

Oligothiophenes: electrochemically obtained smart materials

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Organic materials are finding intensive use as semiconductors in many areas of Organic Electronics, replacing silicon in electronic devices. These new materials showed excellent properties as charge carriers and important chemical-physical characteristics such as low molecular weight, transparency and flexibility. Polymers are the most successful compounds as organic semiconductors, but numerous studies have shown that switching to an oligomeric approach can lead to many benefits. Oligothiophenes are a class of molecules that well-represent these compounds, because in many cases their physico-chemical, optical and electronic properties are better than those of polymers. These compounds have a D-A or A-DA structure, where the donor core (D: thiophenyl, bithiophenyl) is bound to acceptor structures (A) such as cyanoacrylate, dicyanovinyl or rhodaninyl groups. The oligothiophenic chain has octyl groups which make these compounds soluble in most common solvents. It is possible to modify the electrochemical and optical band gaps, and therefore the electronic conductivity, by varying the length of core and/or acceptor groups. The synthetic strategy to obtain these compounds involves electrochemical steps, such as the anodic dimerization. Electrochemistry can be an excellent tool for the synthesis of long-chain oligothiophenes in a cleaner and more efficient way. Instead of dimerizing in the last step, as reported in the literature, the anodic oxidation was carried out on oligothiophenes with an aldehyde group, to subsequently insert the desired acceptor group by Knoevenagel reaction. The electrochemical behaviors were studied by cyclic voltammetry. Then, solvatochromic behavior of oligothiophenes in solvents with different dielectric constants will be reported. This research fits into the field of advanced materials, introducing new functionalities and improved properties, adding value to existing products and processes, in a sustainable approach.