EuroSciCon

6th Edition of European Conference on
Water, Waste and Energy Management

May 13-14, 2019
Stockholm, Sweden

Expert Opin Environ Biol 2019, Volume:8
DOI: 10.4172/2325-9655-C4-054

VALORIZATION OF BIOMASS RESIDUES FOR ENVIRONMENTAL REMEDIATION AND SOLAR FUELS AND CHEMICAL PRODUCTION

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Solar fuels and chemicals are a promising strategic pathway since they are produced from simple and abundant molecules using a renewable energy source such as sunlight. However, the efficiency is still low and far for the practical application. Highly active photocatalysts are required to produce solar fuels. This work will show the advances in the production of solar fuels using efficient carbon-based photocatalysts as well as the valorization of biomass residues to be used in some model reactions to obtain solar chemicals. The efficiency for H_2 production by direct water splitting using TiO_2 is rather low, but it can be notably increased in presence of sacrificial agents. Aqueous pollutants can play the role of sacrificial agent and simultaneous H2 production and pollutant removal can take place. The CO_2 reduction permits to obtain a wide variety of organic compounds such as formic acid, methanol and methane. Considering that noble metals have a high activity for C-O bond cleavage combined with flexible and highly tuneable chemistry of the carbon surface it can be postulated that noble metal/graphene-based catalysts should be suitable to achieve efficient hydrogenation of CO_2 in the aqueous phase. Finally, the photo-assisted valorisation of furfuryl alcohol (FA) and 5-hydroximethyl furfural (5-HMF), two products from the biorefinery industry, and glycerol (Gly), the main by-product of the biodiesel industry, is an innovative approach to explore. These target molecules can be photo-converted into aldehydes or ketones or even more valuable compounds such as five- or six-member dioxane-based carbocycles by condensation reactions.

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