

Microcalorimetric assessment of red mud containing soil substitutes

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Soil substitutes may be an alternative to the use of good quality soil in case of landfill covers, road embankments, recultivation of mine waste dumps, green roofs etc. Soil substitutes can be made from waste materials solving two problems at the same time: satisfying the increasing need for good quality soils and the re-use of waste materials. However, both the risks and the benefits of the application have to be assessed. We performed scaled-up experiments from laboratory microcosms to field experiments at a municipal landfill site in Gyál (Hungary) to construct soil substitutes from various waste materials, including the mixture of subsoil (waste soil from construction) and red mud (from Ajka). To assess the risks and benefits of the technology we developed an integrated monitoring methodology, which includes physical, chemical, biological and ecotoxicological methods. As part of the integrated assessment the microbial activity and the effect of the soil substitute on various testorganisms (e.g. the single-cell animal *Tetrahymena pyriformis* and the plant *Sinapis alba*) was tested in a microcalorimeter. The technique is based on the measurement of the very small heat output changes (± 50 nW with Thermal Activity Monitor) of the organisms in contact with the red mud containing soil substitutes. The results indicated that red mud is tolerable by the testorganisms in sandy soil at up to 10 weight%. Five percent red mud mixed into subsoil increased 1.5 times the soil microbial activity at field conditions one year after the treatment, while additional 10% compost increased the soil activity (maximum heat output) four times. The experiments showed that the red mud and soil mixture removed from the flooded area after the Ajka (Hungary) red mud catastrophe in 2010 increased the microbial activity of subsoil and it was tolerable by plants.