

Quantitative Determination of Uranium in a Certified Uranium Ore Concentrate Reference Material Using ICP-MS

Accurate determination of uranium concentration in uranium ore concentrates is essential for nuclear safeguards, material accountability, and nuclear forensic investigations. Reliable analytical techniques supported by certified reference materials are therefore required to ensure measurement accuracy and traceability. Inductively Coupled Plasma Mass Spectrometry (ICP-MS) is widely used for quantitative determination of uranium due to its high sensitivity, low detection limits, and capability for multi-element analysis. In this study, the uranium content of a Canadian Certified Reference Material (CRM) uranium ore concentrate was quantitatively determined using ICP-MS following acid digestion and dilution procedures. The solid CRM sample was digested using nitric acids under controlled laboratory conditions to ensure complete dissolution of the sample matrix. The resulting solution was analysed using a NexION 2000 ICP-MS, and the measured uranium concentration was converted into weight percent uranium through appropriate dilution and mass balance calculations.

The analytical results indicated a uranium concentration of approximately 76.55 wt.% U, corresponding to 90.27 wt.% U_3O_8 equivalent, which is consistent with the expected composition range for high-grade uranium ore concentrates. The use of a certified reference material provided confidence in the accuracy and reliability of the analytical methodology. These findings demonstrate the effectiveness of ICP-MS for quantitative uranium analysis in uranium ore concentrates and highlight the importance of validated analytical techniques for nuclear safeguards, nuclear forensics, and material verification. The development and application of such analytical capabilities contribute to strengthening nuclear security frameworks and support ongoing efforts to establish nuclear forensic databases and analytical capacity within Africa.

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