

Analisis dan identifikasi unsur radioaktif uranium dan thorium pada sampel norm dengan menggunakan teknik laser induced plasma spectroscopy (LIPS) = Analysis and identification of uranium and thorium radioactive materials in norm sample by using laser induced plasma spectroscopy technique (LIPS) /

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Abstrak

ABSTRAK

Saat ini teknologi nuklir berkembang dengan baik di Indonesia dan pemanfaatannya baik di bidang kesehatan, pertanian, peternakan, industri dan energi digunakan sepenuhnya untuk kesejahteraan seluruh masyarakat Indonesia. Dalam pengembangan dan pemanfaatan teknologi nuklir tentu harus mempertimbangkan dan meminimalisir efek bahaya dari radiasi nuklir, baik untuk pekerja yang berada dilingkungan instalasi nuklir maupun bahaya kontaminasi lingkungan disekitar instalasi nuklir. Untuk itu kegiatan pemantauan, pendeteksian dan pengukuran radiasi mutlak diperlukan. Umumnya kegiatan pemantauan, pendeteksian dan pengukuran radiasi dilakukan dengan perangkat deteksi nuklir. Pada penelitian kali ini dilakukan metode alternatif pengukuran, analisis dan identifikasi unsur radioaktif dengan teknik laser induced plasma spectroscopy LIPS . Penggunaan teknologi LIPS dipilih karena LIPS adalah suatu teknik analisis sampel secara in situ, kualitatif dan kuantitatif yang cepat, dan hampir tanpa preparasi sampel. Analisis dan identifikasi unsur radioaktif dilakukan dengan menembakkan laser pulsa NdYAG Q-Switch 355 nm, 10 Hz, durasi pulsa 5.5 ns, $f = 100$ mm, dengan variasi energi 5.5 mJ - 140 mJ dan dengan variasi tekanan udara 4 Torr ndash; 1 atm pada sampel material radioaktif alamiah atau Naturally Occurring Radioactive Material NORM dengan metoda ablasi laser yang dilanjutkan dengan metoda spectral plasma analisis. Berdasarkan penelitian yang telah dilakukan, secara kualitatif teknik LIPS mampu mengidentifikasi adanya unsur radioaktif Uranium U dan Thorium Th yang terdapat pada sampel uji dengan energi laser optimum sebesar 107 mJ dan secara kuantitatif didapatkan nilai prediksi konsentrasi unsur Uranium sebesar 155 ppm dengan persentase error 11.3 dan nilai batas deteksi sebesar 7.89 ppm, nilai prediksi konsentrasi unsur Thorium sebesar 124 ppm dengan persentase error 8 dan nilai batas deteksi sebesar 12.4 ppm. Dengan kata lain teknik LIPS secara inheren sangat cocok dan sangat memungkinkan digunakan sebagai teknik pengukuran, analisis dan identifikasi keberadaan unsur radioaktif.

ABSTRACT

Nuclear technology is currently well developed in Indonesia and its use in the field of health, agriculture, industry and energy is completely used for the welfare of all the people of Indonesia. In the development and utilization of nuclear technology should certainly consider and minimize the effects of nuclear radiation hazards, both for the workers who are in the environment of nuclear installations and the danger of contamination of the environment around nuclear installations. Therefore monitoring activity, detection and measurement of radiation is absolutely necessary. Generally the monitoring activity, detection and measurement of radiation carried by the nuclear detection devices. In this study, alternative methods of

measurement, analysis and identification of radioactive elements is carried out by using laser induced plasma spectroscopy LIPS . The use of LIPS technology is selected since LIPS is a technique in situ sample analysis, qualitative and quantitative fast, and almost no sample preparation. Analysis and identification of the radioactive element is carried out by firing laser pulses NdYAG Q Switch 355 nm, 10 Hz, pulse duration of 5.5 ns, f 100 mm, with a variation of the energy 5.5 mJ 140 mJ and with variations in air pressure 4 Torr 1 atm in a sample of Naturally Occurring Radioactive Material NORM with laser ablation method, followed by plasma spectral analysis method. Based on the research that has been done, LIPS technique is qualitatively able to identify the presence of radioactive elements, i.e. Uranium U and thorium Th contained in the test sample with a laser energy optimum of 107 mJ and quantitatively obtained predictive value of elemental concentrations of Uranium of 155 ppm along with 11.3 of percentage error and 7.89 ppm of detection limit value, also the predictive value of the elemental concentration of thorium of 124 ppm along with 8 of percentage error and 12.4 ppm of detection limit value. In other words, LIPS technique is inherently very suitable and it is possible to use as a measurement technique, analysis and identification of the presence of radioactive materials.