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Muconic acid and sodium muconate hydrogenation to bio-adipic acid

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The limited fossil resources availability and the climate change are raising wide interest between the scientific researchers and the civil community. Among the several subjects, the production of bulk chemicals from renewable sources is one of the great challenge that researchers are facing. Concerning this theme, adipic acid (AdA) production from wood biomass is one of the most important topic due to the large amount of AdA consumed and the market growth, in particular for the production of polyamides (Nylon 6,6). Bio-AdA can be produced from *t,t*-muconic acid (MA), a metabolic intermediate of the catechol ortho-cleavage pathway.[1] In nature, microorganisms displaying this pathway are quite common and they can accumulate at least 13.5 g/l of MA as sodium muconate[2]. The so produced sodium muconate is then converted to AdA with a heterogeneous hydrogenation chemical reaction. Using mild operating conditions (70°C and hydrogen pressure 4 bar) and commercial catalyst (Pt/AC 5% wt or Pd/AC 5% wt) in 1 hour a full conversion and a complete selectivity toward AdA is achieved[3]. MA coming from the fermenter needs a purification step due to the high purity grade required for the market. The purification process consists in an acidification and crystallization steps, that transform sodium muconate into muconic acid, separating this chemical from all the compounds used in the fermenter. Considering water as hydrogenation reaction media, unfortunately MA is less soluble than sodium muconate. On the basis of these considerations different hydrogenation reactions were performed varying the operating conditions both on muconic acid and sodium muconate. The results reveal a different behavior during hydrogenation reaction performed at 70°C at different hydrogen pressures. Pd/AC 5%wt commercial catalyst was used, maintaining the catalyst/substrate ratio equal to 200:1 (mol basis). The results are reported in Fig.1. Using *t,t*-MA than Na-muconate a higher activity and selectivity to AdA have been observed. Moreover, the effect of reaction conditions, such as reaction temperature, hydrogen pressure and catalyst amount have been investigated.

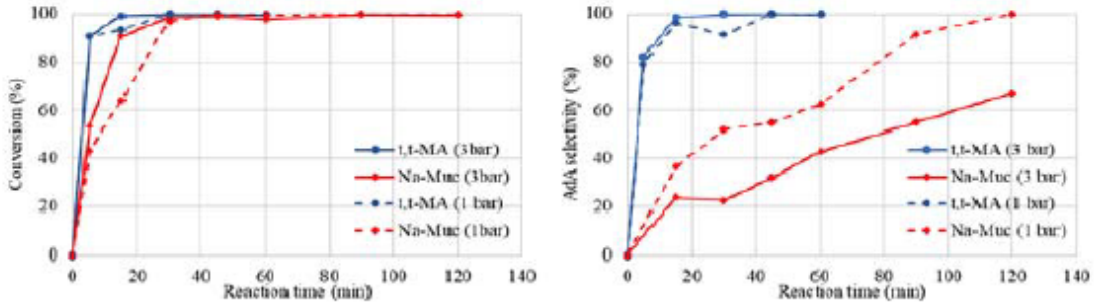

Fig.1 Conversion and AdA selectivity obtained at 70°C, 1,3 bar of hydrogen, using t,t-Ma and sodium muconate (Na-Muc) as substrate.

References

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