select a process train that has the least number of treatment processes and is similar to a conventional wastewater treatment plant. Draw diagram and indicate effluent quality from each process.