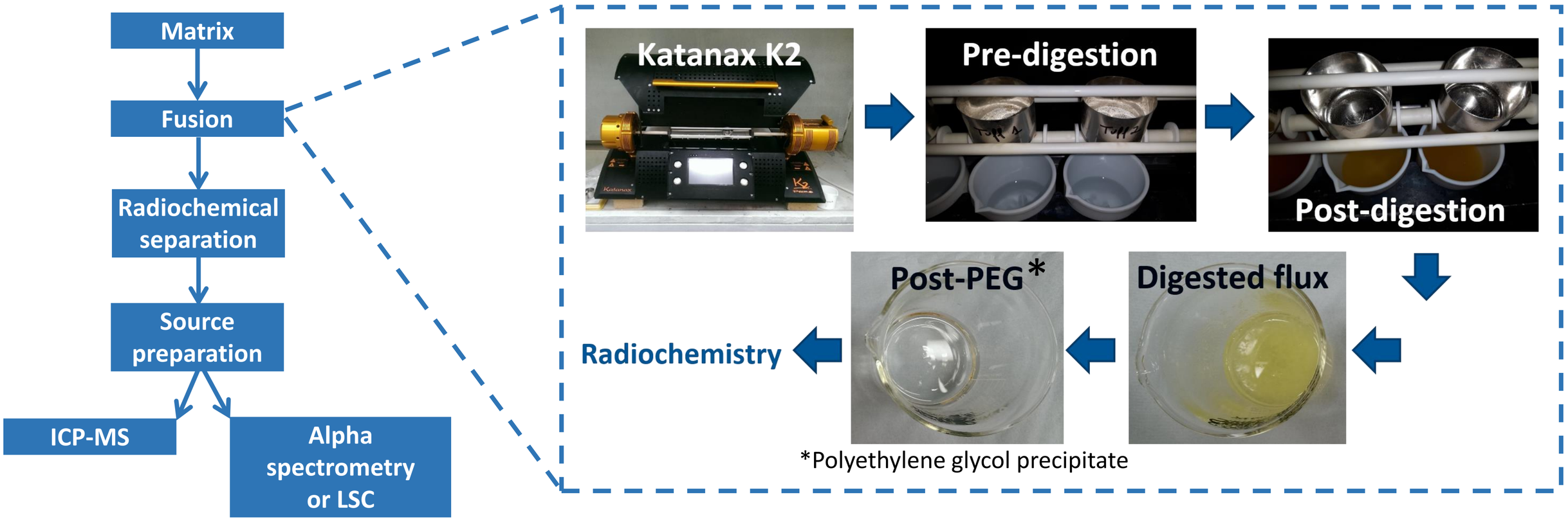
Automated Lithium Borate Fusion for Digestion of Nuclear Decommissioning Samples

Ben Russell, Maria Garcia Miranda, Selina Woods, Peter Ivanov
National Physical Laboratory, Hampton Road, Teddington, TW11 0LW, UK

Introduction

Decommissioning of nuclear reactor sites requires accurate characterisation of multiple radionuclides in a range of complex sample matrices. Quantification of difficult-to-measure alpha- and beta-emitters requires complete digestion of samples prior to radiochemical separation and measurement. The Katanax K2 has been applied to a number of decommissioning matrices, allowing automated digestion of samples by lithium borate and alkali fusion without the need for handling of hazardous reagents e.g. hydrofluoric acid.



Applications

Concrete

- Activation product ^{41}Ca
- 0.5 g blank concrete
- Flux composition1:1:0.25 lithium metaborate : lithium tetraborate : lithium bromide wetting agent
- Melt dissolved in 5M HNO_3 followed by PEG precipitation
- 97% Ca recovered after the PEG precipitation.

Graphite

- Multiple radionuclides

1-5 g graphite → Ash at 800^{0}C for >12h → Add flux mixture → Dissolve melt in *5M HNO_3*

Sand, tuff and titanium dioxide

- Reference materials characterised for naturally occurring radioactivity content (U and Th decay series)
- Fusion flux varies depending on sample matrix:
  - **Sand and tuff**: 1:1 lithium metaborate : lithium tetraborate
  - **TiO_2**: alkali fusion with 4:3 $NaKCO_3$: H_3BO_3

Department for Business, Energy & Industrial Strategy
FUNDED BY BEIS

Acknowledgements

D. Zapata Garcia and **H. Wershofen** (PTB) for their collaborations in the EMRPs MetroRWM and MetroDecom.