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## **Impurities Determination on Nuclear Fuel Element Components for the IEA-R1 Research Reactor by Analytical Methods based on ED-XRF and ICP-OES**

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### **ABSTRACT**

The production of nuclear fuel used in the research reactor at Instituto de Pesquisas Energéticas e Nucleares (IPEN/CNEN-SP) requires a series of chemical and metallurgical processes. The quality of the end product depends on the control over all the stages of the manufacturing process and over the quality of raw materials employed. In fact, spectrometric methods are increasingly used as quantitative analytical techniques applicable to uranium compounds because of simultaneous determination of several elements with minimum amounts of sample. However, the main obstacle of uranium compounds analysis by spectrometric techniques such as optical emission spectrometry with inductively coupled plasma (ICP-OES) is the complex emission spectrum of uranium. The ICP-OES is not appropriately capable of determining the major elements of interest without initial chemical separation of uranium. In this sense, the use of X-ray fluorescence spectrometry (XRF) has been considered for quantitative determination of main elements with the advantage of not being destructive and not requiring a prior preparation of samples for analysis. Due to the simplicity of this technique, its applicability includes research and quality control in universities, research institutions, petrochemical industries, metallurgy, mining, etc. In this work, some components considered impurities in nuclear fuel element samples used in the IEA-R1 research reactor of IPEN/CNEN-SP were chemically characterized by ICP-OES analysis after chromatography extraction separation by using TBP/XAD-14 system and compared to results obtained by energy dispersive X-ray fluorescence spectrometry (EDXRF) and wavelength dispersive X-ray fluorescence (WDXRF).