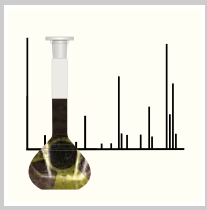
doi:10.2533/chimia.2015.301



Highlights of Analytical Sciences in Switzerland

Division of Analytical Sciences

A Division of the Swiss Chemical Society

Gamma Ray Spectrometry of Sewer Sludge – A Useful Tool for the Identification of Emission Sources in a City

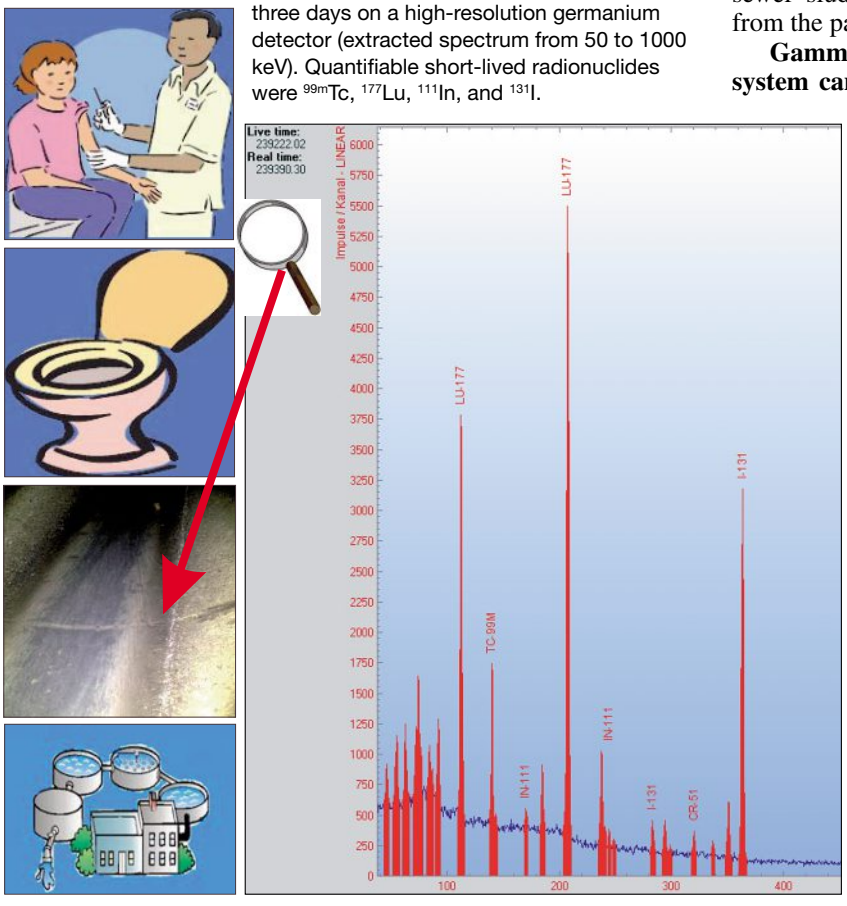
Natascha Rumpel, Franziska Kammerer, Michael Wagmann, and Markus Zehringer*

*Correspondence: Dr. M. Zehringer, Kantonales Laboratorium Basel-Stadt, Kannenfeldstrasse 2, CH-4012 Basel, Tel.: +41 61 385 25 17, E-mail: markus.zehringer@bs.ch

Keywords: Gamma ray spectrometry · Radiopharmaceuticals · Sewer sludge

Sewer sludge stands for the biofilm, which forms between the wastewater and concrete in a sewage water system. It consists of bacteria, algae and fungi and has powerful adsorbent properties for many chemicals and is therefore the remainder or 'memory' of the past load of wastewater running through. The analysis of sewer sludge can provide reference to and can lead to the identification of point sources, such as emissions of heavy metals, organochlorine compounds or radionuclides.

The photo on the lower left shows the object of study, *i.e.* the base of a wastewater tube with wastewater and sewer sludge. Below: Gamma ray spectrum of a sewer sludge sample. 5 g dry weight was counted for three days on a high-resolution germanium detector (extracted spectrum from 50 to 1000 keV). Quantifiable short-lived radionuclides were ^{99m}Tc, ^{177}Lu, ^{111}In, and ^{131}I.



Hospitals are a main source of radiopharmaceutical emissions. Short-lived radionuclides, such as iodine-131, lutetium-177 or technetium-99M, are used in high doses for the diagnosis and treatment of thyroid cancers or neuroendocrine tumours (DOTATOC therapies). After such treatments, patients show high doses of the incorporated radionuclides accompanied by high amounts of radiation in the form of beta and gamma rays. Therefore faeces, urine and all other waste products have to be collected in special wastewater containment units at hospitals and are left to cool down. Due to their short half-lives (technetium-99m: 6.0 hours, iodine-131: 8.0 days, lutetium-177: 6.7 days) the collected waste water can only be discharged into the wastewater system after a number of weeks when its activity is below a certain contamination limit.

Sewer sludge was collected in the wastewater system above and below the discharge point of the radioactive wastewater of a hospital. The sludge was transferred to a calibrated geometry (Petri dish of 12 mm height and 60 mm diameter) and then counted on a gamma ray spectrometer (high-resolution germanium detector) for 24 hours.

Sewer sludge and the running wastewater collected at the same place and time did not provide the same results. A random sample only shows the momentary load of the wastewater, whereas the sewer sludge offers an overview of short-lived radionuclides from the past few days.

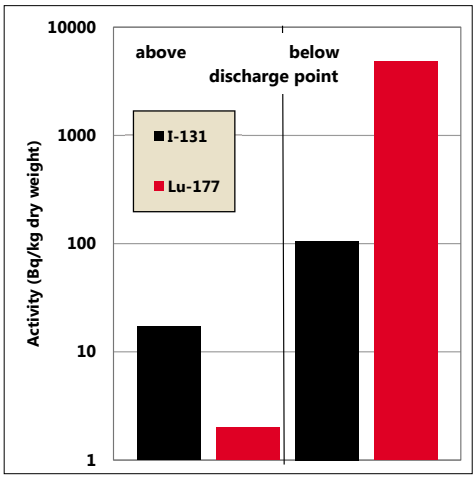
Gamma ray analysis of the sewer sludge of a wastewater system can be a powerful instrument for the identification of gamma emitters. Due to the adsorptive properties of the sewer sludge, emissions of short-lived radionuclides can be detected even after a few days.

Received: March 11, 2015

References

B. Gutekunst, Sielhautuntersuchungen zur Einkreisung schwermetallhaltiger Einleitungen, Diss. Karlsruhe, **1988**.

J. Sauer, E. Antusch, C. Ripp, *Vom Wasser* **1997**, *88*, 49.



Load of sewer sludge in the vicinity of a hospital centre (notice the logarithmic y-axis).

Can you show us your analytical highlight?

Please contact: Dr. Veronika R. Meyer, Unterstrasse 58, CH-9000 St. Gallen
Tel.: +41 71 222 16 81, E-mail: VRMeyer@bluewin.ch