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Agro-food industry waste for bio hydrogen production by dark fermentation

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Increasing demand for energy, depletion of primary energy sources (i.e., coal and oil) and environmental degradation have made the production of energy from alternative nonconventional sources essential. In the same way, recent trends in food production have led to an increase in the generation of wastes during food processing, that needs further management to avoid environmental problems. Therefore, hydrogen produced from renewable sources could play an important role for future energy economy as clean, CO_2 neutral and environmentally friendly energy carrier. Hydrogen is easily used in fuel cells for electricity production, whose high energy yield of 122 kJ g– 1, which is 2.75 times greater than known hydrocarbon fuels, allows its use as a fuel for transportation. In addition, it can be stored not only chemically but also physiochemically in various solid and liquid composites. Hydrogen can be produced from a wide-ranging variety of primary energy sources and different production technologies. However, currently most of it is produced by Steam Reforming from nonrenewable feedstock, producing high greenhouse gas emissions. In contrast, fermentative hydrogen production can utilize renewable carbohydrate-based substrates, such as waste biomass from agricultural sectors. Furthermore, this process occurs at lower temperatures and pressures, and is therefore less energy-intensive than chemical and electrochemical processes. So, abundant biomass from various industries could be a sustainable source for biohydrogen (hydrogen produced by living organisms) where combination of waste treatment and energy production would be an advantage. In this work different types of agro-food industry waste from Castilla- La Mancha (dairy wastes, beer lees, winery waste and mushroom waste) have been studied in order to determine the substrate with the highest biohydrogen production by dark fermentation. For this purpose, different experiments have been carried out with the aim of quantify certain characteristics of substrates, like carbohydrate content and trace elements, that influence in the H2 yield.

Recent Publications

1. Singh A and Rathore D (2017) Biohydrogen production: sustainability of current technology and future perspective. Springer India.
2. Urbaniec K and Bakker R (2015) Biomass residues as raw material for dark hydrogen fermentation – A review. International Journal of Hydrogen Energy 40(9):3648-3658.
3. Kumar G, Shobana S, Nagarajan D, Lee D J, Lee K S, Lin C Y and Chang J S (2018) Biomass based hydrogen production by dark fermentation—recent trends and opportunities for greener processes. Current Opinion in Biotechnology 50:136-145.
4. Robledo-Narváez P N, Muñoz-Páez K M, Poggi-Varaldo H M, Ríos-Leal E, Calva-Calva G, Ortega-Clemente L A and Salazar Montoya J A (2013) The influence of total solids content and initial pH on batch biohydrogen production by solid substrate fermentation of agroindustrial wastes. Journal of Environmental Management 128:126-137.
5. Bharathi Raja B, Sudharsanaa T, Bharghavi A, Jayamuthunagai J and Praveen kumar R (2016) Biohydrogen and biogas: an overview on feedstocks and enhancement process. Fuel 185:810-828.

Biography

Gema Sevilla Toboso has her expertise in improving the environment. Her evaluation based on agro-food industry waste from Castilla-La Mancha creates new ways to produce hydrogen and thus improve the environment through the generation of a fuel that does not produce greenhouse gases while treating this waste. Her investigation is carried out in CNH2, a National Research Centre at the service of the entire Scientific, Technology and Industrial Community.

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