Installation of SRS (Sewage Recycling System) at Aarle-Rixtel WWTP

A joint report with Waterschap Aa en Maas (WSAM)

Trial results and extrapolation to full scale system
April-June 2014

Short version, November 2014

Abstract

Applied CleanTech (ACT) and Waterschap Aa en Maas (WSAM) conducted a trial of ACT's Sewage Recycling System (SRS) in Aarle-Rixtel WWTP during the period of April-June 2014. The success parameters set for the trial were:
1. Sludge reduction of 30%-50%
2. Recyllose™ production of up to 1 ton per day at 25%DM
3. Overall reduction of WWTP operating costs by 15-30%
All of which were successfully met.

In addition to the benefits to the wastewater treatment process, the by-product of the SRS – Recyllose™ was tested for different applications and was found suitable for many uses.
According to the trial results, a reduction of 36% TSS, 15% COD and 18% FOG was anticipated; an extrapolation to full-scale system has been made, with an expected reduction of 30% sludge and total savings on OPEX of 31%, which is very impressive and beyond the initial expectations (costs for sludge treatment, energy for aeration and SRS, and benefit from the Recyllose™).
The Recyllose™ production is projected to be 5,074 kg per day. The Recyllose™ was found to have many promising potential applications in the Dutch industry.
Extrapolation of the pilot results to the full scale WWTP shows that the SRS will result in a 12% decreased load (pollution equivalents) to the biology, which makes it an attractive technology to anticipated increase of the waste load to the WWTP Aarle-Rixtel.
No impact (positive or negative) on the full scale WWTP process was observed during the SRS pilot test.

We see this pilot and its successful results as a promising first step in a long and fruitful cooperation between ACT and WSAM. This cooperation will bring the vast benefits of the SRS technology not only to the waterboard, but also to the citizens, who will be able to benefit from the savings. The SRS technology also contributes to the environment, by reducing carbon footprint and GHG emissions.
The SRS system serving as a Recyllose™ factory creates new business opportunities in the area, develops new markets and positions the waterboard as an environmentally friendly company, and a promoter of green technology.

TNO letter of approval

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Subject
Approval of report

Dear Sir,

As part of the SRS (Sewage Recycling System) pilot project for the extraction of solids from wastewater and the recycling into valuable commodities, Applied CleanTech (Israel) (ACT) has carried out a test using a pilot plant to recover solids from wastewater at the wastewater treatment plant of Aarle Rixtel (The Netherlands). As an independent expert witness I have visited the project location, attended project meetings, seen and studied the methods used, taken part in discussions on the outcome of the test and read the final report. As a result, I state that the conclusions drawn in *Installation of SRS (Sewage Recycling System) at Aarle-Rixtel WWTP, a joint report of Applied CleanTech and Waterschap Aa en Maas (WSAM); Trial results and extrapolation to full scale system,* final version, November 2014, by Nimrhod Becker, are justified on basis of the test results.

Yours faithfully,

J.W. van Groenestijn

Mass Balance and Cost Calculation for the Full Scale System Installation

A mass balance was calculated for the full scale SRS system installation at the Aarle-Rixtel WWTP, based upon the extrapolated results. The data was based on the data received for the year 2013. The calculation appears in the attached file. The savings in cost for the WWTP were based on numbers received from the Waterschap.
Sludge dewatering costs include polymer consumption and energy for dewatering and exclude incineration.
Centrifuge daily load (in hours per day) was based upon the assumption of 25 m^3/h of sludge to the centrifuges.
The following table summarizes the savings, excluding labor, maintenance depreciation and interest:

Table 1 Calculations for daily savings with SRS

Calculation of amounts			100%	
Parameter	unit	Without SRS	With SRS	Reduction (%)
Dewatered sludge for disposal	kg/d	63421	44649	30%
Dewatered sludge	kgdm/d	13699	9644	30%
Energy for aeration	kWh/d	7,200	6,768	6%
Polymer for dewatering	kg/d	226	159	30%
Centrifuge daily load	h/d	19.7	13.8	30%
Expected Recyllose™	kgdm/d	0	5,074	

Cost Reduction assessment				100%	
Parameter	unit	cost (€)	Without SRS	with SRS	Daily savings (€)
Sludge dewatering costs*	€/tdm	98	1343	945	397
Sludge incineration (SNB)	€/ton	78.26	4963	3494	1469
Energy for aeration	€/day	0.10	720	677	43
SRS energy consumption**	€/kWh	0.10	0	160	-160
Expected Recyllose™***	€/tdm	100	0	4,313	431
		Total (€/day)	7,026		2,181
				Savings	31%

* Sludge dewatering costs including polymer consumption and energy for dewatering (excluding incineration)
** Without additional pumping
*** After deduction of 15% for self-consumption.

It can be seen from the above tables that the main savings for the WWTP is due to reduction in sludge dewatering and disposal (84%), while the rest is due to energy consumption and commerce in Recyllose™.

Conclusions

The SRS installation was successfully installed in the Aarle-Rixtel WWTP.
Out of the trial objectives, two were met successfully and the third one was nearly reached.

- ✓ According to anticipated reduction rates, sludge will be reduced for the full scale by 30%.
- ✓ The SRS produced 240 kg/d Recyllose™ at 82%DM which is ~200 kgdm/d. The production of 200 kgDM/d Recyllose™ attained is near the envisaged 250 kgDM/d.
  The Recyllose™ was partially (75%) burned by the SRS as an internal energy source; for the future, it is assumed that Recyllose™ consumption will be lower.
- ✓ According to the cost savings we calculated (see above), savings for the WWTP will be around 2,181 €/day which is 31% of the daily operational costs of the WWTP (excluding labor, maintenance, depreciation and interest) – a number that is beyond expectations.

The trial purpose was to explore the following success parameters:
1. Performance of the SRS technology. Performance indicators are removal efficiencies for different components like TSS, COD, BOD, O&G, N and P.
2. Economic feasibility of the SRS performance in the WWTP, including potential Recyllose™ revenues.
3. Impact of the SRS technology on the WWTP processes and performance.

All the performance indicators were investigated during the trial period and removal efficiencies were determined.
Economic feasibility and the impact on the WWTP was discussed above.

The mass balance and value proposition based on the agreed extrapolations for the full scale show OPEX savings of 31% for the WWTP.

Recyllose™ was found to be a valuable commodity, with many promising applications in the Dutch industry.

Based on the successful trial results and expected performance of a full-scale SRS system, ACT and Aa en Maas are discussing a full-scale installation of a ‘tailored-made’ SRS for Aarle-Rixtel WWTP.