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26 NEW ELEMENTS FOR LEAKAGE WATER TREATMENT IN RURAL AREAS

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According the official data from Waste Management Strategy of Latvia [1] in 1997 there were 558 active dumping sites in the territory of Latvia. It was stated that 257 of them are producing the negative impact on environment and 152 must be immediately closed [2]. During the next four years, due to waste management policy of state, great part of them was closed, and in 2001 there were only 380 dumps [3]. In reality those activities diminished the problems of pollution of air and ground water, but do not avoid them. Most of closed dumps are small (more than 77 % smaller as 2 ha), disposing less then 1,000 m^2 of waste per year. In the same time taking in account that every year the precipitation exceeds the evaporation for ~ 200 mm in Latvia, we can estimate that in average 1 ha of the territory of the dumping site will produce 2000 m^3 of polluted leakage water. As the total area of dumps are more than 780 ha and ground waters are not protected in greatest part of territory (there dominate the soil and gravel as the bottom material), using the date characterising the leakage content, we can estimate that ground waters together with infiltrated leakage water will receive more than 1092 t of nitrogen, 900 t chlorine, 1099 t of ferrous, 780 t of sulphides, and ~ 200 t of different heavy metals per year [2].

Provided studies during the last years about the situation in the biggest river Daugava basin [4], shows that there are 333 dumping sites in the territory of river basin; 135 of them are actively working today. The total occupied territory by dumps is more than 500 ha. Most of them are small without any protection installation eliminating the ground water pollution. The data shows that there are 70 dumps, where less than 100 m^3 waste per year are disposed, 37 sites where allowed limit of disposal overcomes 1000 m^3 and 13 where more than 10 000m^3 waste per year are disposed.

On of the most popular solution of this problem is closing and remediation of existing dumps and creating a net of new sanitary landfills. According to Waste Management Strategy of Latvia it will takes the next ten to twenty years and will require more than 80 millions EUR. On the bases of real situation both of those figures are hardly to accept. In practise we need to eliminate the ground water pollution without delay using cheap and effective methods. The Latvian scientists and specialists from University of Agriculture in Jelgava city are dealing with those problems during last ten years. One of the proposed and implemented methods for the reduction of leakage water pollution is usage of wetlands for final treatment of leakage water from waste disposal sites. The date on leakage water cleaning from one of the disposal sites (municipal waste landfill near Bauska), where are arranged wetland consisting of different stages, are presented in the table1.

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Parameter/ Year	1994	1995	1999	2000		2001
	before	after	after	before	after	after
pH	7,34	7,5		8,05	8,00	
Small particles, mg/l	28	8,6	3,2	8,4	3,3	
Dissolved substance	3703	2615				45
BOD_7 mg/l	840	122		680	6,3	
COD mg/l	1378	685	59	1000	59	600
NH_4, N mg/l	120	143,5	-	111	5,9	
N total mg/l	135,3	172,3	16,2	16	7,1	50
PO_4, P mg/l	3,4	2,0	0,2	0,68	<0,013	2,8

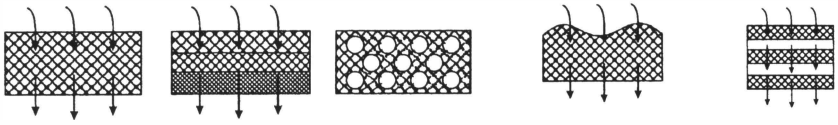
Table 1. The content of the leakage water before and after the wetland

The presented data, reported by Regional Environmental Board of Bauska district, shows that during the first years after arrangement of wetland improvement of controlled parameters were negligible, as plants were young and non-effective. The greatest reduction of pollutants was detected in year 2000 – after five years of vegetation. Unfortunately, the data from the next year's shows that the situation becomes worsen. One of the most real reasons for it was the lack of suitable maintenance of the wetland and inappropriate selection of the plants.
The results from other sites, as old dump near Jelgava city, shows that plantation of some species of reeds in the ditches surrounding the old dumps are effective for reduction of pollution of outgoing streams. This indicates that properly arranged and managed wetlands can be used as relatively cheap and effective tool for reduction of ground water pollution caused by leakage from dumps.
In the same time leakage water analyses from the landfills located near the biggest cities indicates that municipal landfills contains the large quantities of hazardous waste, too. There are presented leakage water analyses from two largest landfills of Latvia located near Riga (Getlini landfill) [5] and Daugavpils (Demene landfill)[6] cities in the table 2.

Parameter	Getlini landfill	Demene landfill
pH	8, 07	8,36
Small particles, mg/l		36,0
Dissolved substance, mg/l	10220	1795
BOD_7 , mg O_2/l	136	659
COD , mg/l	3250	1570
N/ NH_4 mg/l	640	380
N total, mg/l	939	381
P total, mg/l	5,50	
Oil products	<0,05	
Cl, mg/l	2918	531,8
Cr, mg/l	1,1	
Zn, mg/l	0,5	
Cu, mg/l	0,3	

Table 2. The Leakage Water Analyses from Getlini and Demene Landfills

The data from regional environmental boards shows that in both cases basic parameters reflecting the pollutants concentrations as COD, BOD, content of heavy metals and others are exceeding the authorized limits ten and even hundred times.
For such greatly polluted waters the wetlands can be used as one of the final elements in the comprehensive leakage water treatment system.
Comparing the different leakage and wastewater treatment methods in rural areas, we can state that the most popular today are biological systems of medium size. To improve the effectiveness of this method, the scientists from The Institute of Water and Land Management are offering the new filtration elements [7], schematic represented in the figure 1. As the filter's materials are used different composite plastics with high porosity or natural cellulose fibres. The main components of those filters are grains of different size covered by thin plastic film. Large and ruffle surface of used materials are supporting of the rapid gross of biofilms and producing good sticking properties. The appropriate physical parameters of filtration can be obtained by selection of different compositions of filter material and variation of the grain size, but the functional quality of the element is definite by the used plastic films. According the functional demands of water treatment equipment the filter elements can be situated in special container arranging the single layer (a), system containing different layers with various porosity (b), materials with special cavities increasing the surface of filter (c), materials with ruffle surface (d) and multi layer systems with air gaps (e).



a) b) c) d) e)

Fig. 1

The figure 2 describes the schema of the water treatment equipment consisting of four stages (I-IV) including the basin for sedimentation (1), containers with filters (2), separated by filtration walls (3). Arrows show the wastewater flow inside the treatment system.

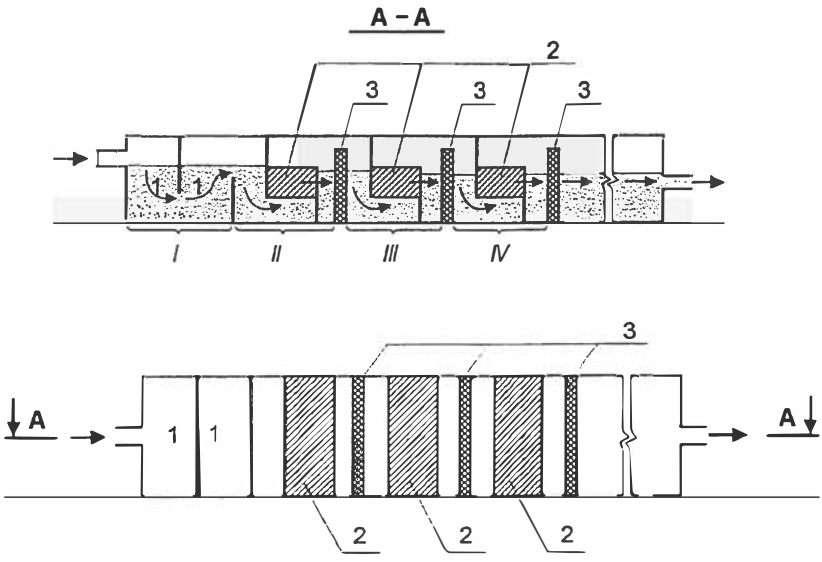


Fig. 2

One of the positive properties of such equipments, beside the low price, is relatively easy maintenance of them. Thereby they can be used in many small facilities located far from big industrial centres. Ensuring the self-consistent leakage water flow through the system, it can be used for leakage water treatment even for closed dumps.

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