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238U, 40K, 226Ra, 222Rn and Trace Metals in Chemical Fertilizers in Saudi Arabia Markets

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Abstract : The specific activities of 238U, 226Ra, 40K and 222Rn in chemical fertilizers were measured using gamma ray spectrometer and Cr-39 detector. In this study 21 chemical fertilizers were collected from Eastern Saudi Arabia markets. The specific activities of 238U ranged from 23 ± 0.5 to 3900 ± 195 Bq kg^{-1}, 226Ra ranged from 5.6 ± 2.8 to 392 ± 18 Bq kg^{-1} and 40K ranged from 18.4 ± 3 to 16476 ± 820 Bq kg^{-1}. The radon concentrations and the radon exhalation rates were found to vary from 3.2 ± 1.2 to 1531.6 ± 160 Bq m^{-3} and from 1.6 to 773.7 mBq m^{-2} h^{-1}, respectively. Radium equivalent activities (Raeq) were calculated for the analyzed samples to assess the radiation hazards arising due to the use of these chemical fertilizers in the agriculture soil. The Raeq for Six local samples (NPK and SSP) and one imported sample (SOP) were greater than the acceptable value 370 Bq kg^{-1}. The total air absorbed doses rates in air 1 m above the ground (D) were calculated for all samples. All samples, except one imported granule sample (DAP), were higher than the estimated average global terrestrial radiation of 55 nGy h^{-1}. The highest annual effective dose was in TSP fertilizers (2.1 $mSvy^{-1}$). The results show that the local TSP, imported SOP and local NPK (sample 13) fertilizers were unacceptable for use as fertilizers in agricultural soil. Furthermore, the toxic elements and trace metals (Pb, Cd, Cr, Co, Ni, Hg and As) were determined using atomic absorption spectrometer. The concentrations of chromium in chemical fertilizers were higher than the global values.

Keywords : chemical fertilizers, 238U, 222Rn, trace metals, Saudi Arabia
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