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Editorial

Progress in Catalytic Hydrodechlorination

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Catalytic hydrodechlorination (HDC) is a technology with great potential for the treatment and valorization of organic chlorinated wastes. It is a structure-sensitive reaction, which mainly consists in the substitution of the chlorine atoms by hydrogen atoms to obtain non-chlorinated clean products by means of a propriated catalyst. HDC has applications both in the gaseous [1–5] and liquid [6,7] phase, and can operate under mild conditions, mainly, but not only, using molecular hydrogen as a reducing agent.

The current Special Issue gives an overview of the state-of-the-art HDC, which we hope the readers will find interesting. In it, the use of this technology for the abatement of chlorinated pollutants of different natures is considered, such as chloromethanes [1], chloroethanes [8], chlorophenols [6] and chlorofluorocarbons [9] or the selective obtainment of valuable products, such as olefins [1,9,10] and paraffins [1], using a variety of supports and active phases, mono- and bimetallic. Electronic interactions between the most common metals used for the process, namely, Pd and Pt, and their effect in the catalytic activity, are reported [2]. The effect of the preparation method of Pd catalysts using novel supports, like ordered mesoporous carbon, on the degree of dechlorination and the selectivity to different hydrocarbons is analyzed [3]. The addition of different additives to the catalysts or the modification of their surface acidity are strategies being used to improve the catalysts' activity and stability [6] or favor the selective production of a desired product [1,11]. In that sense, more acidic catalysts have been found to favor the hydrogenation of intermediate olefins to generate paraffins in the HDC of chloromethanes [1]. On the other hand, the presence of N-containing ligands modifies the electron density of the active centers, improving the catalysts' behavior to produce vinyl chloride by hydrochlorination of acetylene [11]. Furthermore, doping with nitrogen enhances the activity of activated carbons in the HDC of 1,2-dichloroethane. Pyridinic-N are the catalytic sites, which are basic in nature. A kinetic study of dehydrochlorination has shown that the surface reaction rate on the N-doped carbon catalyst is the limiting step in the catalytic dehydrochlorination of 1,2-dichloroethane [4]. These results also provide a new method for optimizing the catalytic activity, i.e., by increasing the amount of pyridinic-N and the base strength. What seems clear is that the excellent performances and environmental friendliness of N-doped carbon catalysts will encourage experimental studies to develop new applications in chemical reactions. In a different study [6], the catalysts' stability was improved by adding an organic stabilizer (F-127) to the catalyst. The operating conditions and the reactants' structure also have an important influence on the catalytic stability. In that sense, the deactivation of Ni-derived catalysts has been explored, determining the influence of reaction conditions on the formation of carbonaceous deposits, and showing evidence of their structure and morphology [5]. The Special Issue also includes new findings for the abatement of organochlorinated contaminants in water effluents. Conventional bimetallic catalysts (Raney Al-Ni and Devarda's Al-Cu-Zn) found a new application for the HDC of polychlorinated aromatic compounds in alkaline aqueous solution [7].

Finally, two extensive review studies are included in the Special Issue. The first one [8] discusses the thermodynamics, kinetics and catalysts generally used in the process, especially regarding the use of HDC for the treatment of tetrachloromethane, di- and

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trichloroethane and (poly)chlorobenzenes. The second review [10] presents a global analysis of experimental and theoretical studies, particularly regarding the HDC of chloromethanes, analyzing the influence of the catalysts' properties and the effect of the operating conditions on the process, paying attention to the catalysts' deactivation and discussing the mechanisms and kinetics of the process. Besides, this review discusses the possibility of upgrading chloromethanes into valuable hydrocarbons, like olefins. This last objective, the selective production of olefins (vinylidene fluoride), is achieved in another contribution of the Special Issue by dehydrochlorinating 1-chloro-1,1-difluoroethane [9], showing that this technology is much less energy demanding than the current industrial manufacturing process.

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