Use of bentonite for MSWI fly-ash stabilisation

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Fly-ash produced during combustion processes is usually considered to be hazardous waste. Therefore, its effective treatment is necessary.

Stabilization of hazardous waste by solidification is one of the effective methods of immobilization of pollutants. A solid structure resistant to leaching is created by stabilization. The created stabile structure has to resist the influence of natural factors such as rainfall causing possible leaks of pollutants in the form of leachates.

Having fulfilled the required properties, the stabilized structure can be used as raw material in the construction or reconstruction of pavements as well as in the construction industry. All around the world, the stabilization processes are used for solidification of municipal solid waste incineration (MSWI) including fly ashes.

The MSWI plant in Košice is planning to introduce a technology of solidification as a possible treatment stage before deposition in a landfill.

In the process of stabilization/solidification, several ingredients to achieve the desired result are used. The created solidified structures must be characterized by sufficient compressive strength with a minimum probability of release of pollutants in the event of disruption of its structure. The basic ingredients are water, cement, and other natural materials, such as bentonite. Bentonite is a residual clay, which was created by mechanical and chemical weathering of parent rock in an alkaline medium, mainly volcanic tuffs, rhyolites, basalts, andesites and other predominantly Tertiary rocks. It is plastic rock that has a high sorption capacity. Its chemical and mineral composition depends on the bearing formation. Bentonite contains mainly montmorillonite. Other major components are mainly beidellite, kaolinite, and illite. World reserves of bentonite deposits are estimated as more than 2 millions tons per year mined and discovery of new deposits is assumed (Bentonite 2013).

In the experimental part of the work, the possibility of solidification of MSWI fly-ash was studied using fly-ash from filters (hereinafter referred to as F), and fly-ash from cyclone (hereinafter referred to as C). Several experiments of solidification with different ratios and various combinations of materials were conducted. The results confirm that the method of solidifying of both fly-ashes F and C from the MSWI plant appears to be an effective procedure for their stabilization. The next experiments were concentrated on leaching of heavy metals from the stabilised structures. Atomic absorption spectrometry enabled to detect only small concentrations of heavy metals in the leachates of the stabilized structures. The comparison of measured concentrations of heavy metals in the leachates from solidified fly-ashes with limit values given by valid legislation shows that none of the concentrations of assessed heavy metals achieved or exceeded the limit values.

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