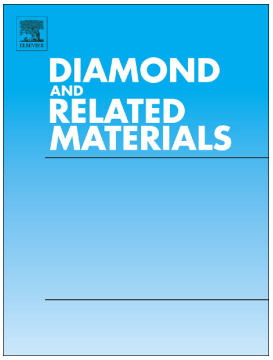

Acidic activated carbons as catalysts of biodiesel formation

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Abstract

Biodiesel is recognized as one of the most attractive motor vehicle fuels of the future. Therefore, technologies of its production are continuously improved and optimized. The research work reported concerns the process of biodiesel production via transesterification of vegetable oil over modified carbon catalysts obtained from waste material. In order to introduce strongly acidic groups into the carbon structure, the initial sample was treated with concentrated or fuming sulfuric acid, sodium sulfide, 4-aminobenzenesulfonic acid, phosphoric acid or H_2SO_4/HNO_3 mixture. The carbon materials prepared in this way were thoroughly characterized (elemental and textural analysis, potentiometric titration, TG, NMR, SEM, and XPS measurements) and then used in transesterification of rapeseed oil in the presence of methanol at 130^{o}C under elevated pressure. The results obtained revealed that not only sulfonic groups are capable of catalyzing transesterification reaction (FAME yield up to 60% for the best -SO_3H bearing sample), but also materials containing phosphate groups can successfully catalyze this process (FAME yield 43%). It was established that the carboxyl functionalities, which can be generated on the catalyst surface upon its reaction with some modification agents (e.g., H_2SO_4 or H_2SO_4/HNO_3 mixture), block the active sites of the process and reduce the reaction effectiveness. The stability of the catalysts was rather poor, as they underwent deactivation in subsequent reaction cycles (mainly due to neutralization of -SO_3H groups but also by their leaching); however, the catalyst regeneration was possible.

Keywords: Activated carbon; Carbon modification; Solid acid catalysts; Transesterification

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