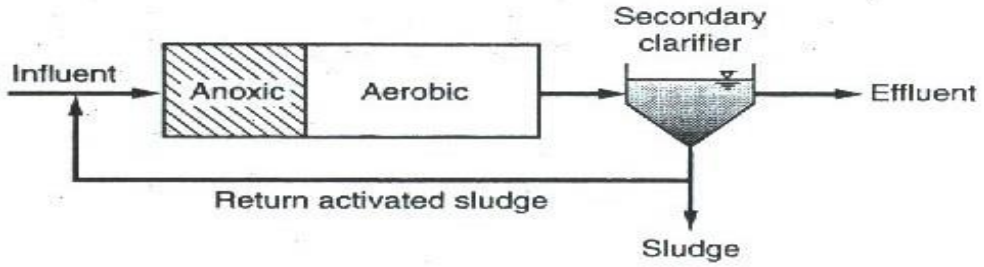
Biological Nutrient Removal (BNR) PLANTS

Ref: M&E

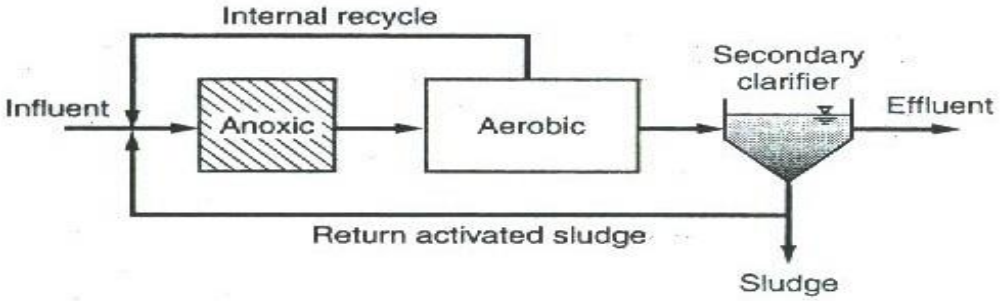
Dr. A. Saatci

Table 8–21
Description of suspended growth processes for nitrogen removal

Process
Preanoxic
(a) Ludzack-Ettinger

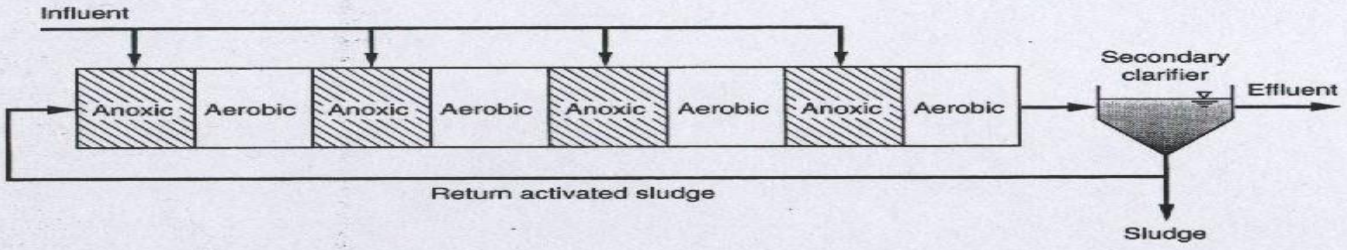


(b) Modified Ludzack-Ettinger (MLE)

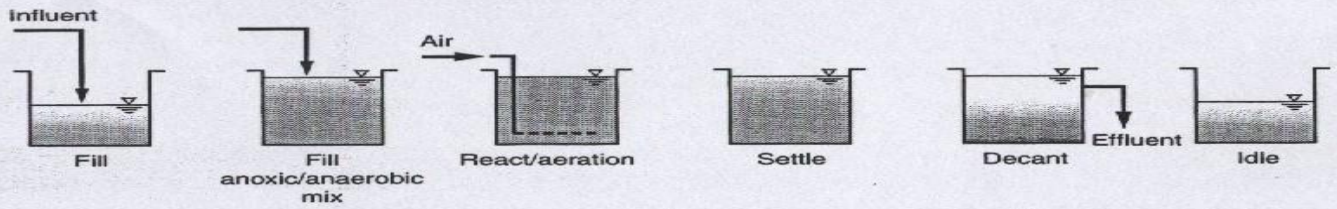


Preanoxic (*Continued*)

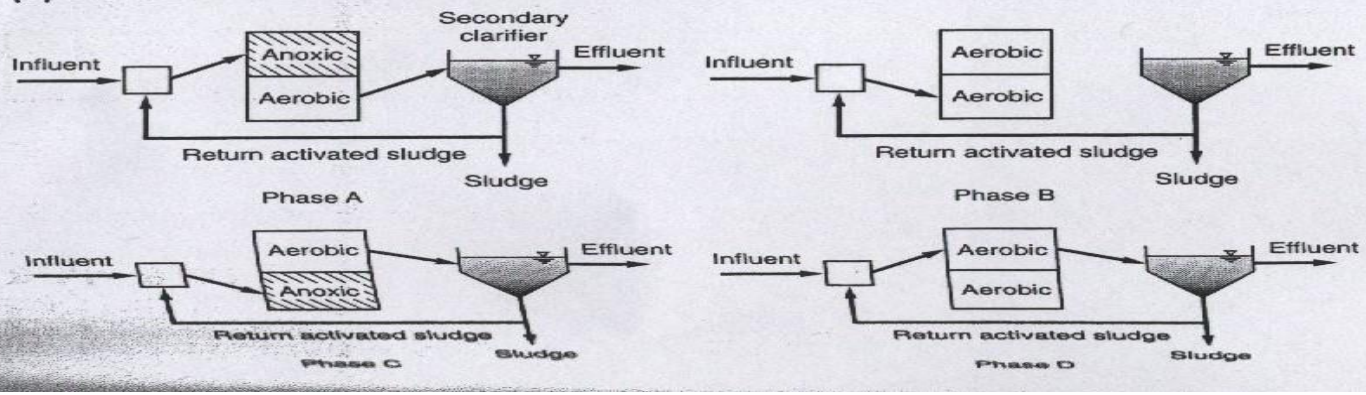
(c) Step feed



(d) Sequencing batch reactor (SBR)

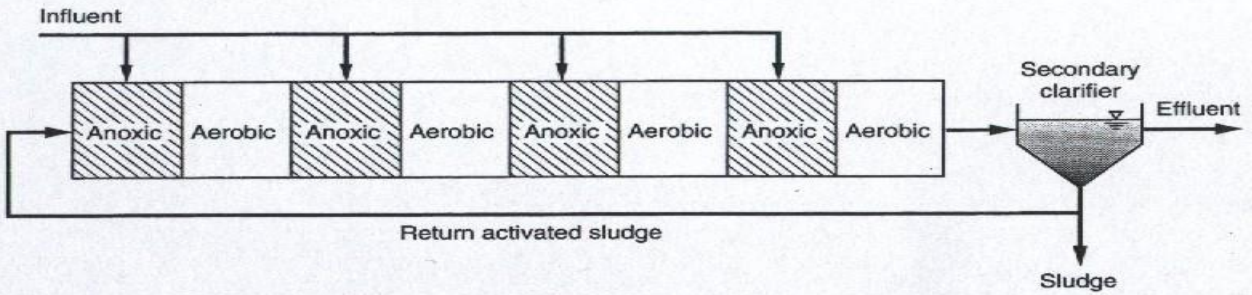


(e) Bio-denitro™

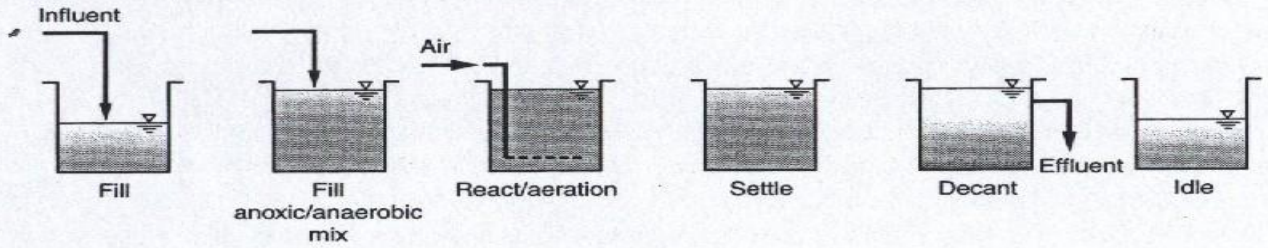


Preanoxic (Continued)

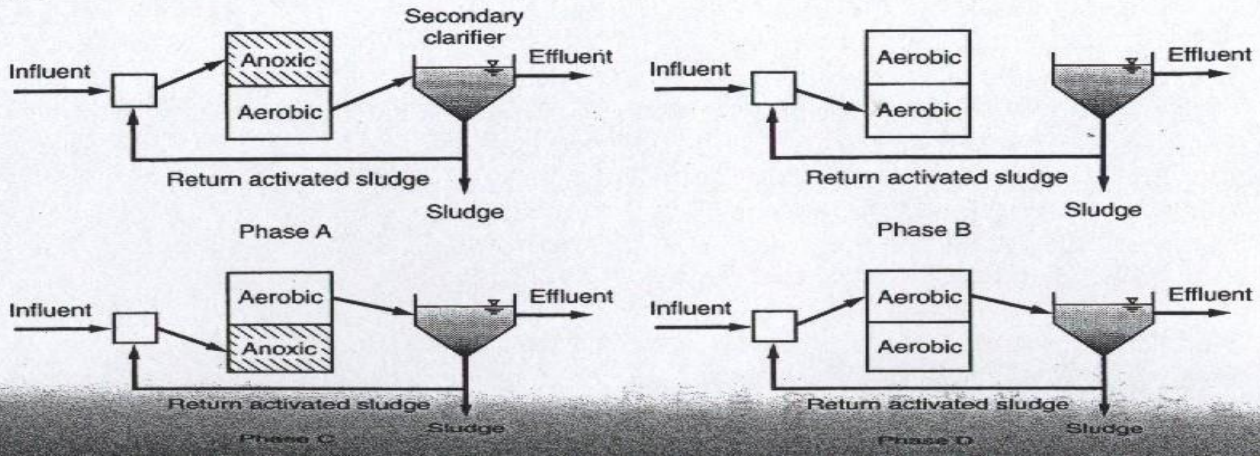
(c) Step feed



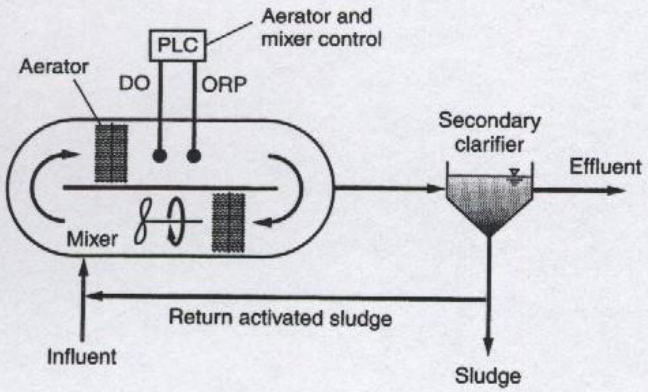
(d) Sequencing batch reactor (SBR)



(e) Bio-denitro™

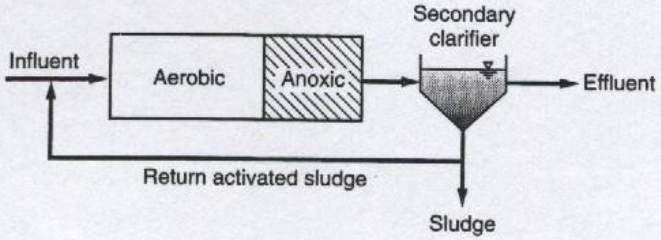


(f) Nitrox™

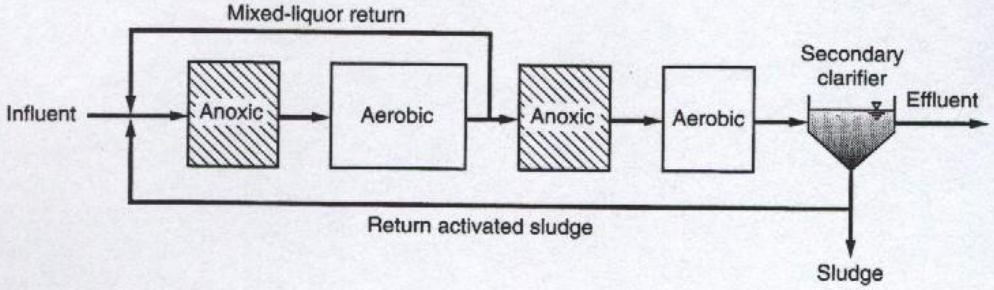


Postanoxic

(g) Single-sludge

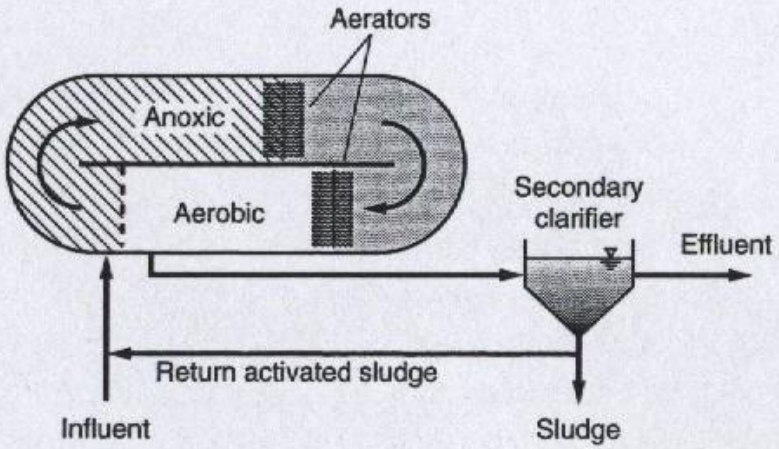


(h) Bardenpho (4-stage)

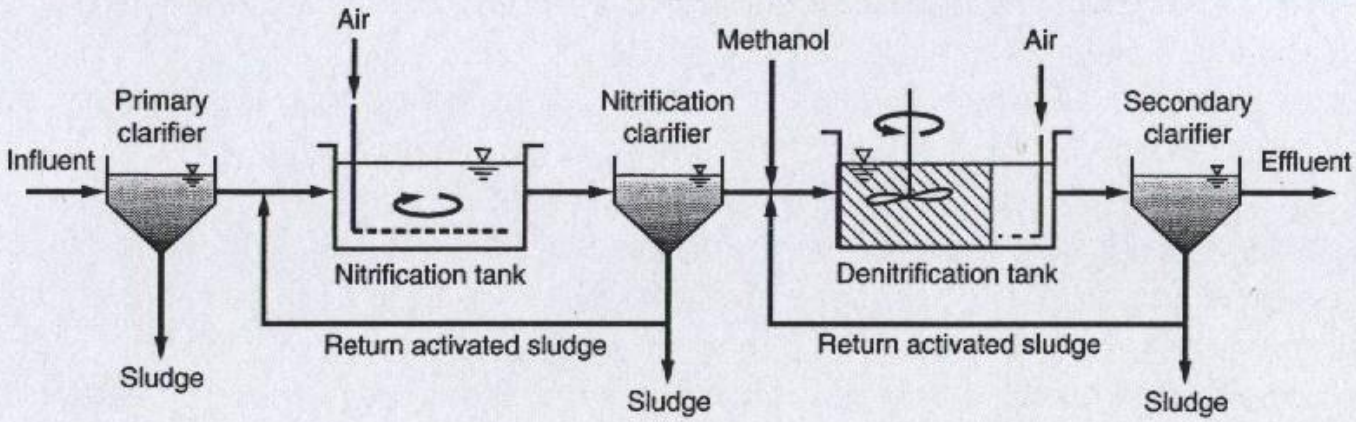


Postanoxic (*Continued*)

(i) Oxidation ditch

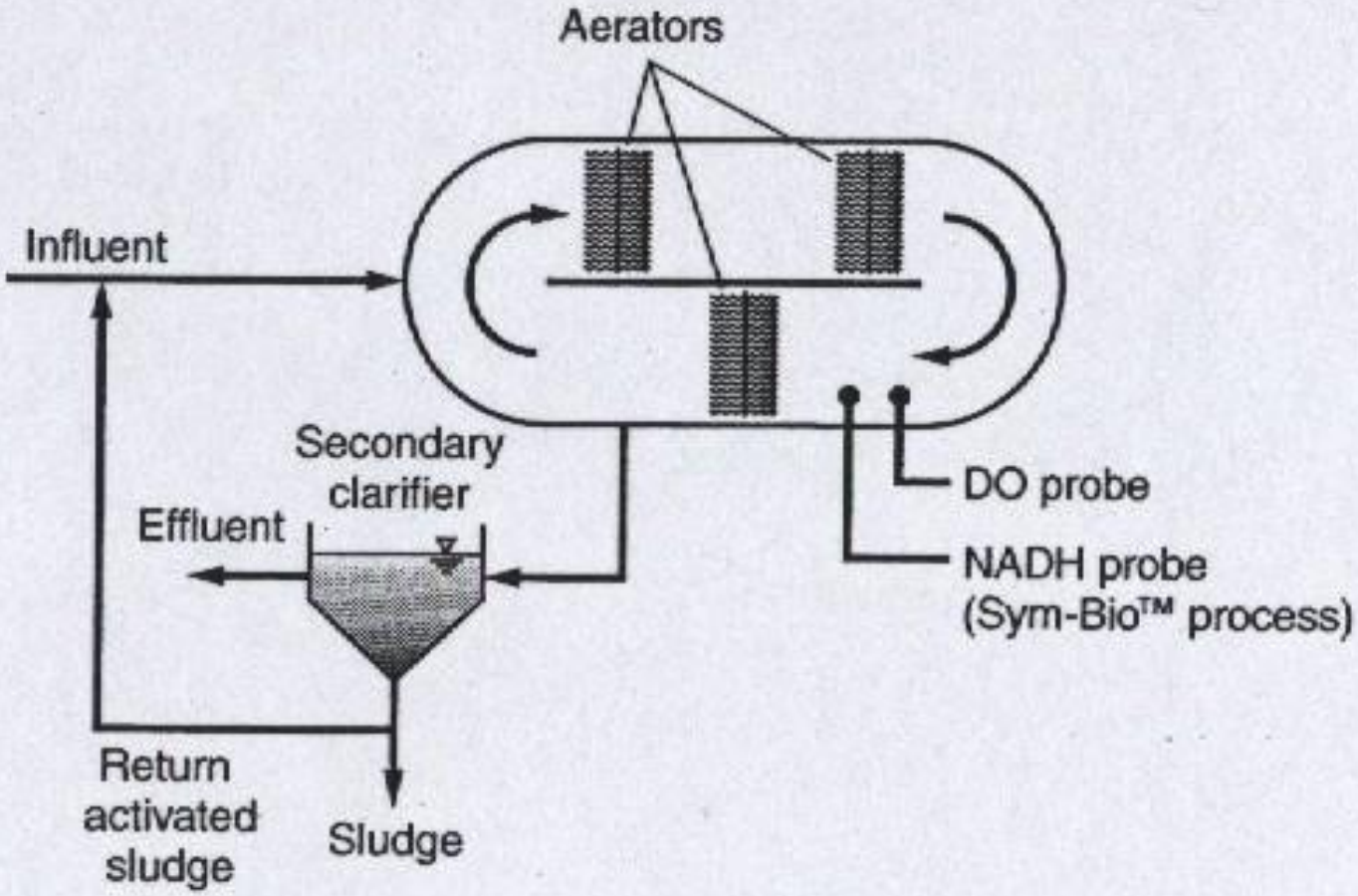


(j) Two-stage (two-sludge) with an external carbon source



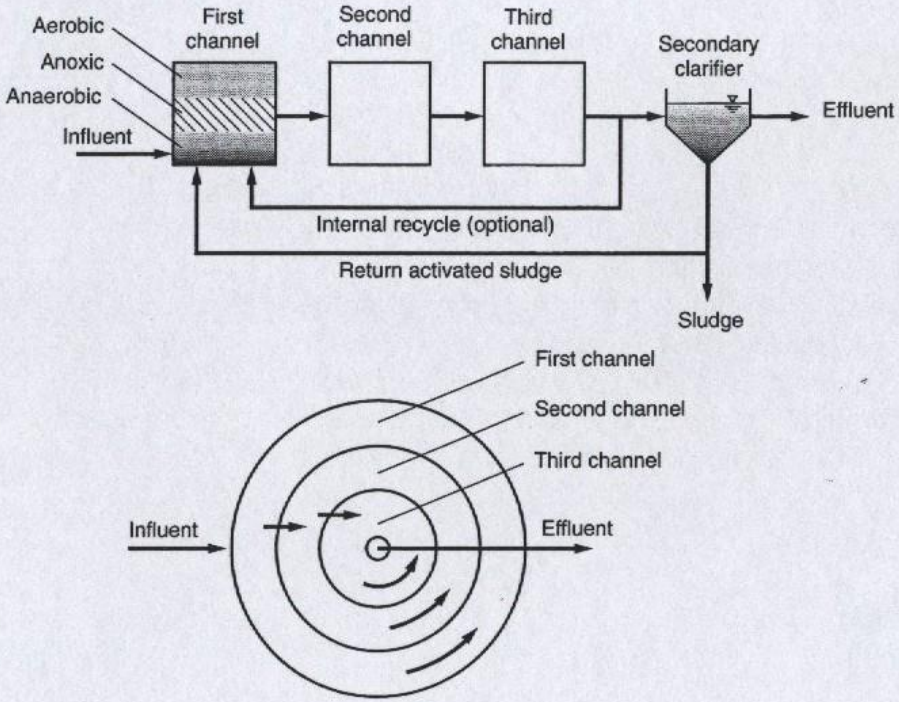
Simultaneous nitrification/denitrification

(k) Low DO oxidation ditch



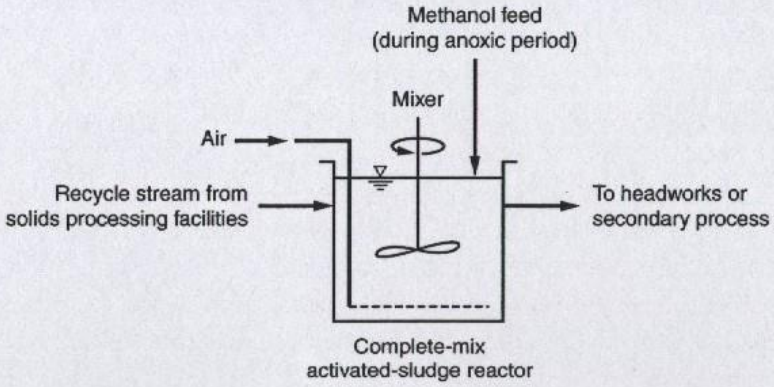
Simultaneous nitrification/denitrification (*Continued*)

(l) Orbal™

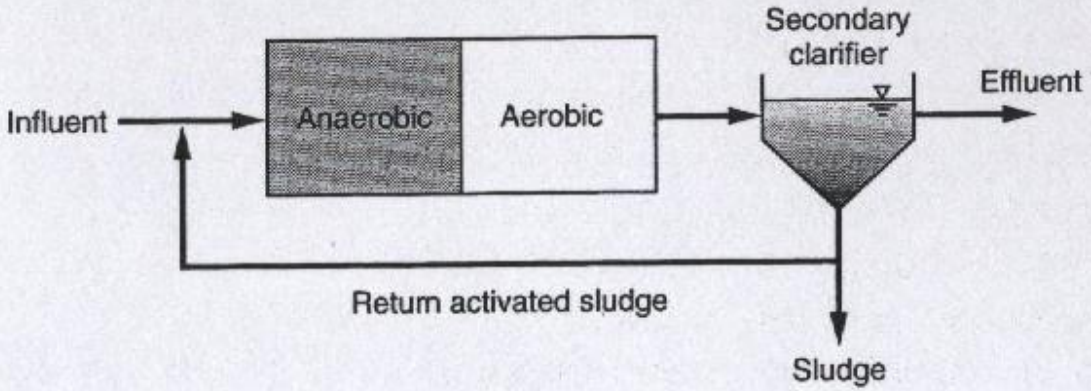


Nitrogen removal from digested sludge processing recycle flows

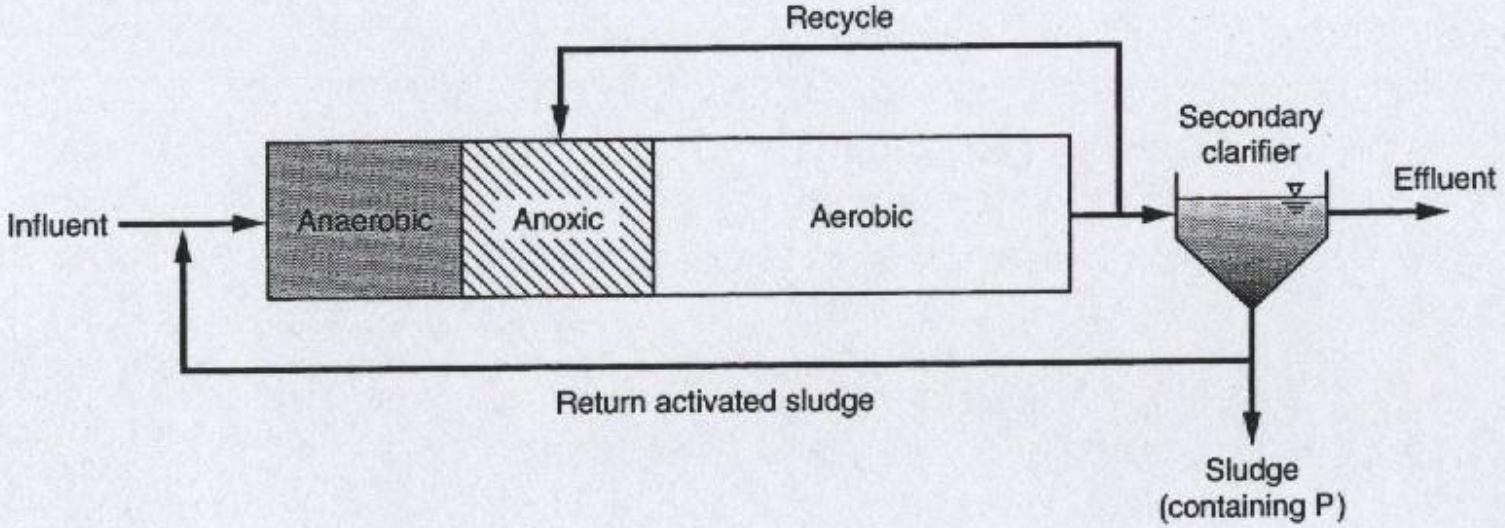
(m) Sharon (single-reactor high-activity ammonia removal over nitrite)



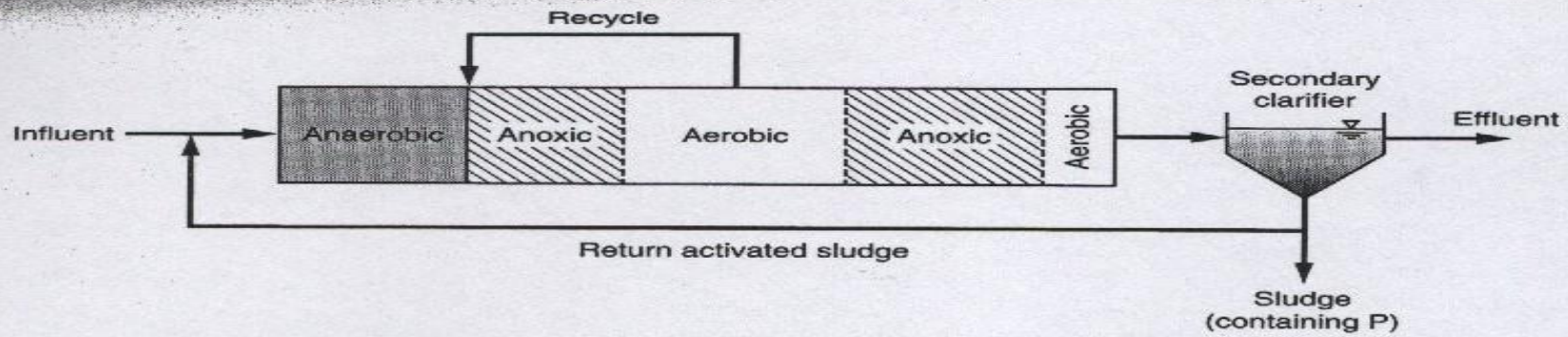
(a) Phoredox (A/O)



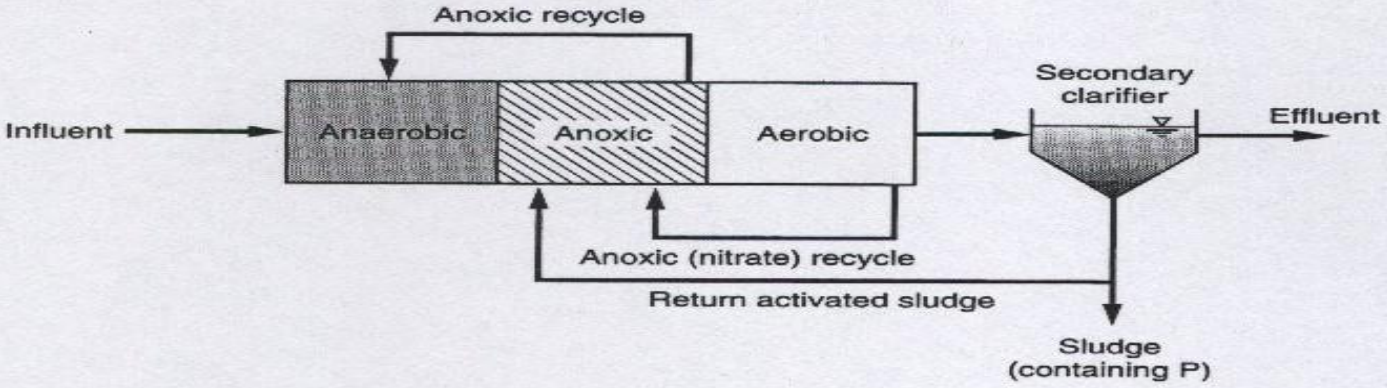
(b) A^2/O

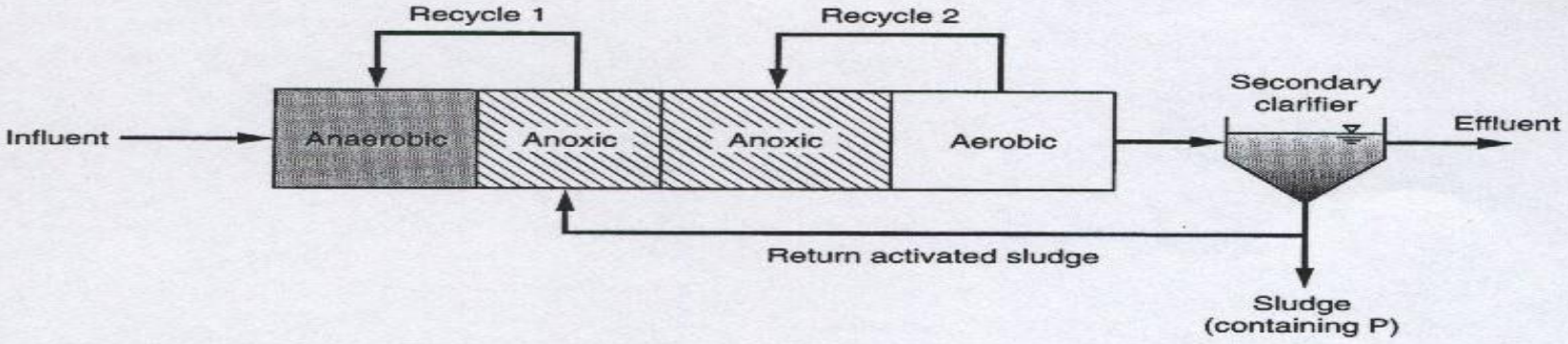


(c) Modified Bardenpho (5-stage)

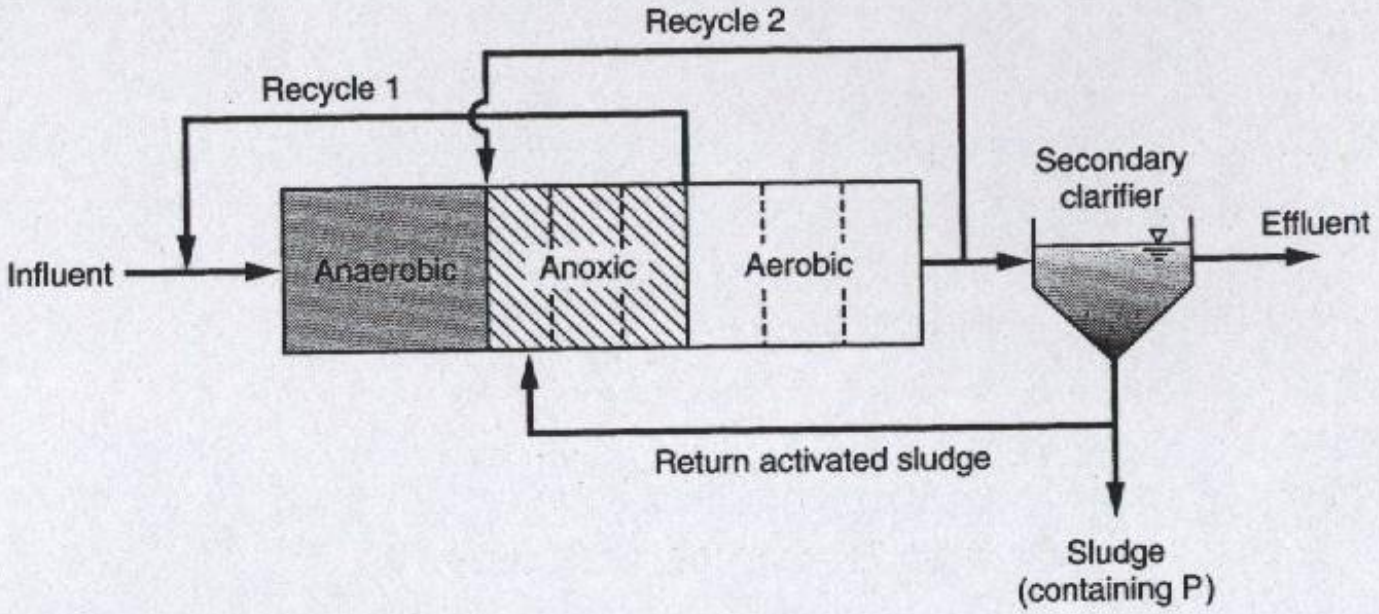


(d) UCT (standard and modified)

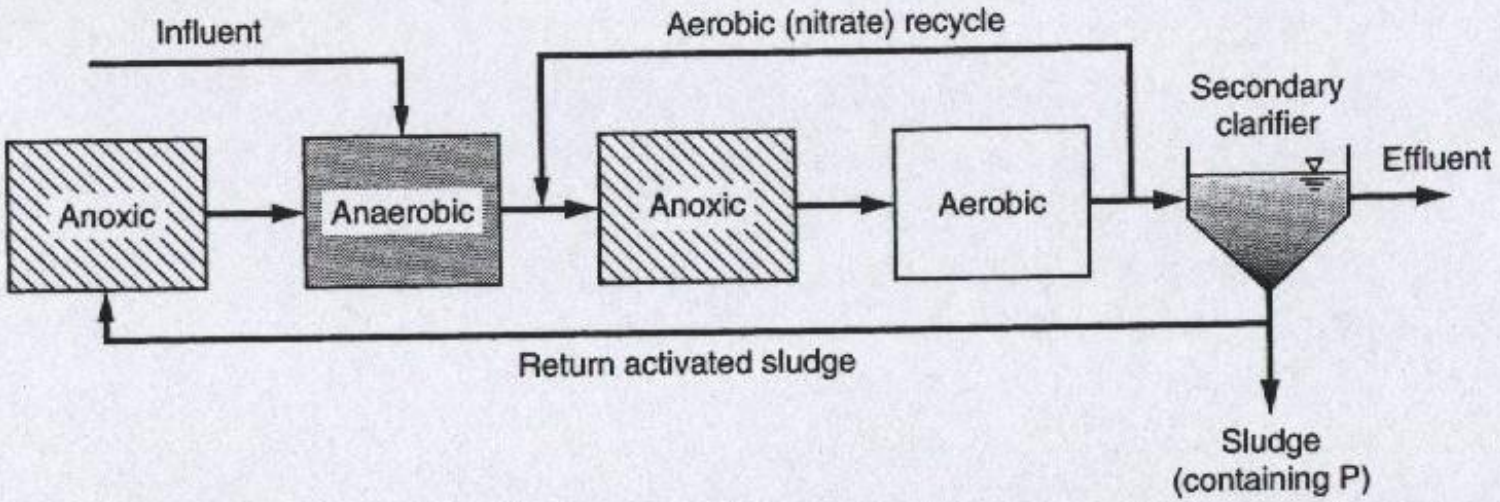




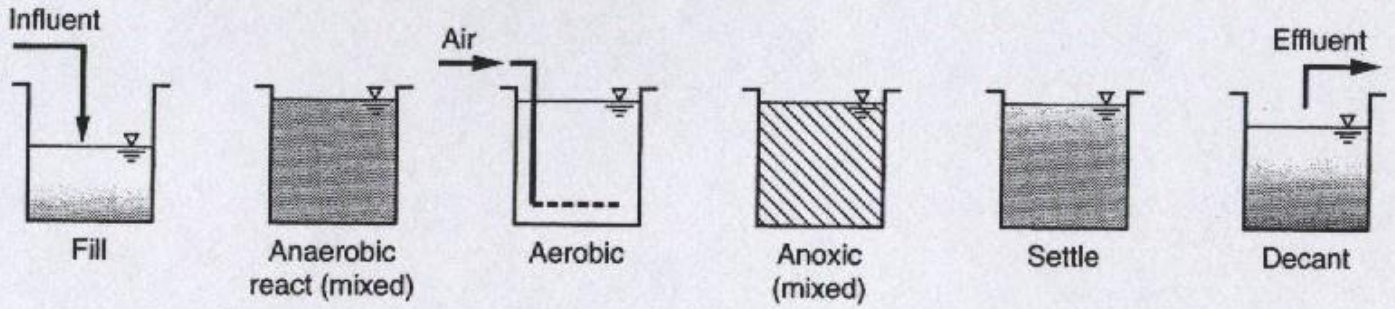
(e) VIP



(f) Johannesburg process



(g) SBR with biological phosphorus removal



(h) PhoStrip

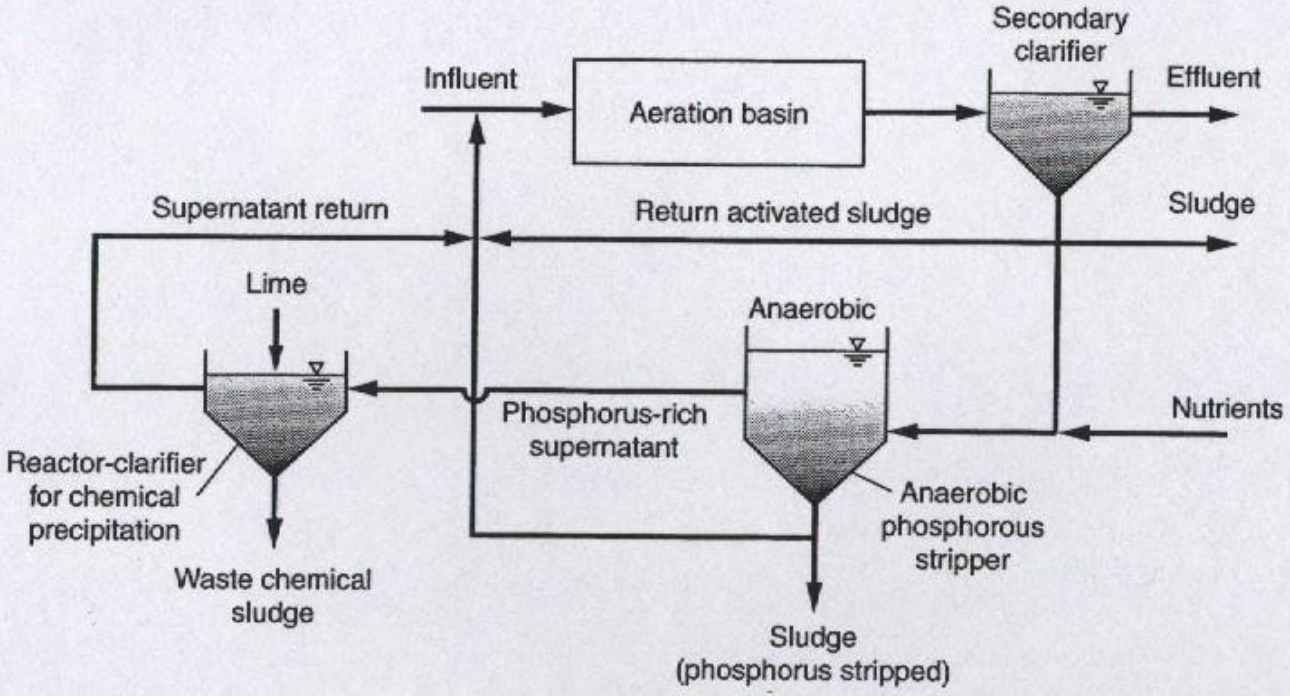


Table 8-26
Typical design parameters for commonly used biological phosphorus-removal processes[a]

Design parameter/process	SRT, d	MLSS, mg/L	τ, h			RAS, % of influent	Internal recycle, % of influent
			Anaerobic zone	Anoxic zone	Aerobic zone		
A/O	2–5	3000–4000	0.5–1.5	—	1–3	25–100	
A^2/O	5–25	3000–4000	0.5–1.5	0.5–1	4–8	25–100	100–400
UCT	10–25	3000–4000	1–2	2–4	4–12	80–100	200–400 (anoxic) 100–300 (aerobic)
VIP	5–10	2000–4000	1–2	1–2	4–6	80–100	100–200 (anoxic) 100–300 (aerobic)
Bardenpho (5-stage)	10–20	3000–4000	0.5–1.5	1–3 (1st stage) 2–4 (2nd stage)	4–12 (1st stage) 0.5–1 (2nd stage)	50–100	200–400
PhoStrip	5–20	1000–3000	8–12		4–10	50–100	10–20
SBR	20–40	3000–4000	1.5–3	1–3	2–4		

[a]Adapted from WEF (1998).