

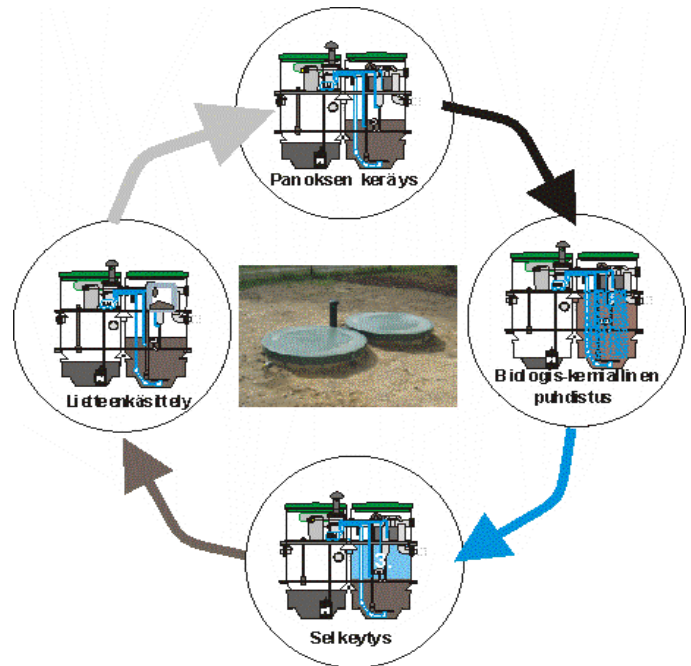
COLLECTED RESULTS OF CE TESTING and ESTIMATE OF OPERATION IN RESPECT OF THE REQUIREMENTS OF THE WASTEWATER DECREE (542/2003)

Raita PA0.6R07 –Sequencing Batch Reactor (SBR)
 Raita Environment Oy

The Finnish Environment Institute (SYKE) has carried out initial type testing of the Raita -SBR in accordance with the standard EN 12566-3 (CEN 2005), including tests in accordance with Annexes A and B. Testing was performed at SYKE's Suomenoja Research Station at Hyljeluodontie 5, FI-02270 Espoo, Finland between 27 June 2007 and 13 July 2008.

SYKE has been found to fulfil the requirements on reliability and independence, as well as other general requirements set by the Act on the approval of construction products (230/2003) for a body participating in proving the conformity of a product required for CE marking, including the competence to carry out initial type testing of equipment for the treatment of domestic wastewater.

The Raita -SBR is a biological-chemical treatment plant designed for all wastewater generated by one household (max. 6 persons). The design flow of the treatment plant is 720 l/day and the organic design load 300 g BOD₇/day.



Test schedules

| Sequence | Flow l/d | Duration weeks | Samples |
|--|-------------|-------------------|-----------|
| 1 Biomass establishment | 720 | X | X |
| 2 Nominal 100 % | 720 | 6 | 4 |
| 3 Underloading 50 % | 360 | 2 | 2 |
| 4 Nominal 100 % + power breakdown 24h | 720 | 6 | 5 |
| 5 Low occupation stress 0 % | 0 | 2 | - |
| 6 Nominal 100 % | 720 | 6 | 3 |
| 7 Overloading 150 % * | 1080* / 720 | 2 | 2 |
| 8 Nominal 100 % + power breakdown 24h | 720 | 6 | 5 |
| 9 Underloading 50 % | 360 | 2 | 2 |
| 10 Nominal 100 % | 720 | 6 | 3 |
| * 150% overload is organised for a duration of 48 h at the beginning of the sequence | | 38+X | 26 |

The mean values of the efficiency ratios

| Parameter | Nominal* 720 l/d | Underloading** 360 l/d | Overloading*** 1080 l/d |
|--|---------------------|---------------------------|----------------------------|
| Total chemical oxygen demand COD (%) | 93 | 92 | 89 |
| Total biological oxygen demand BOD (%) | 96 | 96 | 95 |
| Suspended solids SS (%) | 86 | 86 | 78 |
| Total nitrogen N _{kok} (%) | 44 | 27**** | 42 |
| Total phosphorus P _{kok} (%) | 90 | 88 | 88 |

* the mean value of 20 samples, ** the mean value of 4 samples, *** the mean value of 2 samples, ****1 value of 0% decreases the mean value


The average values for influent loads as well as influent and effluent concentrations

| Parameter | Unit | BOD ₇ | Total nitrogen | Total phosphorus |
|------------------------|------|------------------|----------------|------------------|
| Influent load | g/d | 221 | 43 | 7,7 |
| Influent concentration | mg/l | 284 | 56 | 9,9 |
| Effluent concentration | mg/l | 10,0 | 31 | 1,0 |

Use and maintenance of the Raita -SBR during testing

The normal use and maintenance operations of the Raita -SBR are monthly checks (property owner) and the yearly services (a service contract is recommended). Monthly checks include visual monitoring of the treated water as well as the changing of the sludge basket/bag and/or emptying of excess sludge as required. There is a 30 l tank for the precipitating chemical which needs to be filled approximately every 5 months with this test load. When needed, alkalisng chemical is added to regulate the pH level. When the testing was completed, a final inspection was performed on the treatment plant, which was found to be in good order. Equipment failures were not observed during testing.

Model of the CE marking for the Raita -SBR

| | |
|--|------------------------|
|  | |
| Raita Environment Oy, Ankkuritie 2, FI-21590 Karuna, FINLAND 08 | |
| EN 12566-3 | |
| "Raita –Sequencing batch reactor (SBR)" | |
| Nominal organic daily load (BOD ₇): | 300 g/d |
| Hydraulic daily flow: | 0,72 m ³ /d |
| Material: | Polyethylene (PE) |
| Watertightness (water test): | Pass |
| Crushing resistance: | NPD |
| Treatment efficiency ratios (at tested organic daily load BOD ₇ = 0,22 kg/d) | |
| COD _{Cr} : | 93% |
| BOD ₇ : | 96% |
| SS: | 86% |
| Total nitrogen: | 44% |
| Total phosphorus: | 90% |
| Electrical consumption: | 1,7 kWh/d |
| pH: | 6,5 |
| Temperature (effluent): | 12,9 °C |
| Dissolved oxygen concentration: | NPD |
| Sludge production: | NPD |

Estimate of the operation of the Raita -SBR in respect of the requirements of the Wastewater Decree (542/2003)

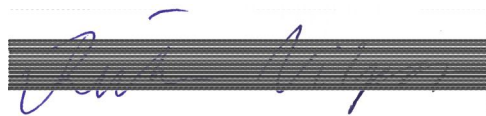
Based on the testing results, it can be stated that the Raita -SBR fulfils the requirements of the Wastewater Decree, if properly used and maintained. The Decree requirements for treatment – BOD₇ 90%, total phosphorus 85% and total nitrogen 40% – were met, on average, for all parameters in normal loading and overloading conditions. In underloading conditions the nitrogen removal efficiency was slightly under the required 40%. Treatment efficiency was also good after a break of 2 weeks.



Scaling rules for the Raita -SBRs in the same range (M=MULTI)

| Parameter | PA0.6R07 | PA0.6M | PA0.8M | PA1.1M | PA2M | PA3M | PA4.5M | PA6M | PA8M |
|--|----------|--------|--------|--------|-------|-------|--------|-------|-------|
| Nominal hyd-raulic flow (l/d) | 720 | 720 | 800 | 1 150 | 1 900 | 3 000 | 4 500 | 6 000 | 8 000 |
| BOD ₇ -load (kg/d) | 0,30 | 0,30 | 0,32 | 0,46 | 0,76 | 1,20 | 1,20 | 1,80 | 2,40 |
| Volume load (kg BOD ₇ /m ³ xd) | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 | 0,4 |
| Sludge retention time (d) | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 | 25 |

26.11.2008



Research engineer Riikka Vilpas, SYKE