Fullerene-Derivates Containing Selenium

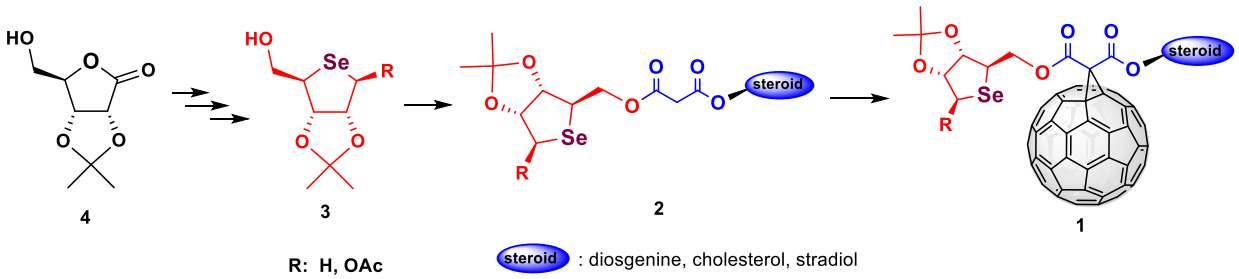
Reinier Lemos,[a,b] Mauro De Nisco,[c] Yoana Pérez-Badell,[d] Margarita Suárez,[a] Silvana Pedatella[b]

[a]*Laboratory of Organic Synthesis, Faculty of Chemistry, University of Havana, 10400-Havana, Cuba*
[b]*Department of Chemical Sciences, University of Napoli Federico II, via Cintia 4, I-80126 Napoli, Italy*
[c]*Department of Sciences, University of Basilicata, Via dell'Ateneo Lucano 10, I-85100 Potenza, Italy*
[d]*Laboratory of Computational Chemistry, Faculty of Chemistry, University of Havana, 10400-Havana, Cuba*
e-mail: reylemos81@gmail.com

Over the years, fullerenes have been covalently linked to other polar structures, increasing its aqueous solubility, thereby improving its potential use for biological and biomedical applications.[1] The functionalization of C_{60}, the most study fullerene, with biomolecules shows one of the best approaches to increase their bioavailability and access the benefits of these molecules.[2] C_{60} derivatives have shown antioxidants and antivirals propierties. In adition, remarkable examples relate with the synthesis of C_{60} hybrids, where the [60]fullerene is covalently connected to biological active compounds such as sugars and steroids have affinity to some nucleic acids, proteins and cellular receptors.[3]

In the frame of a consolidated research focused on the versatility of steroid-C_{60} hybrids,[4] we propose the synthesis of new methanofullerenes **1** (**Scheme 1**) containing selenium with potential antiviral and antioxidant propierties by a synergistic activity of selenium and the C_{60}. The new methano[60]fullerenes were prepared using a cyclopropanation reaction employed the Bingel–Hirsch protocol in a multistep synthetic procedure. The precursors malonates contained three sterols – diosgenine, cholesterol, and stradiol – and a D-selenodeoxysugar **3**. These conjugates were synthetized in good yields based on the consolidated synthetic technique performed previously by our reserch group[5] and a computational study was carried out.

Theoretical calculations using the DFT-PBE method and 6-311G(d,p) basis set, were performed to predict the most stable conformations for the synthesized conjugates (**2**). For the more, the applications of the novel steroid-selenosugar conjugates were also evaluated in medicinal chemistry, in particular, was explored their potential application as anti-SarsCov-2 agents. The molecular docking suggested that the conjugates form H-bonds with the active residues involved in the interaction of RBD-SarsCov-2 with ACE-2. How RBD protein plays an important role in the entry of virus in the cellule, the conjugates could be considerate with potential antivirals propierties.



Scheme 1. Synthetic scheme.

1. Lemos, R.; Ortiz, F.; Almagro, L.; Makowski, K.; Martín, N.; Albericio, F.; Suarez, M.; Rodriguez, H. *Surf. Interface Anal*. **2022**, *10*, 1041–1051.
2. Camps, X.; Hirsch, A. *J. Chem. Soc., Perkin Tran. 1* **1997**, *11*, 1595–1596.
3. Mohajeri, M.; Behnam, B.; Sahebkar, A. *J. Cell. Physiol*. **2018**, *234*, 298–319.
4. Almagro, L.; Lemos, R.; Makowski, K.; Rodríguez, H.; Ortiz, O.; Cáceres, W.; Herranz, M.Á.; Molero, D.; Martínez-Álvarez, R.; Suárez, M.; Martín, N. *Eur. J. Org. Chem.* **2020**, *2020*(37), 5926–5937.
5. Serpico, L.; De Nisco, M.; Cermola, F.; Manfra, M.; Pedatella, S. *Molecules* **2021**, *26*, 2541.