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ORIENTAL JOURNAL OF CHEMISTRY
An International Open Access, Peer Reviewed Research Journal

www.orientjchem.org

ISSN: 0970-020 X
CODEN: OJCHEG
2018, Vol. 34, No.(6):
Pg. 2789-2795

Super Extended Calix[4]pyrroles as Candidate for Binding Mercury

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http://dx.doi.org/10.13005/ojc/340615

Received: October 17, 2018; Accepted: November 22, 2018)

ABSTRACT

The binding of mercury Hg (II) by calix[4]pyrrole derivative; 2 has been much less discovered than anion complexation. The presence of hydroxyl group in the structure of meso-tetramethyl-tetrakis-[2(4-hydroxyphenyl)ethylcalix[4]pyrrole is important for further modifications in the next steps. The modification of the hydroxyl group by the substitution of ester group was carried out to produce the ester derivative for the modified calix[4]pyrrole 2. The ester group would be expected to deliver high electronic contributions in the complexation processes with the guests as well as to increase the solubility of the receptor in different organic solvents. ^{1}H NMR and isothermal titration calorimetric studies revealed that the receptors exhibited strong interaction with mercury cation and the complexation process was driven enthalpically and entropically. Conductance measurements in acetonitrile were carried out to identify the composition of the formed complex from nano isothermal titration calorimetric studies, the thermodynamic parameters for the complexation processes were calculated.

Keywords: Calix[4]pyrrole, Complexation, Guest, Conductance, Thermodynamic, Calorimetry.

INTRODUCTION

In recent three decades, probing and recognizing of an ionic species has become a target in supramolecular chemistry due to their hazardous effect on the environment and for their importance in industrial applications[1-7]. Mercury will be the target in this report[8]. Mercury is a poisonous metallic element exists in nature in various forms and can be transformed from one state to another, it is allocated in soil, rocks, water, air and living systems. It is a toxic material towards organisms and has serious impact on the human health and the environment. The using of metallic mercury or its organic and inorganic derivatives in batteries, thermometers and some of traditional products means that the ecosystem is vulnerable to contaminated with mercury through the discharge of organic and inorganic mercury derivatives in rivers and eventually contaminate fishes, birds and animals and can affect seriously the healthiness of these systems. For instance, it is found that people who are exposed to a high concentration level of methylmercury suffered from severe variation in nerve response and several markers of symptoms can exist. Also, increasing the concentration level of mercury in blood stream leads to trembling hands and numbness or tingling in their lips, tongues, fingers or toes. These markers can