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Characterization of radium-containing compounds in the human digestive tract for decorporation

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Radionuclides ingested with food may accumulate in the human body and pose a potential health risk. Radium is a naturally occurring radionuclide, which may be present in drinking water and in certain foods in larger quantities up to ca. 10 Bq kg-1 [1]. Daily consumption of only a few Brazil nuts, which can have activity concentrations of > 200 Bq kg-1 caused by radium [2], may lead to an additional committed dose in the mSv range, while consumption of drinking water high in uranium progenies, such as the Disi Aquifer in Jordan, can lead to even higher doses [3]. For risk assessment, precise knowledge of the radionuclides'biokinetics is needed. This is also important for development and application of decontamination procedures after accidental incorporation of very high radium quantities. In this project, artificial biofluids produced according to the UBM protocol (BARGE) are used to investigate the interaction of radium in the alimentary tract of humans. In preliminary experiments, the non-radioactive homologue barium is used to determine compounds being formed in these biofluids. The speciation of radium in biofluids, i.e. in the digestive system, are determined by ESI-MS and gamma-spectroscopy. Subsequently, the decorporation agent is added, and the Ra-containing complexes are analyzed again with ESI-MS, and additionally with NMR and IR. The influence of complexation agents on Ra(II) speciation under physiological conditions is investigated. Potential decorporation strategies will be tested in further work. The experimental determination of the speciation of Ra(II) is corroborated by thermodynamic modelling using appropriate tools (e.g.PHREECC).
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Primary authors: Mr SHAMOUN, Ahmadabdurahman; Dr RIEBE, Beate; WALTHER, Clemens (Universität Hannover, IRS); Mr HOLTMANN, Linus

Presenter: Mr SHAMOUN, Ahmadabdurahman

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