

10.1.4 Applicable system configurations

Once the influent flow and -composition and the required effluent composition have been determined, the selected configuration and main unit volumes will be determined by the ambient conditions and particularly by the temperature.

In the previous chapters it was shown that nitrification at very low temperature is practically impossible, allowing only secondary treatment with removal of suspended solids and organic material. At higher temperature nitrification will be possible and in regions with a warm climate it will practically be inevitable. In this case secondary treatment systems with nitrification or tertiary treatment systems with nitrogen and possibly also phosphorus removal can be operated.

Therefore five basic configurations of the activated sludge process can be distinguished. Table 10.5 lists the five configurations and their performance in the removal of several waste water constituents. Fig. 10.1 and 10.2 show the basic process flow schemes.

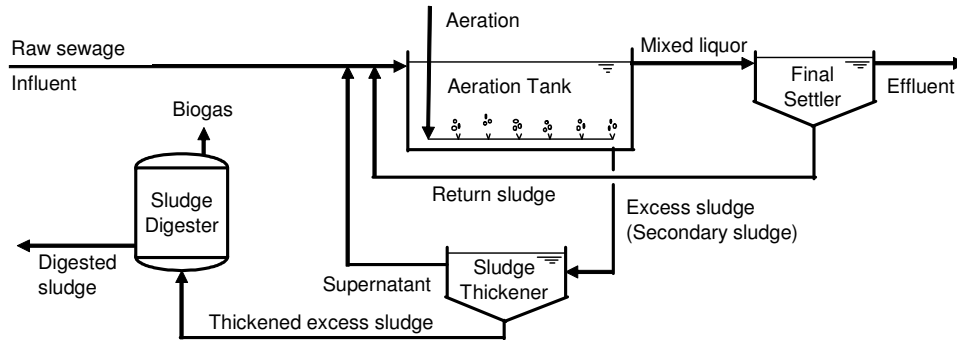
Table 10.5 Summary of the five basic configurations of the activated sludge system and their treatment efficiency with respect to suspended solids (SS), organic material (COD), total organic nitrogen (TKN), total nitrogen (N_t) and phosphorus (P)

Configuration		Removal efficiency				
		SS	COD	TKN	N_t	P
A1	Secondary treatment with thickening and anaerobic digestion of the excess sludge	+	+	-	-	-
A2	Secondary treatment preceded by primary clarification, with subsequent thickening and anaerobic digestion and stabilisation of the produced primary and secondary sludge	+	+	-	-	-
B1	Anaerobic pre-treatment, secondary aerobic post-treatment with nitrification and excess sludge digestion	+	+	+	-	-
C1	Tertiary treatment with nitrogen removal, thickening and anaerobic digestion of the excess sludge (Bardenpho configuration)	+	+	+	+	+
C2	Tertiary treatment with nitrogen and phosphorus removal with thickening and anaerobic digestion of the excess sludge (UCT configuration)	+	+	+	+	+

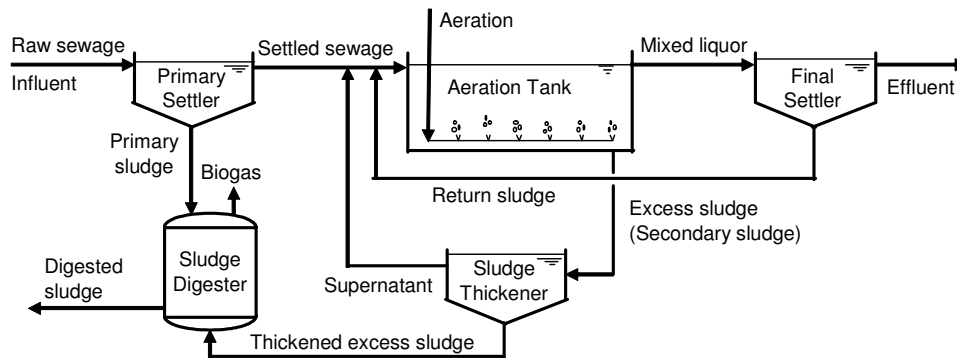
Starting from these basic configurations, hybrids can be constructed. For example, when the waste water has a low COD/N ratio, it may be possible to include primary clarification or even anaerobic pre-treatment in configuration C1 or C2 in order to reduce the organic load to the activated sludge system, and still leave enough organic material in the pre-treated influent for removal of the nutrients through means of biological treatment.

Furthermore it may be possible to combine the configurations with other types of treatment. For instance in the Netherlands, configuration C2 is often preceded by primary clarification and supplemented by the addition of metal salts to remove any phosphate not taken up by the bio-P organisms. However, in this chapter the optimising procedure will be restricted to the five basic configurations presented above.

A1 - Conventional secondary treatment



A2 - Conventional secondary treatment with primary clarification



B1 - Anaerobic pre-treatment with aerobic post-treatment (nitrification)

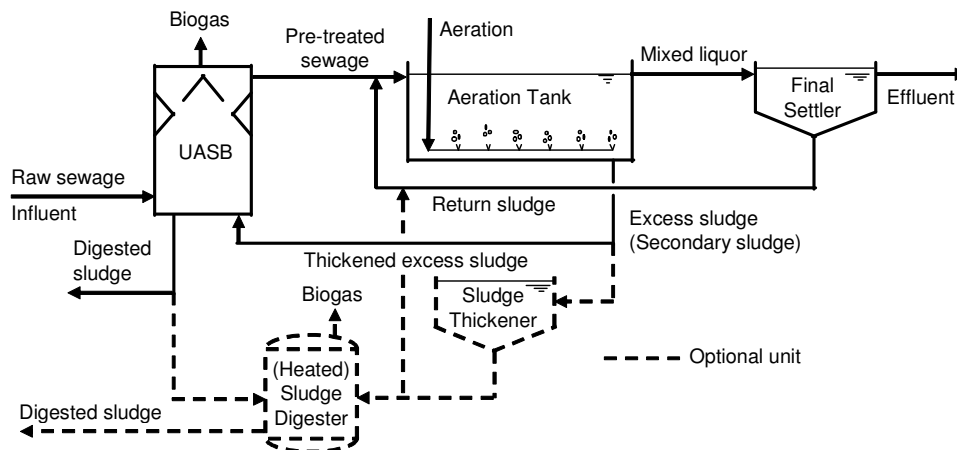


Figure 10.1 Basic process flow diagrams of system configurations A1, A2 and B1

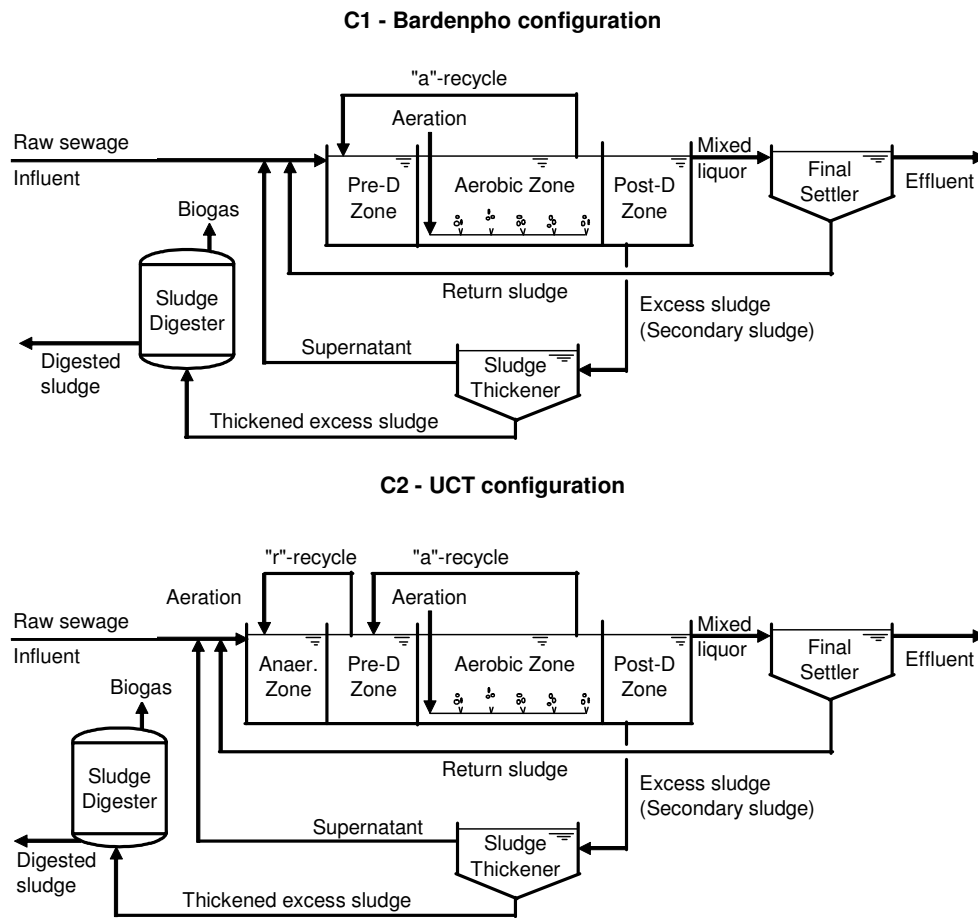


Figure 10.2 Basic process flow diagrams of system configurations C1 and C2