

Translation - English

3. Operational results from domestic sewage treatment plants

3.1. A 500 EP domestic sewage pilot plant in Kingsten Seymour (England)

In 1994 three English water utilities decided to trial the Wabag process (with KUBOTA membranes) under real operating conditions for further applications in England. In March 1995 a 500 EP pilot plant was commissioned. The trial period was to be 12 months, aiming to establish the system's capability and economics as well as design parameters and operational performance. To date the plant is still operational with continued good results.

The plant's main units are coarse screen, denitrification zone ($V = 8 \text{ m}^3$), fine screen ($a = 1 \text{ mm}$), membrane bioreactor ($V = 30 \text{ m}^3$, membrane surface area = 240 m^2) with mixed liquor return to an upstream denitrification zone ($Q_{\text{recycle}} = 160 - 320 \text{ m}^3/\text{d}$) and sludge storage.

Daily flow is $100 \text{ m}^3/\text{d}$ at a maximum hourly flow of $8 \text{ m}^3/\text{h}$. Complete carbon and nitrogen removal is to be achieved. In April 1995 the plant was seeded with activated sludge from a nearby domestic sewage treatment plant. Target MLSS of $15 - 20 \text{ g/L}$ was achieved after 40 days. Carbon and Ammonia removal were observed as early as day two. After 42 days the target discharge values of $\text{BOD} < 5 \text{ mg/L}$, $\text{COD} < 24 \text{ mg/L}$, $\text{NH}_4\text{-N} < 1 \text{ mg/L}$, $\text{TKN} < 15 \text{ mg/L}$, $\text{NFR} = \text{not detected}$, bacteria $< 50/100 \text{ mL}$ were safely met (**Table 1**). Sludge age varied between $\tau_{\text{TS}} = 40$ and $\tau_{\text{TS}} = 70$ days.

| Parameter | Influent | Effluent required | Effluent achieved |
|------------------------------------|-----------------------------------|-------------------|-------------------|
| BOD | 130 – 311 mg/L max. 2,200 mg/L | < 5 mg/L | 2 – 5mg/L |
| COD | 318 – 660 mg/L max. 4,000 mg/L | -- | < 24 mg/L |
| NH ₄ -N | 30 mg/L max. 90 mg/L | < 5 mg/L | < 1 mg/L |
| TKN | -- | < 15 mg/L | < 15 mg/L |
| SS | 176 – 344 mg/L max. 2,400 mg/L | -- | not detected |
| Faecal coliforms | 15.6 max. 180 | -- | < 0.00002 |
| Total coliforms | 60 max. 740 | -- | < 0.00004 |
| Faecal streptococcus 106/100 mL | 1.44 max. 7 | -- | < 0.000013 |
| Coliphage viruses PFU/10 L | 1,540 max. 33,000 | -- | 0.37 |

Table 1: pilot plant performance results

During the first 650 days of operation one mechanical and two chemical cleans were performed. Chemical cleans were performed in situ with Sodium Hypochlorite. This restored start-up flux. Transmembrane pressure was between 0.1 and 0.15 bar. No membranes have been replaced so far.

After five years of operation up to now, the following conclusions can be drawn:

- required discharge values were safely met,
- effluent quality was not affected by large variations of influent concentrations (BOD = 30 – 2,100 mg/L, COD = 100 – 4,000 mg/L),
- the system requires only minimum maintenance with two membrane cleans per year recommended,
- no primary and final clarifiers required,
- minimal space requirements and compact design allow problem-free minimisation of odour and noise emissions,
- sludge bulking or fibrous bacteria do not affect operation or effluent quality.

These positive results led to the decision to design and build a 5,000 EP plant located at the seaside with inherent seasonal variations and tight discharge limits utilising the WABAG membrane process. This modern sewage treatment plant was commissioned in February 1998.