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## Heterogeneous acid and base catalysts for biodiesel production

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**B**iomass is a promising sustainable feedstock for the production of chemicals and transportation fuels. Biodiesel is a clean burning and biodegradable fuel which, when derived from non-food plant or algal oils or animal fats, is viewed as a viable alternative to petroleum-derived diesel. Catalytic esterification of free fatty acids (FFAs) and the transesterification of triacyl glycerides (TAGs) represent efficient routes to biodiesels from non-edible oils or waste oils. A major hurdle in the commercialization of such processes is the synthesis of efficient, inexpensive and robust heterogeneous catalysts able to operate at low temperature and pressure, and with good water and FFA tolerance. Here we discuss the application of diverse nanocrystalline and nanoporous solid acid and base catalysts for FFA esterification and TAG transesterification. Promising solid base catalysts include hydrotalcites, MgO and dolomitic mineral waste. Sulfonic acid and zirconia functionalised mesoporous silicas (SBA-15, MCM-41, KIT-6 and PMO) are promising solid acid catalysts for esterification under mild conditions, with both surface functionality and framework architecture playing an important role in promoting activity and permitting continuous biodiesel manufacture.

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