



Measurement of organic residues of uranium ore concentrates (yellow cakes) for nuclear forensics

Z. Varga¹, D. Ho Mer Lin¹, M. Novak², Z. Eke², Z. Bodai², A. Nicholl¹, K. Mayer¹

¹ EC JRC Institute for Transuranium Elements, Karlsruhe, Germany

² Eötvös Loránd University, Budapest, Hungary

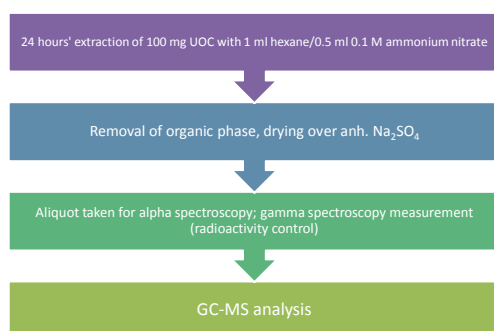
Introduction

Uranium ore concentrates (UOC, commonly known as yellow cakes) potentially contain organic impurities in various forms. They can derive from the original ore (e.g. bitumens, humic acid, coal) or from the industrial production process (e.g. tertiary amines, TBP). The analysis of such organic traces are still unexploited for nuclear forensics to identify the source of the ore or the production process.

Objectives

- ✓ Method development for the analysis of organic residues in UOCs
- ✓ Target analytes: TNOA: tri-n-octylamine; TBP: tri-butylphosphate; TOPO: trioctyl-phosphine oxide
- ✓ Test for UOC samples from various production routes
- ✓ Application for origin assessment in nuclear forensics

Proposed sample preparation

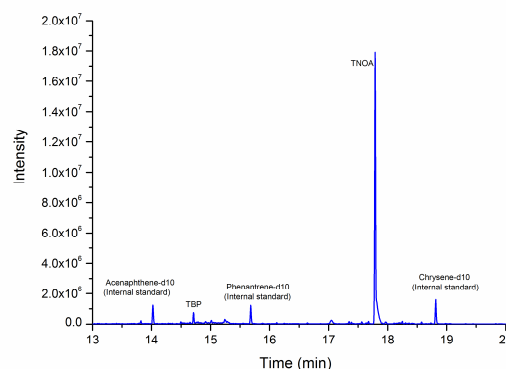


Instrumentation

Large Volume Injection gas chromatography mass spectrometry (LVI-GC-MS). Column: DB-5ms UI, 30m x 0.25mm x 0.25µm.



Chromatogram of organic extract from yellow cakes



Organic extract from a uranium ore concentrate processed with solvent extraction method using tertiary amine. TNOA was detected at a concentration of 150 ng/g.

Major findings

- Aqueous phase is necessary to extract the target analytes
- Method is appropriate to measure trace-level organic residues in UOCs
- Trace-level organics was detected in a few UOCs in agreement with the known production way