

Soil substitute from red mud-soil mixture: field study

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The worst environmental catastrophe of Hungary occurred on October 4, 2010. The red mud reservoir in Ajka (Hungary) storing 3–4 million cubic meters of highly alkaline (pH=13) red mud broke and released 1.8 million m³ of slurry into the environment. The red mud flooded the lower laying part of three villages and the neighbouring agricultural land, so it was mixed up with the surface layers of the soil, the surface waters and their sediments. After the disaster much effort was devoted to the removal of the thin red mud layer from soil surfaces during the springtime, 4–5 months after the accident. This mixture is stored at the landfill near Ajka, which involves a lot of cost. The utilization of this waste is needed and based on the laboratory pre-experiments the red mud mixed with soil can improve the soil functions.

A two step field demonstration was carried out to study the beneficial effects of the red mud-soil mixture when applied in cultivation media. In the first step we set up lysimeters with the mixture of waste soil (used for the temporary cover of a landfill slope in Gyál, Hungary) and red mud-soil mixture (removed from the Ajka area after the catastrophe) in 0, 20 and 40 weight%. In the second step we applied the red mud – soil mixture in 0, 10, 20, 50 and 100% in field plots. The experiments were monitored by an integrated methodology combining physical, chemical, biological and ecotoxicological methods.

The results show that red mud - soil mixture used in a cultivation media at up to 20% has positive effects on the waste soil and no harmful effect on the environment. The red mud-soil mixture improved the texture of the waste soil. This was confirmed by significant improvement of the water holding capacity of the waste soil with the increase of the red mud-soil mixture ratio added to the soil. The total metal content of the soil substitute do not exceed the Hungarian limit value for soil. The 20% red mud-soil mixture in the waste soil proved to have favourable effects on the activity of the soil microflora. The plant (*Sinapis alba*) and animal (*Folsomia candida*) toxicity tests did not show inhibition with the increase of the red mud-soil mixture content in the waste soil. The toxicity test with *Aliivibrio fischeri* (bacteria) showed that 10% red mud-soil mixture is only slightly toxic to the testorganism and a decreasing tendency in toxicity was observed with time during the one year of the experiment. Based on our results the red mud-soil mixture can be applied in media soil substitute for the covering of landfills, road slopes or mine spoil. This way we would find an alternative for its reuse.