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A Novel Boron–Succinate Chelate for application in BNCT

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Boron Neutron Capture Therapy (BNCT) is a radiotherapy treatment considered binary, consisting of two therapeutic procedures, the first being characterized by the administration (prescription) of a compound based on ^{10}B. The second procedure involves irradiating the patient through a collimated and filtered beam of epithermal neutrons, whose energies are close to 2 keV. The epithermal neutrons penetrate the tissue and are thermalized close to thermal energies (0.0253 eV), producing few effects on the tissue. The search for new boron compounds with low toxicity and high conversion rates ($^{10}B \rightarrow ^{7}Li$) has intensified in recent years due to the possibility of performing binary therapy only in the tumor region. This work synthesized and characterized a new boron-10 chelate using a biocompatible carboxylic diacid as a ligand to compose a therapeutic prototype for BNCT. Succinic acid was the ligand used in synthesizing the boron chelate in its deprotonated form to stabilize boron and optimize its biodistribution process. The chelate was synthesized through a reaction between boric acid and succinic acid (1:2) in a basic medium under agitation for 24 hours at room temperature. Spectroscopic techniques and thermogravimetric analysis characterized the boron chelate, and an epidermal neutron irradiation test in boron chelate-PVC systems was also performed. The results obtained by infrared spectroscopy showed the chelate formation, with absorption bands in characteristic regions such as BO at 640 cm^{-1}, BO_3 at 1423-1450 cm^{-1}, and B-O-C at 1307 cm^{-1}. The ^{1}H, ^{13}C, and ^{11}B NMR spectra presented characteristic signals that confirmed the structure of the compound (Figure 1), corresponding to BL3, with L3 referring to three coordinated succinic acid ligands in the monodentate form. The irradiation test analyses confirmed that the chelate could be used in BNCT since it presented a high conversion rate with values above 85%.

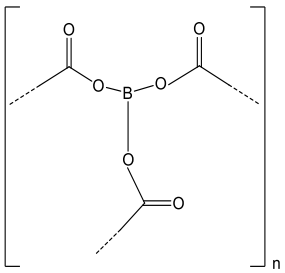

Figure 1. Proposed structural fragment of boron chelate through characterization data.

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