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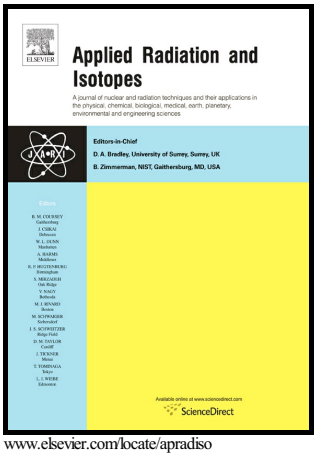

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PII: S0969-8043(17)31037-0
DOI: https://doi.org/10.1016/j.apradiso.2018.04.019
Reference: ARI8330

To appear in: *Applied Radiation and Isotopes*

Received date: 5 September 2017
Revised date: 21 March 2018
Accepted date: 13 April 2018

Cite this article as: S. Savoye, A. Rajyaguru, N. Macé, S. Lefèvre, G. Spir and J.C. Robinet, How mobile is tritiated water through unsaturated cement-based materials? New insights from two complementary approaches, *Applied Radiation and Isotopes,* https://doi.org/10.1016/j.apradiso.2018.04.019

How mobile is tritiated water through unsaturated cement-based materials? New insights from two complementary approaches

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Abstract

This work presents two complementary approaches (for low and high desaturation) to study tritiated water (HTO) diffusion through unsaturated cement-based materials. The first approach was based on through-diffusion experiments where suction was controlled by osmosis. In the second approach, diffusion experiments were performed in humidity chambers controlled by under-saturated saline solutions. Results revealed a decrease of effective diffusion coefficient by a factor of 10 from 100% to 23% of saturation degree. Comparison with gaseous H_2 suggests that HTO diffuses through unsaturated cement-based materials at rates 4 orders of magnitude lower.

Keywords:

Tritiated water (HTO); Diffusion; Cement; Desaturation; Osmosis; Saline solution

Highlights:

- Osmosis allows HTO diffusion experiments to be performed up to 9 MPa of suction
- Diffusive vapor exchange method enables the application of suction up to 170 MPa
- HTO mainly diffuses as dissolved species in solution in hardened cement paste
- Extent of irreversible HTO uptake on by cement-based materials increases with desaturation
- HTO diffuses 10 000 times slower through unsaturated cement-based materials than H_2 gas