Journal of Applied Geochemistry
March, 2012. pp 74 - 95

RECENT TRENDS IN CHEMICAL CHARACTERISATION OF GEOLOGICAL AND HYDROGEOCHEMICAL SAMPLES FOR MAJOR, MINOR AND TRACE ELEMENTS INCLUDING TRACE IMPURITIES IN NUCLEAR GRADE URANIUM OXIDE SAMPLES

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Abstract

Determination of major, minor and trace constituents in complex geological materials, hydrogeochemical samples and allied materials has always been a fascinating field of analytical chemistry and more so, for application in uranium exploration/exploitation programmes. The trace level occurrence of uranium, economic compulsions and other related uncertainties are the natural causes for the interest in its exploration and analysis. Methods have been standardized and developed for estimation of many elements from major to trace quantities using state-of-the-art analytical instruments like ICP-AES, GF-AAS, FAAS, Ion-chromatography, TOC analyser, Fluorimeter etc., in connection with the uranium exploration programme. Brief account of work is presented mainly for strategic elements like U, Nb, Ta, REE, Au, PGE, B, Sc etc., after separation and estimation using ICP-AES /FAAS techniques. Geochemical research is not only the wide range of analytical measurements, but also the high degree of performance demanded in terms of precision, accuracy, sample throughput coupled with high sensitivity.

Uranium metal is generally used as fuel in research reactors while power reactors use natural uranium and enriched uranium oxides as the fuel including mixed oxides of U and Pu. In nuclear industry, successful working of a reactor mainly depends on the performance of the nuclear fuel and consequently, purity of the fuel with respect to trace metal constituents assumes importance. The presence of some of the trace metal constituents in nuclear fuel can affect its performance significantly due to their metallurgical and neutron absorption properties. Therefore, some nuclear grade uranium oxide samples were analyzed for their trace impurities like Gd, Sm, Dy, Eu, Cd, Co, Cr, Ni, Cu, Zn, etc., after chemical separation followed by estimation using ICP-AES and the results are presented .The detailed laboratory steps for the determination of different elements as described above are given in the enclosed appendix.

Keywords: Geological, Hydrogeochemical, ICP-OES, AAS, ICP-MS, Nuclear grade uranium.