

## Abstract

Macrocyclic ligands are known for their ability to bind paramagnetic lanthanide metal ions to form kinetically inert and thermodynamically stable complexes that can be used as contrast agents for MRI.

This thesis deals with the study of new ligands derived from the known parent ligand H<sub>8</sub>DOTP – 1,4,7,10-tetraazacyclododecane with four pendant methylenephosphonate groups. The prepared new derivatives contain two different pairs of pendant groups, always in opposite positions of the macrocycle. One of the pairs are methylenephosphonate groups, the other pair are methylenephosphinate groups with different substituents on the phosphorus atom. Specifically, it is a compound with a P–H phosphinate group (H<sub>6</sub>DO2P2P<sup>H</sup>), a phenyl group (H<sub>6</sub>DO2P2P<sup>Ph</sup>) and a trifluoroethyl group (H<sub>6</sub>DO2P2P<sup>tf<sub>e</sub></sup>). The thesis describes the synthesis of the target ligands, the preparation of their complexes with paramagnetic ions Eu<sup>3+</sup> and Yb<sup>3+</sup> and their further study using NMR spectroscopy (pH NMR titration and relaxometric NMR measurements).

Keywords:

H<sub>4</sub>DOTA, H<sub>8</sub>DOTP, MRI, contrast agent, lanthanides, macrocyclic ligands, paramagnetic complexes