

Comparison of different heterogeneous catalysts for the estolides synthesis from oleic acid

Abstract

Different catalysts, namely various loading of perchloric acid on various supports; HClO₄/silica (SiO₂), HClO₄/silica gel (SG) and HClO₄/alumina (Al₂O₃) were tested for the direct addition reaction of oleic acid (OA) to form estolide compounds. The reactions were carried out under vacuum (2 mBar) for 10 hours at 70 °C under solvent-less conditions. LC-MS ToF of reaction products results showed chromatographic peaks for the presence of two new estolide compounds, oleic-oleic monoestolide acid (m/z 563.51, as [M-H]⁻), and oleic-oleic diestolide acid (m/z 845.77 [M-H]⁻). The optimum loading of HClO₄ for every support are 15 wt.% HClO₄/SiO₂ (SiO₂ 215), 10 wt.% HClO₄/SG (SG10) and 35 wt.% HClO₄/Al₂O₃ (Al₂O₃ 335). The SG10 turned out to be the best catalyst, achieving a final conversion of 97.5 % with 79.8 % selectivity to oleic-oleic monoestolide acid and 17.7 % selectivity to oleic-oleic diestolide acid. The activity and selectivity of the SG10 have been investigated and compared with homogeneous HClO₄. The optimum catalysts for every support were characterized by XPS analysis, BET, TEM and TPD-NH₃.