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Catalytic conversion of glycerol to polymers in the presence of ammonia

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Abstract

In this contribution, the development of a process for the synthesis of potentially highly valuable polymeric products from the reaction of waste glycerol with ammonia is reported for the first time. The polymers were the result of a single step, continuous gas phase process, catalysed by an alumina-supported iron catalyst, operating under relatively mild reaction conditions. The solid product was characterised using 1D and 2D NMR spectroscopy, FTIR spectroscopy, qualitative chemical tests and elemental analysis. Characterisation revealed building blocks with unsaturated, amido and ester functionalities shaping a mixture of polymers. Nitrogen atoms were present in the main chain of the resultant polymers. NMR analyses of the polymer denotes the formation of structural defects such as unsaturation and branching; while the partial solubility of the polymer in solvents such as $CDCl_3$ and THF is indicative of the formation of cross-linked structures. Insights into the mechanism of formation of these functional groups were based on the liquid and gas phase product distribution. Polymers with chain structures similar to those synthesised in this work are currently manufactured from fossil fuels and are widely used in biomedical applications not