RESEARCH & DEVELOPMENT

REPORT NO. 2083

Study of Sludge Co-settling

in

Yuen Long Sewage Treatment Works

Final Report

Sewage Treatment One Division
Drainage Services Department
August 2014

Final Report endorsed by R&D Steering Committee Meeting
No. 3-2014 (E&M Part) on 21 Aug 2014

R&D Report No.	2083
Title of R&D Item	Study of Sludge Co-settling in Yuen Long Sewage Treatment Works
Version (for draft final report)	Final
Month and year of issue	August 2014

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Abstract

The co-settling trial in Shatin Sewage Treatment Works (Shatin STW) had successfully demonstrated a number of benefits such as energy saving, increase in biogas production and reduction in the quantity of dewatered sludge. In view of the success in Shatin STW, the Drainage Services Department would like to extend the co-settling process to other sewage treatment works. As a start, Yuen Long Sewage Treatment Work (Yuen Long STW) was chosen as the site to evaluate the feasibility of incorporating co-settling into the sewage treatment process by studying its associated impact on various aspects such as performance of the primary sedimentation, effluent quality, sludge and biogas production, odour as well as savings.

For sludge co-settling to occur, part or all of the surplus activated sludge (SAS) is pumped to mix with the incoming crude sewage before entering into the primary sedimentation tanks. The baseline data collection was started in June 2012. Trials were conducted between 27 Aug 2012 and 23 Nov 2012 as well as 10 Dec 2012 and 14 Jan 2013. There were no change in the number of primary sedimentation tanks, aeration tanks and final sedimentation tanks during the trial.

The trial showed that the co-settling process did not exert any effect on the effluent quality in terms of Total Suspended Solids (TSS) and Biochemical Oxygen Demand (BOD) after the co-settling. It could be observed that there were increases in sewage strength for both crude sewage and settled sewage in terms of TSS and BOD after the co-settling due to the increase in loading from the SAS. When compared with crude sewage, the increases in both TSS and BOD for settled sewage were less significant as part of the TSS was settled in the primary sedimentation tank. There was a gradual increase in the biomass or mix-liquor suspended solids (MLSS) in the aeration tank during the trial. The increase indicating that the solid removal capacity of the primary sedimentation tank was not able to remove the additional solid loading due to co-settling. Such observation could be confirmed with a decrease in MLSS after the suspension of co-settling.

There were virtually no changes in the total solids content of primary sludge. A significant increase in the volume and quantity of primary sludge was observed indicating co-settling did occur in the primary sedimentation tank. The quantity of feed sludge to the digester was found to be slightly decreased due to the reduction of SAS which was further confirmed by the reduction in sludge cake production. The

advantage of co-settling for reducing sludge production could be confirmed. Theoretically, the reduction in feed sludge volume would increase the solid retention time in the digester and further increase the biogas production. However, as the present solid retention had already approached 40 days thus the slight increase in retention time would not have any effect on the biogas production which was confirmed by the trial.

The change in energy consumption for the co-settling trial could only be evaluated qualitatively as there were no individual installations to monitor the energy consumption for each step. There was no significant effect on energy consumption in the co-settling trial in Yuen Long STW as the operation profile of the pump with and without SAS thickening process was similar. Since both the total sludge and cake production were small due to low sewage flow, thus the saving due to less sludge production was not significant at this stage. The increase in electricity consumption for aeration due to increase in MLSS in the aeration tank was also not noticeable. We might expect to have an increase in energy consumption due to increase in primary sludge quantity and also additional SAS through the conventional way to control the MLSS in the aeration tanks. Based on the above estimations, there might be a slight increase in energy consumption due to co-settling.

A maximum of about 140 kg of polyelectrolyte (HK$ 3,950) could be saved each month if the co-settling is adopted. It should be noted that with the rapid increases in MLSS in the ATs during the trials, additional SAS would be required in order to control the process. The amount of savings should be much less than the expected HK$ 3,950/month.

There was no significant difference found for the surface condition of primary sedimentation tank during the co-settling trial.

It should be noted that the majority of the savings in Shatin STW was **NOT** coming from the co-settling process; it was actually coming from the reduction in number of digester being used which was an ***operation issue***. With smaller number of operating digesters, less heat is required to maintain the temperatures inside these digesters, thus part of the electricity for heating could be saved. As part of the sewage going to Ha Tsuen will be diverted to Yuen Long from time to time due to operational needs, the sewage flow can be as high as 50,000 m3/day under such arrangement. Therefore, there is an operational need to have two digesters in operation and the number of digesters in used in Yuen Long STW remained unchanged, thus there would be no

savings in keeping the temperature of the digesters.

It could be concluded that the benefits obtained from co-settling such as reduction in sludge production, savings in chemical consumption could be observed in the trial in Yuen Long STW even though they were not significant. In contrast to the significant energy saving and increase of biogas production observed in the co-settling in Shatin STW, there were no changes in the production of biogas and the energy saving was minimal in Yuen Long STW due to the low sewage flow and operation strategy.