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Assessment of radioactivity contents in bedrock groundwater samples from the northern region of Saudi Arabia

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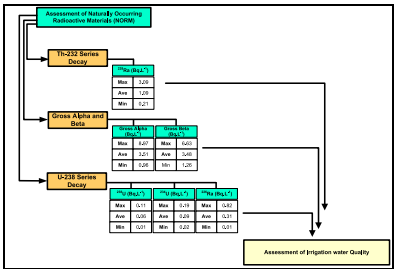
HIGHLIGHTS

- Gross α and β radioactivity in groundwater samples has been investigated in northern part in KSA.
- The contributions of U and Ra alpha emitters to gross α radioactivity were discussed.
- The ratios of the measured β emitters to gross β radioactivity were discussed.
- The ratios of $^{228}Ra/^{226}Ra$, $^{226}Ra/^{238}U$, and $^{234}U/^{238}U$ in groundwater were investigated.

GRAPHICAL ABSTRACT



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ABSTRACT

Recognizing the vast uses of water in human life, the presence of α and β particles emitting radionuclides in groundwater of northern Saudi Arabia has been evaluated as a means of water quality assessment of the region. A liquid scintillation counting technique was used to determine the gross α/β, and ^{228}Ra radioactivities in water samples, while the radioactivity concentrations of $^{234,238}U$ and ^{226}Ra were determined using alpha spectrometry after the separation process.

Present results show that all water samples contain a higher level of gross α and β radioactivity than the WHO recommended limits; the average gross α activity is about 7 times greater than the limit value of 0.5 Bq L^{-1}, while the average gross β activity value is about 3.5 times greater than the limit value of 1 Bq L^{-1}. Correlations of TDS and pH with gross α and β radioactivity in the studied samples were investigated. The activity ratio of the measured U and Ra alpha emitters to the gross α radioactivity and the ratio of the measured β emitters to gross β radioactivity were also discussed. Furthermore, interesting information on thorium abundance and radioactive disequilibrium in U series were observed by studying the activity ratio of $^{228}Ra/^{226}Ra$, $^{226}Ra/^{238}U$, and $^{234}U/^{238}U$. Although these samples are not directly used for human being drinking, and mainly used in irrigation, the higher gross α/β radioactivity may cause

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