MIGRATION AND RETARDATION OF POLLUTANTS FROM MUNICIPAL LADFILLS IN CLAYEY BOTTOM LINERS

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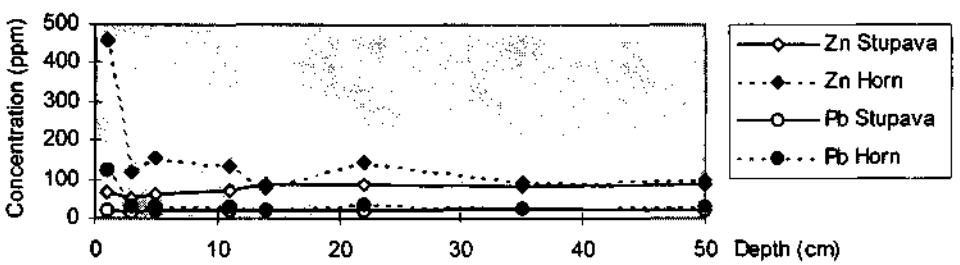
The sealing effect of clayey bottom liners of two landfills was compared. Both landfills were probably 10 years old. Municipal waste is prevailing in the ladfills, leachates should be quite similar. We were interested, how could the different mineral composition influence the migration velocity of some pollutants.

The ladfill "Stupava" is situated in Slovakia 10 km west of Bratislava in an old clay pit. The bottom liner is the natural clayey ground. The sediment belongs to the formations of the Vienna Basin and contains Miocene marine clays (Badenian) without sandy layers. The thickness of the clay layer is about 30 m. Undisturbed samples were taken from a core drilling through the landfill.

The ladfill "Horn" is situated in Austria in the region of Waldviertel near the town of Horn. The bottom liner is an artifficial mineral layer, 60 cm thick, overlying an older part of the landfill. Probably, the clayey part of marine to freshwater bedded clay - silt - sand Miocene sediments of the Horn Basin was used for the liner. During remedial works at the ladfill, the waste covering the liner was removed. This was an excellent opportunity to take undisturbed samples directly from the liner surface.

The clay samples were mineralogically, geotechnically and chemically investigated. Some results are summarized in the table. Concentration profiles of heavy metal ions and chloride or sulphate anions in the liner were established. The figure shows the migration of both, the zinc and lead, ions.

Physical properties	Stupava	Horn	Mineral composition of the <2µm fraction (%)	Stupava	Horn
<2µm fraction (%)	51	33	smectite, illite, I/S-mixed layers	81	15 to 20
liquid limit w_L (%)	65	54	kaolinite	5	75 to 90
plastic limit w_P (%)	22	20	chlorite	9	0
plasticity index I_P (%)	43	34	Other adsorbents in whole samples (%)		
geotech. classification	CH	CS	carbonate	20	0
permeability k_f (m.s^{-1})	1.10^{-8} consolid.	$1{,}3.10^{-11}$ triaxial	Fe-oxihydroxide	present	present



From the concentration profile, an estimate of the apparent diffusion coefficient was done for chloride in Stupava ($1{,}6.10^{-9}$m^2/s, corresponding with the relatively high permeability of the "fissured clay") and for sulphate in Horn (>2.10^{-9}m^2/s). An estimate for heavy metals was impossible. Higher contents were found only in first 1-2 cm (Cu and Cd in Stupava, all metals in Horn), skipping to natural background values in deeper parts. Heavy metals migrate very slowly in both clays. Due to high carbonate and swelling clay minerals content, there is still a high retardation capacity in Stupava. Neither the adsorption capacity of kaolinitic clay from Horn was exhausted yet. Near to the contact with waste, the heavy metal content in the liner is higher than in Stupava. But we did not find big differences in deeper parts after 10 years of landfilling.

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