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38 GREEN TECHNOLOGY DEVELOPMENT IN PÕLVA WWTP

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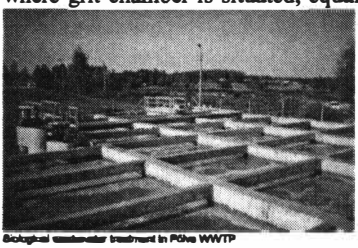
Põlva Wastewater Treatment Plant (WWTP) was reconstructed in 1997 when water treatment technology and all facilities (except facilities for surplus sludge management) were innovated. Today Põlva WWTP treats 650 000 m^3 wastewater annually, 50% of sewage is municipal (town Põlva), the other 50% originates from diary "Põlva Piim", that is the main employer of the town and at the same time shareholder of the Põlva WWTP (together with town government). The average parameters of wastewater (inlet) and treated water (outlet) are presented in table 1.

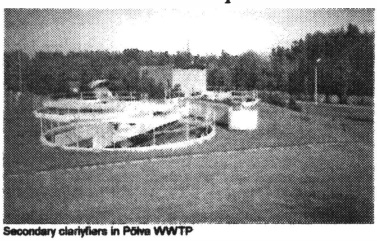

Main building of Põlva Wastewater Treatment Plant

Table 1. The inlet and outlet water parameters of Põlva WWTP.

	BOD_7 (mg/l)	SS (mg/l)	N_{tot} (mg/l)	P_{tot} (mg/l)
Inlet	750	440	56	20
Outlet	3,4	7,1	4	0,6

Treatment facilities at the WWTP include the pumping station with screen and rake, steelhall where grit chamber is situated, equalization basin and several basins with different aeration conditions to fulfil the enchanced phosphorus bioremoval, nitrification and denitirfication of nitrogen consisting compounds in the wastewater, as well the biodegradation of organic matter of the sewage. From biological stage suspension of activated sludge and treated water is lead into clarifier where sludge will be settled down and the purified water goes through the measuring unit into a ditch that leads the water into river. Surplus sludge from wastewater biotreatment process will be removed from the process and pumped into sludge thickener. From this facility the reject water is sent back to the wastewater treatment process and thickened sludge is flowing to the sludge lagoons. All processes and equipment related to the wastewater


Biological wastewater treatment in Põlva WWTP


Secondary clarifiers in Põlva WWTP

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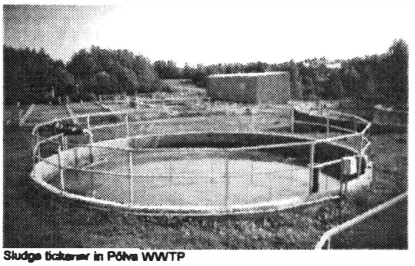
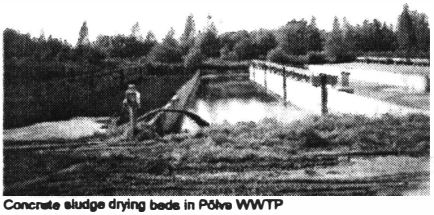
treatment are operated by PC. The treatment technology does not use any chemicals and is worked out observing the principles of green technology.


Sludge thickener in Põlva WWTP

After renovation Põlva WWTP has to solve the technology concerning surplus sludge management. Up to now the sludge is held in concrete sludge lagoons which are emptied straight onto the fields using cisterns due to the high water content in the thickened sludge (content of dried matter ca 6-7%). Meeting the requirements of EU in the near future it is not allowed any more to send the row sludge onto fields without quality certificate of the sludge (microbiology, hazardous compounds, etc). Having in mind these coming requirements Põlva WWTP has to reconstruct their surplus sludge management in environmentally sound way.


Concrete sludge drying beds in Põlva WWTP

The amount of surplus sludge produced in Põlva WWTP is 138 000 m^3 annually. Sludge is pumped from aerated basins into two sludge thickeners, each 375m^3 of capacity. The content of dried matter of the sludge is about 3,5 g/l. In sludge thickeners the content of dried matter of the sludge increases up to 38 g/l. Thickened sludge is flowing into five sludge lagoons with total volume 6 400 m^3, where content of dried matter will increase till 70 g/l, mainly by the process of evaporation. Present technology at the Põlva WWTP does not satisfy the needs of sludge management because the mineralization process of the sludge in the lagoons is not sufficient and the product is not ready for use in agriculture.

In 2001 new project has been started in the WWTP that includes the proper sludge management using several methods for the sludge treatment with the aim to get a product that is usable as a fertilizer in agriculture. Our measurements showed that the sludge from Põlva WWTP consists necessary nutrients (nitrogen, phosphorus and potassium) for plant growth. The average nutrient content in sludge is presented in table 2.

Table 2. Surplus sludge parameters (Põlva WWTP)

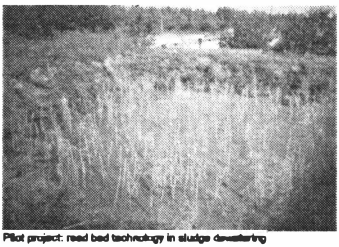
N_{tot} (g/kg)	P_{tot} (g/kg)	K_{tot} (g/kg)
77,7	23,0	7,5

*Contents of nitrogen phosphorus and potassium are presented in dry matter of sludge.

In the future one part of the sludge treatment technology in Põlva will be sludge drying beds. For this purpose five sludge drying beds will be provided with new multi steps sliders and drainage system. From aerated basins the surplus sludge will pass via two sludge thickeners into sludge drying beds where the content of water in the sludge will be decreased down to a level, that will be economically profitable for transportation of the sludge onto fields. The suitable time for field fertilizing is autumn.

At the same time it is intended to build reed bed system for mineralization of sludge. In the beginning of vegetation period the sludge from sludge drying beds will be pumped to the reed beds, where it looses water and mineralizes. The final product after 3-6 years of utilization of reed beds is compost.
In spring 2001 the pilot project in Põlva WWTP was started to get real estimation and technology development related to the reed bed system and its effectiveness and capability to compost the sludge in Estonian climate conditions.


Pilot project: reed bed technology in sludge dewatering


Pilot project: reed bed technology in sludge dewatering

Reed bed filters for sludge treatment were first implemented in Germany ca 20 years ago. Results of the process are presented in many reports /1-7/. It is mentioned, that in red bed filters the dewatering and mineralization processes will reduce the sludge amount down to 2-5 % from the starting amount. Water content of the sludge will be reduced 33-46 % and the residue of the reed bed filter is removed with intervals of 4-8 years onto the fields as a fertilizer.

Sludge mineralisation beds utilize the evaporative and aerating capabilities of wetland species reed, *Phragmites australis*. Upon a layer of clay (or plastic membrane) the 50 cm filter is placed and planted with reeds.

The reeds for planting were taken from two places, from a ditch near to the WWTP and from an eutrophic lake. The plantation took place in June 2001. After plantation the suspension of water and activated sludge from sludge thickener was pumped to the reed bed with the aim to provide nutrients to the reed plants. During first period of growth root zone of plants spread 5-10 cm around the planted reed and the new plants appeared. At the end of August 10 cm thick layer of stabilized sludge from sludge lagoons was pumped onto reed bed. In two weeks the layer of sludge shrunk about 7-8 cm. In autumn and winter period the pumping of sludge onto the bed is not allowed, because it could have negative or even destructive effects for new reed plant growth. Some problems seemed to be with plants that had been brought from the lake. The growth of these plants was considerably less compared with other plants from the ditch. Probably it was caused by some ecological reasons, ie changes in nutrient load and growing place.

The stabilized sludge originated from wastewater treatment process, which does not contain toxic chemicals, will be improved into valuable fertilizer for agriculture. Using this waste product as fertilizer we can save resources, which are used to produce fertilizers industrially. Operating surplus sludge in ecologically sound way we manage green principles, which are saving resources and providing the ecological circulation of nutrients in the environment.

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