

# 34 LANDFILL LEACHATE SAMPLING TECHNIQUES

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## ABSTRACT

A number of landfill leachates and related effluents has been characterised in research projects from 1996 till today. It has been important to carry out the sampling procedures with a minimum of contamination because many compounds are present at very low concentrations.

## KEYWORDS

Landfill leachate, sampling, grab sampling, organic compounds, characterisation.

## BACKGROUND

A number of landfill leachates and related effluents has been characterised in research projects from 1996 till today. In the projects the main focus has been to detect specific compounds. It has been important to carry out the sampling procedures with a minimum of contamination because many compounds are present at very low concentrations. Both water and sediment has been sampled. In the projects, grab sampling has been mostly used.

## SAMPLING EQUIPMENT

The equipment coming into contact with the samples are selected carefully to avoid any contamination by release of compounds from the material, and loss of compounds by absorption to the material.

Samples for analysis of pH, conductivity, particles, organic sum-parameters, salts, nutrients, metals and other elements are collected in containers made of polyethylene.

Samples for analysis of methyl-mercury are collected in containers made of Teflon (FEP, fluorinated ethylene propylene)

Samples for analysis of mercury, organic tin, and organic compounds are collected in borosilicate glass containers with Teflon coated caps.

## EQUIPMENT PREPARATIONS

The sampling equipment is thoroughly cleaned prior to sampling.

Sample containers for pH, conductivity, particles, organic sum-parameters, salts and nutrients are washed with laboratory detergent, and rinsed with deionised water (for nutrients the detergent is free from phosphate).

Sample containers for metals and other elements except mercury are washed with laboratory detergent, rinsed with deionised water, soaked in 6 M hydrochloric acid (also at the outside) at 60° C for three days, or in room-temperature during two weeks, and are then rinsed three times with deionised water. The containers are filled with 0.05 M hydrochloric acid for one week or more until the time for sampling, and then emptied and transported to the sampling sites in plastic bags. Sample containers for mercury are washed with laboratory detergent, rinsed with deionised water, soaked in 4 M hydrochloric acid (also at the outside) at 70° C for 48 h, and rinsed three times with deionised water. The containers are then filled with 0.1 % hydrochloric acid, sealed and heated at 70° C for 12 h, cooled and rinsed three times with deionised water. The containers are emptied, dried in a mercury free area, sealed and kept in plastic bag until the time for sampling. Sample containers for organic mercury are rinsed with Milli-Q-water, heated with nitric acid for 6 hours, rinsed with Milli-Q-water, treated with a solution of KBr and HCl for 24 h, and then treated with hydroxy ammonia chloride, NH<sub>2</sub>OH-HCl. After rinsing with Milli-Q-water, they are heated with nitric acid for 24 h, and rinsed again with Milli-Q-water. The containers are then filled with hydrochloric acid and stored in double plastic bags until sampling. Sample container for organic tin, organic compounds and organic sum-parameters, such as EGOM, EOX, aliphatic compounds and aromatic compounds are thoroughly rinsed and dried, then coated with aluminium foil and heated for 1 hour at 400°C. The Teflon coated caps are washed with laboratory detergent and rinsed with deionised water. Pieces of aluminium foil are also heated for 1 hour at 400°C. These foils are then put between the samples and the Teflon coated caps in order to prevent contamination from the caps.

## SAMPLING

The sampling persons wash their hands thoroughly prior to sampling, and disposable plastic gloves are used when sampling for metals. The openings of the containers and the inside of caps are never touched. Leachate samples are collected directly into the sampling bottles when possible. This precaution is made in order to prevent contamination from sampling equipment or loss of compounds during sampling by using pumps or other sampling equipment. When the leachate surface could not be reached, or the bottles contained preservation agent, the samples are collected in an identical bottle as the sample bottle, which had been rinsed using the previously described methods. This sampling bottle is lowered below the surface using a Teflon coated rope. The leachate sample is then carefully poured into the sample bottle. The samples are collected 0.1-0.2 m below the leachate surface when possible, and samples from leachate ponds are collected a few meters from the shore. When sampling from a boat, the bottles are held in front of the boat while slowly rowing the boat forward. In ditches with flowing water the openings of the bottles are directed towards the flow stream. All bottles are rinsed one time with sample water before sampling, except bottles already preloaded with preservation agents. Also in the case of metal analyses the bottles could not be rinsed with sample water before sampling, as this could adsorb metals on the inside bottle surface. These metals could then be desorbed during the acidification at the laboratory, and thus increase the metal concentrations to levels above the actual values. Efforts are made to sample the amount of particles representative for the sampling site. Bottles are filled with water leaving no air space, are effectively capped, and are stored dark and cold during the transport to the laboratory.

Also when collecting sediments a number of precautions are made to minimise contamination of the samples. The samplings equipments are rinsed thoroughly at the laboratory are let to

dry and are then folded with plastics prior to the transport to the sampling site. Moreover, the samples are collected using the minimum of amount of equipment and therefore, sediments are collected with the use of only a simple spade when possible. A plastic spade is used for the sampling of metals and metal spade is used for all other parameters. For sampling at the bottom of landfill ponds it's often necessary to collect the sediment using some sort of sampling equipment. Then a corer or an Ekman dredge is used. The choice between a corer and an Ekman dredge is based on the expected thickness of the sediment layer. After sampling with corer or Ekman dredge efforts are made to only collect sediment that has not been in direct contact with the surface of the sampling equipment. Containers are filled with leachate sediment leaving no air space, are effectively capped, and are stored dark and cold during the transport to the laboratory.

Preservation agents are added to the samples *in situ* in order to minimise any transformation of the compounds before analyse. Samples collected for the analyses of TOC, N-Kjeldahl and P-total are acidified with 10 ml/l 4 M sulphuric acid. Samples collected for analysis of metals and other elements are acidified with 5 ml/l supra pure 65% nitric acid. Extractable aliphatic and aromatic compounds are acidified to pH 2 with nitric acid. Organic compounds, EGOM, EOX, total aliphatic compounds, total aromatic compounds and tin organic compounds are either frozen within 6 hours after collection or preserved with sodium azide (0.2 weight %).

The preservation agents are added to the empty sampling bottles and containers at the laboratory prior to the transport to the sampling site. This precaution is performed in order to minimise the risk of contamination at the landfill site. An exception is made with samples were organic compounds are going to be analysed, then the preservation agent is added at the landfill site directly after sampling, in order to enable the rinsing of the sampling bottle with leachate prior to sampling.

After sampling the samples are held in dark, and the temperature is adjusted to 4°C within 6 hours. The samples are delivered to the analytical laboratory the same day or the day after sampling. At the analytical laboratory the samples are taken care of at the time of arrival.

## REFERENCES

Öman et al. (2000). Handbok för lakvattenbedömning. Rapport B 1354. IVL Svenska Miljöinstitutet AB, Stockholm.