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Study of hafnium sodium salts of DTPA using PAC Spectroscopy

Text

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Summary

The applications of PAC spectroscopy to biochemical subjects have progressed at a constant sustained rate in the last years. The principal limitations that face this type of systems concern the sample requirements: it is necessary to bind a suitable PAC isotope to the molecule of interest in stoichiometric or substoichiometric amounts. In the biomedical field, the technique has been used to investigate organic compounds, lipid vesicles and macromolecules [1].

DTPA (diethylene triamine pentaacetic acid) is a polyamino carboxylic acid consisting of a diethylenetriamine backbone with five carboxymethyl groups. The molecule can be viewed as an expanded version of EDTA and it is used to treat the internal contamination with radioactive metals and as a "bridge" between isotopes and macromolecules in the radiopharmaceutical industry. Thus, the elucidation of the structure and dynamical behavior of metal-DTPA systems is of interest in both fields.

In this communication, PAC spectroscopy has been used to obtain the hyperfine parameters of hafnium sodium salts of DTPA at pH 4, 8, 9 and 10 using radioactive ^{181}Hf as probe nucleus. The samples were prepared by mixing proper amounts of solid DTPA, $^{181}\text{Hf-HfF}_4$ in fluorhydric acid and sodium hydroxide 2M. Once the salts decanted, the supernatant was removed and the wet salts were measured at room temperature. All the samples showed both dynamic and static interactions. The obtained hyperfine parameters, quadrupole frequency, asymmetry and the relaxation parameter are presented. Different behaviors were observed for the sample at pH 4 and the alkaline ones, indicating the possibility of ^{181}Hf being bonded to different ligands depending on the pH. Among the samples at alkaline pHs can be observed a variation tendency in the hyperfine parameters, corresponding to slight changes in the DTPA molecule as the pH varies.

References

[1] Hemmingsen et al., Chemical Reviews 104, 4027 (2004) and references therein.

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