

# New Synthetic Routes for 1-Benzyl-1,4,7,10-tetraazacyclododecane and 1,4,7,10-Tetraazacyclododecane-1-acetic Acid Ethyl Ester, Important Starting Materials for Metal-coded DOTA-Based Affinity Tags

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Two improved routes to synthesize 1-benzyl-1,4,7,10-tetraazacyclododecane (**6**) and 1,4,7,10-tetraazacyclododecane-1-acetic acid ethyl ester (**11**) are described as well as the synthesis of 1-{2-[4-(maleimido-N-propylacetamidobutyl)amino]-2-oxoethyl}-1,4,7,10-tetraazacyclododecane-4,7,10-triacetic acid (**17**) and its Y, Ho, Tm, and Lu complexes. The <sup>1</sup>H and <sup>13</sup>C NMR spectra of the new compounds as well as the single crystal X-ray structure analyses of the intermediates 4-benzyl-1,7-bis(*p*-toluenesulfonyl)diethylenetriamine (**3**) and 1,4,7-tris(*p*-toluenesulfonyl)diethylenetriamine (**7**) are reported and discussed. The rare earth complexes of **17** have been characterized by <sup>1</sup>H NMR spectroscopy and MALDI-TOF mass spectrometry.

*Key words:* Tetraazacyclododecane, Macrocyclic, DOTA, Affinity Tag, Rare Earth Complexes