Catalytic hydrodechlorination of chloroform to olefins with Pd supported on activated carbons obtained by chemical activation of lignin

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Olefins are very interesting compounds for the petrochemical industry because of their use on the synthesis of many products. However, their production is usually done by steam cracking that requires high temperature and high pressure and thus a high energy consumption. Different alternatives have appeared recently to substitute this technology, and catalytic hydrodechlorination (HDC) of chlorinated volatile organic compounds (ClVOCs) arise as a promising one.

ClVOCs are hazardous compounds, which contribute to global warming and to the depletion of the ozone layer. HDC allows the valorisation of these compounds into high-valued olefins, ethylene and propylene. Different catalysts and supports have been studied to optimize the catalytic activity, being Pd catalysts supported on activated carbons one of the most promising. In this study we have prepared five activated carbons (AC) by chemical activation of lignin with $ZnCl_2$, H_3PO_4, $FeCl_3$, NaOH and KOH. Afterwards, these carbons were impregnated with Pd active phase (1 wt%) by incipient wetness method given rise to five different Pd on AC catalysts.

All the catalysts were fully characterized before and after been used in the HDC of chloroform. They showed different Pd nanoparticle size, probably as a result of the different surface chemistry and morphology of the supports, with the consequent differences in their catalytic performance. The catalyst derived from $FeCl_3$ activation showed high selectivity to olefins although conversion decreased during the operation mainly by Pd sintering. In contrast, the catalyst activated with $ZnCl_2$ was very stable for over 50 hours operating at 300 ºC probably due to the redispersion of the Pd particles.