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GREEN SYNTHESIS OF BIODIESEL USING IONIC LIQUIDS

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Petroleum resources are depleting, leading to increases in cost. Green concerns exist regarding the emissions produced when using petroleum for fuel; alternatives to petroleum that are clean and renewable are of considerable importance.

Perhaps at the forefront of petroleum alternatives today is biodiesel: some cars already run on biodiesel and, although the technology is advancing, the use of biodiesel was discovered over a century ago. It has yet to be embraced by the mainstream, and more work is required to refine the technology.

We report here the production of biodiesel through the acid catalysed transesterification of animal fat, wherein the glycerol (glycerine) is separated from the fatty acid methyl ester (Fig. 1).

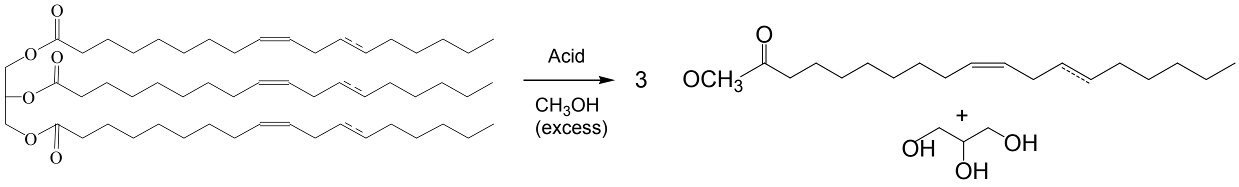
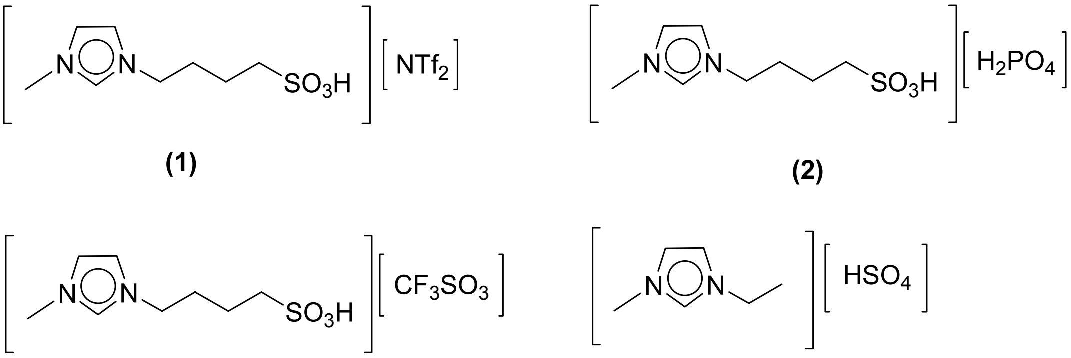


Fig.1 The acid catalysed transesterification of triglycerides, the major constituent of animal fat

Triglycerides (of animal or vegetable origin) are available locally in the UK at a low cost, and were therefore chosen for the transesterification process.

Four acidic ionic liquids were used for this work; three **(1)**-**(3)** contained acidic cations, and two **(2)** and **(4)** contained an acidic anion (Fig. 2). The best results were obtained for the ionic liquids **(1)** and **(3)** after a microwave reaction (30 min at 120 °C; yields of greater than 95%). Using a Brønsted ionic liquid instead of a conventional acidic catalyst, such as H_2SO_4, made the reaction more "green" for the following reasons: 1) Ionic liquids may be recycled and reused and act as catalysts; 2) no waste products are produced; 3) the ionic liquids used are less corrosive compared to the H_2SO_4 used in conventional acid transesterification; 4) the ionic liquids used in the reaction have negligible vapour pressure and are non-flammable; and 5) the ionic liquids remain in the methanol / glycerol layer, hence facilitating the separation of the product and the ionic liquids do no contaminate the product.



(1)

(2)

(3)

(4)

Fig. 2. Acidic catalysts used in this study (1) 4-(3-methylimidazolium)butanesulfonic acid bis{(trifluoromethyl)sulfonyl}amide; (2) 4-(3-methylimidazolium)butanesulfonic acid dihydrogen phosphate; (3) 4-(3-methylimidazolium)butanesulfonic acid trifluoromethanesulfonate; (4) 1-ethyl-3-methylimidazolium hydrogensulfate.