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The benefits of applying microsystems in radiochemistry

ABSTRACT. Microsystems, in particular microelectromechanical systems (MEMS), are widely applied to the chemical analysis of fluids in pharmaceutical screening, biochemical assays, environmental monitoring, etc. The development of these microsystem applications is mainly economically driven: a series of experiments can be performed with a much smaller amount of material and with a much shorter preparation time. The chemical analysis of radioactive products is complicated by the necessary shielding to reduce the dose uptake for the analyst. For very 'hot' products with high radiation levels, either remote handling in hot cells with telemanipulators or extreme dilution is necessary. A radiochemist therefore uses different timescales for sample preparation and instrumentation setup. Nevertheless it seems that here also, a great benefit due to miniaturization can be expected. The scaling down of the radioactive sample means an almost proportional reduction of radiation, hence considerable simplification of the shielding measures. For sample size reduction by a factor of 1000, analysis of a real radioactive solution, for example a nitric acid solution in which spent nuclear fuel is dissolved, becomes possible in a glove-box system without the need for dilution.

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