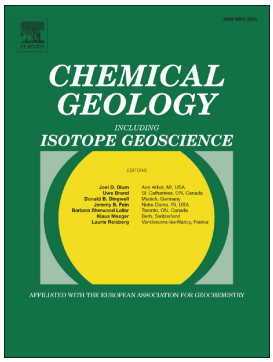

Decomposition of diverse solid inorganic matrices with molten ammonium bifluoride salt for constituent elemental analysis

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ABSTRACT

Ammonium bifluoride (ABF, $NH_4F{\cdot}HF$) is a well-known reagent for converting metal oxides to fluorides and for its applications in breaking down minerals and ores in order to extract useful components. It has been more recently applied to the decomposition of inorganic matrices prior to elemental analysis. Herein, a sample decomposition method that employs molten ABF sample treatment in the initial step is systematically evaluated across a range of inorganic sample types: glass, quartz, zircon, soil, and pitchblende ore. Method performance is evaluated across two variables: duration of molten ABF treatment and ABF reagent mass to sample mass ratio. The degree of solubilization of these sample classes are compared to the fluoride stoichiometry that is theoretically necessary to enact complete fluorination of the sample types. Finally, the sample decomposition method is performed on several soil and pitchblende ore standard reference materials, after which elemental constituent analysis is performed by ICP-OES and ICP-MS. Elemental recoveries are compared to the certified values; results indicate generally good to excellent recoveries across a range of alkaline earth, rare earth, transition metal, and actinide elements.

KEYWORDS

decomposition; digestion; fluorination; mineral; glass; soil; ore; environmental analysis; ICP-MS; ICP-OES; NH_4HF_2; $NH_4F{\cdot}HF$; ammonium bifluoride; ammonium acid fluoride