Abstract

In this work, we focused on the synthesis and applications of calix[4]arene derivatives with triester on its lower rim and three types of functional groups on the upper rim which include *p*-methoxyphenylazo-calix[4]arenes (**29**), monoisoxazoline methyl-calix[4]arenes (**32a-c**), propylthiol-calix[4]arenes (**34**) and silicon-based calix[4]arenes (**36**).

Firstly, we observed azo-calix[4]arene (**29**) complex with several metal ions (Li^{+}、Na^{+}、Ca^{2+}、Ba^{2+}、Mg^{2+}、Cu^{2+}、Hg^{2+}、Cr^{3+}、Ni^{+}、Cd^{2+}) from UV-Vis spectroscopic titration methods. Upper rim monoisoxazoline methyl substituted calix[4]arenes is a chiral molecule because it possesses a chiral center, therefore, it may be useful in chiral recognition.

Secondly, quartz crystal microbalance (QCM) technique was used to probe the complexation between propylthiol-calix[4]arenes (**34**) and lead ion (Pb^{2+}). Based on ^{1}H-NMR titration method, we suggest a 1:1 binding ratio between **34** and Pb^{2+}.

Finally, the silicate-based calix[4]arenes (**36**) is a polysilsesquioxane formed by the sol-gel process, and the host is calix[4]arenes with triester on lower rim from solid state ^{13}C and ^{29}Si-NMR. It is a water-insoluble material, which binds with and extracts metal ion from water.