

Sumanene-based materials for optical and electrochemical detection of cesium cations

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INTRODUCTION

The development of new cesium receptors is an issue from the viewpoint of human health and the protection of the natural environment. ¹³⁷Cs isotopes are radioactive and their possible spreading is primarily related to failures of nuclear power plants, such as after the Fukushima disaster (2011). As a result, radioactive ¹³⁷Cs uncontrolled released into the environment, including groundwater. ¹³⁷Cs salts are also a threat to human life and health since they accumulate in the environment. The half-life of the ¹³⁷Cs isotope is about 30 years, and cesium salts are characterized by very good solubility in water. Therefore, the radioactive ¹³⁷Cs (from the radioactive waste) will be present in the environment for another 20 years. Sumanene, a C₃-symmetric fragment of fullerene C₆₀, was synthesized for the first time in 2003.¹ Sumanene is a polyaromatic compound exhibiting a bowl-shaped shape. This feature of sumanene results in its good photophysical properties and those related to the crystal structure. The chemistry of sumanene is developing intensively. Research works in recent years were not only focused on the development of new methods of sumanene modification, but also on its application in various fields. A newly proposed research concept is the use of sumanene derivatives as molecular receptors for ion detection.²

EXPERIMENTAL/THEORETICAL STUDY

Sumanene derivatives were applied in optical or electrochemical (voltammetric, potentiometric) detection of cesium cations, supported with density functional theory (DFT) computations.

RESULTS AND DISCUSSION

Sumanene derivatives were successfully applied in optical or electrochemical (voltammetric, potentiometric) detection of cesium cations, providing good detection parameters, together with excellent detection limits and selectivity.³

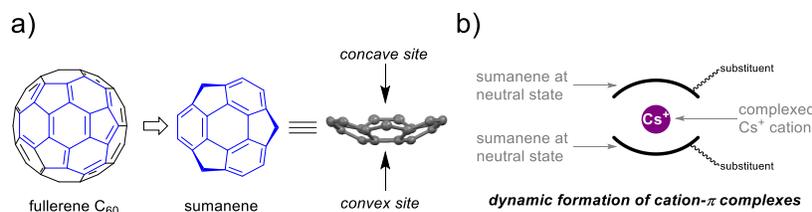


Fig. 1 (a) Structure of sumanene; (b) graphical representation of the formed complexes.

CONCLUSION

Our studies conducted over the last 6 years point on the possibility of the usage use of sumanene derivatives as effective receptors for cesium cations. These studies open new horizons in the general organic, supramolecular and materials chemistry of sumanene, as well as applied sciences of this unique bowl-shaped molecule.

REFERENCES

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