Graphene quantum dots-terbium ions as novel time-resolved luminescent probes

E.J. Llorent-Martínez[1], A. Ruiz-Medina[1], G.M. Durán[2,3], A. Ríos[2,3].

[1]*Department of Physical and Analytical Chemistry, Faculty of Experimental Sciences, University of Jaén, Campus Las Lagunillas, E-23071 Jaén, Spain.*
[2]*Department of Analytical Chemistry and Food Technology, University of Castilla-La Mancha, Camilo José Cela Av., 13071 Ciudad Real, Spain.*
[3]*Regional Institute for Applied Chemistry Research (IRICA), Camilo José Cela Av., 13071 Ciudad Real, Spain.*

Although luminescent analytical methods are widely used in most research fields, different approaches are usually required to improve the analytical characteristics, depending on the analyte(s) and sample to be analyzed. Lanthanide-sensitized luminescence (LSL) presents interesting features that make it a highly sensitive and selective detection technique. Lanthanide cations (mainly europium and terbium) can form chelates with ligands that present specific functional groups (such as carboxylic groups). However, the use of surfactants and synergistic agents is common to improve the luminescence signal. We discuss here a novel approach for LSL, implementing the use of nanomaterials. In particular, we have used terbium-sensitized luminescence (TSL) and graphene quantum dots (GQD), due to the inherent advantages of these nanomaterials for the development of analytical methodologies.
We have selected L-ascorbic acid (AA) as a model analyte to show the advantages of the implementation of GQD in TSL. AA quenches the luminescence of terbium. However, the selectivity and sensitivity of the analytical method are highly improved if the quenching is produced on GQD-Tb(III). The advantages of the use of these nanoparticles will be critically discussed, examining the results obtained in our laboratory. This novel approach can lead to simpler and easy-to-use analytical methods, avoiding the use of surfactants and additional reagents. In addition, GQD can be modified with different (bio)chemicals compounds, which may expand their potential applications in different research fields.