

# Synthesis of dimeric surfactants derived from bile salts for preparation of dye sensitizers for solar cells

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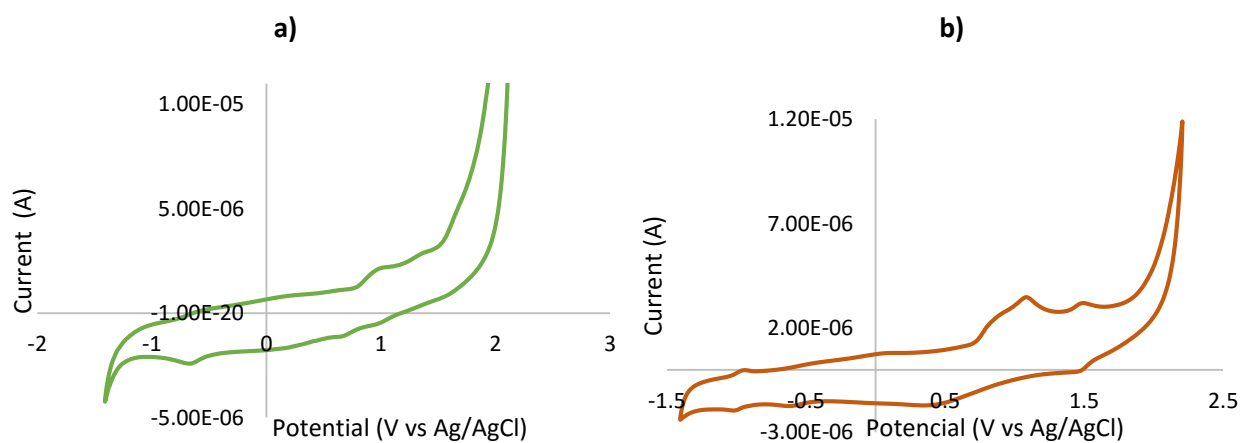
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The world energy consumption, presents a general growth trend. New sources of renewable energy, such as photoelectrochemical cells, artificial photosynthetic devices or semiconductors used in photocatalysis, are being investigated and improved [1]. Dye sensitized solar cells, best known as Grätzel cells, represent new sources of renewable energy due to its low cost and high efficiency [2]. There is a large number of ruthenium complexes with organic ligands that are used as dyes in Grätzel cells. Dimeric derivatives of bile salts, could be employed as ligands for preparation of dyes based on ruthenium (II). Bile acids and some derivatives have been used as coadsorbents in dye sensitized solar cells, improving efficiency of the cells [3]. Recently, new dyes known as heteroleptic dyes have been prepared. These dyes consist in a bipyridine with hydrophobic substituents, such as cholesterol or adamantane [2]. The use of these molecules in dye sensitized solar cells represent an increase efficiency and an improvement in some properties of the cell. For this reason, we have synthesized two dimers, whose hydrophobic section contains two bile salts joined across an amide bond to bipyridine. The dimers were synthesized by the reaction between 2,2'-bipyridine-3,3'-dicarboxylic acid activated with HOBt/DIC and amines in 3 $\beta$  position of the respective steroids (cholic and deoxy cholic acid). They were characterized through NMR (<sup>1</sup>H, <sup>13</sup>C, <sup>15</sup>N, COSY, HSQC, HMBBC). Preliminary tests have been made in order to obtain the ruthenium complex with the deoxycholic acid derivative. Also, electrochemical characterization has been made to determine the behavior of dimers and the ruthenium complex (cyclic voltammetry and differential pulse voltammetry). The ruthenium complex has a behavior similar to a reversible system ( $\sim -1$  V), which makes it ideal to act as a dye sensitizer. However, further experiments should be carried to demonstrate this condition.



**Figure 1.** Cyclic voltammetry of a) the ligand and b) the ruthenium complex, at a scan rate of 0,1 V s<sup>-1</sup>.

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