Improvement of the photocatalytic activity of TiO2 using Colombian Caribbean species (Syzygium cumini) as natural sensitizers: Experimental and theoretical studies

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Natural dyes composed by anthocyanins extracted from natural Caribbean species S. cumini, were employed to evaluate their effects on the photocatalytic properties of TiO2 thin films. The qualitative and quantitative analyses of the anthocyanins were carried out using high-performance liquid chromatography with photodiode array detection (HPLC-DAD). From the chemical characterization of the S. cumini extract three main anthocyanins were identified and the most abundant compound was delphinidin-3,5-diglucoside (44%). The total anthocyanin content expresses as delphinidin chloride (TAEDC) per mL of the extract was equal to 124 ± 5 ?g TAEDC/mL. After the identification, a sensitization process was performed and verified by infrared spectroscopy (IR) and absorption diffuse reflectance. Afterwards, the Methylene Blue photodegradation process was studied under visible light irradiation on the S. cumini-sensitized TiO2 material (TiO2/S. cumini). The results indicated that the photocatalytic activity of the sensitized material TiO2/S. cumini was ?3 times greater than unmodified TiO2 thin films, which let us to propose that the extract from Caribbean Colombian S. cumini could have a great potential as source of photosensitizers for photocatalytic applications. Finally, the electronic structure of each anthocyanin found in the extract (delphinidin-3,5-diglucoside, malvidin-3-5-diglucoside and petunidin-3-5-diglucoside) and their

interaction with a TiO2 model was studied by means of the density functional theory (DFT). © 2017 Elsevier Ltd