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LAND AND AQUATIC BIOMASS DERIVED MONOMERS FOR POLYMERS AND FINE CHEMICALS

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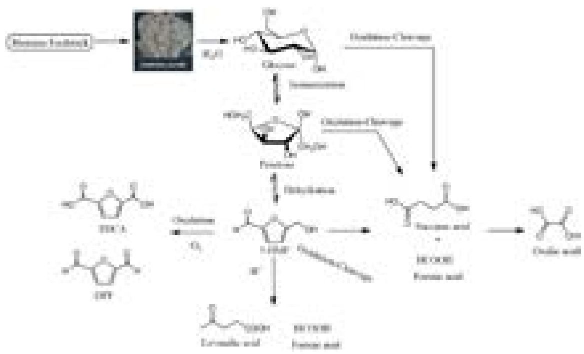
The depletion of fossil resources is pushing the scientific community to look-for alternative feedstock. The transition from petroleum and natural gas feedstock to bio-based supplies is essential for the sustainability of the chemical industry.[1] Creating new energy-efficient processes to utilize bio based feedstock, will allow industry to produce goods from domestic resources with a substantially lower carbon emission. In this context, biomass represents an abundant low-carbon renewable resource for the production of bioenergy, chemicals and biomaterials, and its enhanced use would address several societal needs. In order to avoid any conflict with food, non-edible biomass should be used such as wood or waste from agro-forest industry or algae. Currently the global yield of agricultural crop residues, excluding grass, varies from ~8 dry Mt ha-1y-1 to ~22 dry Mt ha-1y-1, [2]. The main component of such agricultural residues is cellulose, which represents the most abundant form of biomass, and holds impressive potential as alternative to fossil carbon for sustainable production of fuels and chemicals. [3]. Cellulose can be hydrolysed into glucose using supercritical water in acidic conditions and even better by the use of catalysts with acid properties,. The isomerization of D-Glucose provides D-Fructose, the platform molecule for making 5-hydroxymethylfurfural (5-HMF), [4] that is considered as one of the most promising platform molecules because of its potential as intermediate in the synthesis of furan derivatives that can replace chemicals sourced from fossil carbon [5]. (Scheme 1, left) Developing selective catalysts that may use oxygen as oxidant in water for the synthesis of the products shown in Scheme 1 is an important issue that targets sustainability in the chemical industry. 5-HMF and its precursors (fructose and glucose) can even undergo ring cleavage to afford di-acids such as succinic acid and oxalic acid. [6] [Scheme 1, right]. Another important source of monomers for polymers and fine chemicals are monounsaturated fatty acids. Non eatable oleic acid (restaurant oils, oil from algae or from tobacco and other non-eatable plants) can be converted into mono- and di-carboxylic acids that are useful monomers for polymers (the latter) or additives for the cosmetic industry or can be directly used in agrochemistry (the former).[7]. This talk will discuss a few options for sustainable conversion of biomass derived compounds into chemicals that may have an industrial utilization.



Biography

Michele Aresta, Dr. Industrial Chemistry and PhD of Engineering HC, has his expertise in Inorganic Chemistry and Catalysis (homogeneous, enzymatic and heterogeneous). He was the initiator of the CO2 chemistry and one of the pioneers of Carbon Recycling for a Circular Economy. He has developed several synthetic methodologies for the valorization of CO2 recovered from industrial and power plants. More recently, he has developed new catalytic methodologies for sustainable chemistry using abundant metals as catalysts in water as solvent and oxygen as oxidant. He is author of over 280 papers, 10 books on CO2 Utilization and owner of several patents. He is CEO of the IC2R Innovative Start-up for Carbon Recycling. He was the recipient of several Awards, including the Gold Medal of the Inorganic Chemistry Division of the Italian Chemical Society, 2016. He is Honorary Professor at the University of Tianjin, Tianjin, China.

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