"Micromotors for (bio)sensing and environmental applications: exploring their collective behavior"

Alberto Escarpa[1,2]

[1] Department of Analytical Chemistry, Physical Chemistry, and Chemical Engineering, Universidad de Alcalá, Alcalá de Henares, E-28871 Madrid, Spain.

[2] Chemical Research Institute "Andres M. del Rio", Universidad de Alcalá, E-28807, Madrid, Spain.

* alberto.escarpa@uah.es

Abstract

Micromotors represent one of the most exciting horizons in micro and nanotechnologies, due to their great potential for a plethora of relevant applications in biosensing and environmental remediation. The utilization of self-propelled micromotors in (bio)chemical assays has led to a fundamentally new approach where their continuous movement around the sample and the mixing associated effect, all this as a collective behavior, greatly enhances the target-receptor interactions and hence the performance of the assay or the efficiency of removal or degradation of environmental pollutants [1, 2].

Micromotors are constituted by a few microscale layers that confer them self-propulsion (catalytic layer, *e.g.,* platinum nanoparticles, PtNPs, magnesium for water-based propulsion, MnO_2), (bio)functionalization capabilities (sensing layer, *e.g.*, graphene oxide, rGO, carbon nanotubes), and magnetic guidance (magnetic layer, *e.g.*, Ni or ferrite nanoparticles). In addition to integrating nanomaterials, micromotors technology can also incorporate molecular recognition-based functionalization (*e.g.*, aptamers, antibodies, enzymes) and they are highly compatible with electrochemical and optical detection approaches, and even with microfluidics. In addition, in recent years, autonomous micromotors have also been used as sustainable and efficient micro cleaners to remove pollutants in water samples, and other related applications (see Figure 1).

In this plenary conference, formally speaking, the analytical possibilities of micromotors for the *on-the-fly* (bio)sensing and environmental remediation applications will be discussed.

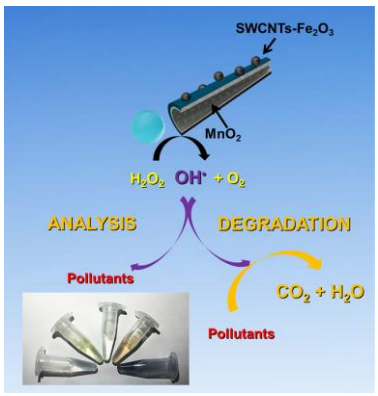

Figure 1. Single-walled carbon nanotubes (SWCNTs) ferrite micromotors based on MnO_2 catalyst for sensing and degradation of pollutants.

References

[1] K. Yuan, J. Bujalance-Fernández, B. Jurado, A. Escarpa. Microchimica Acta 187 (2020) 167.

[2] J. Parmar, D. Vilela, K. Villa, J. Wang, S. Sánchez. Journal of the American Chemical Society 140 (2018) 9317-9331.

Acknowledgements

The financial support of grant PID2020-118154GB-I00 funded by MCIN/AEI/ 10.13039/501100011033 and the Community of Madrid, grant number S2018/NMT-4349 (TRANSNANOAVANSENS) are gratefully acknowledged.