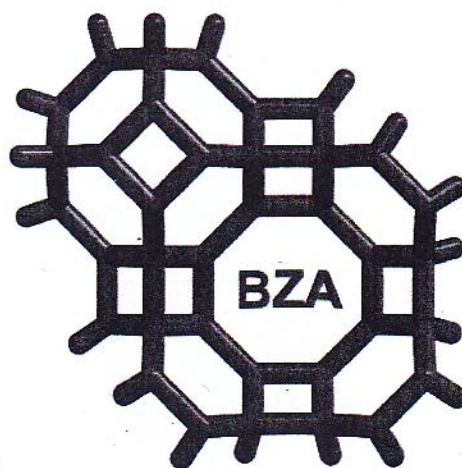


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Biodiesel production using zeolites prepared from shale rock and domestically sourced ash.

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Biodiesel is an alternative diesel fuel that is produced from natural sources such as vegetable oils and animal fats. Vegetable oils were first used as a fuel over a century ago by Rudolf Diesel but this source of fuel has been replaced with cheap petroleum oil fractions that are reformed to diesel using heterogeneous catalysts. Despite the continuing widespread use of fossil fuels, and recent technologies that allow increasing amounts of extraction from previously unavailable sources, the total amount of petroleum oil that is available is limited and will some day expire. Vegetable oils are extracted from plants and are therefore an almost limitless means of storing solar energy. However, natural oils typically comprise mostly glycerides/triglycerides and suffer from high viscosity and inappropriate burning rate (cetane number), both of which render them less than ideal as a fuel for transportation. The (trans)esterification of natural oils using heterogeneous catalysis, Fig. 1, overcomes these problems by generating alkyl esters that are much more suited to use as fuels, and is therefore the focus of much present day research.

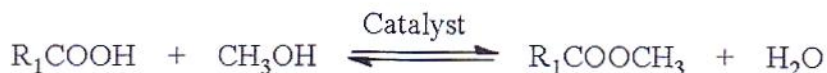
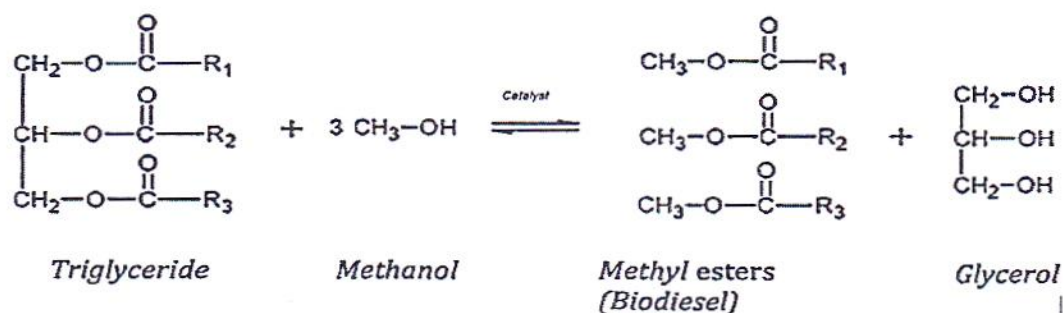


Fig. 1: Transesterification of triglyceride (top) and esterification of free fatty acid (bottom) with methanol.

It is well known that fly ash may be used to successfully prepare Faujasite zeolite. Here we investigate the use of ash derived from a variety of fuel types (coal, timber and peat), following their combustion in a domestic solid fuel stove, as a reagent to prepare zeolite catalysts. The fuels used in this study originate from different geographical locations and the ash resulting from their combustion is thus expected to exhibit distinct mineralogical properties. Attempts are also being made to prepare zeolite using naturally occurring shale as an aluminosilica source. Results will be presented showing the elemental composition and crystal structure (where relevant) of the ash and shale samples following varying degrees of thermal pre-treatment. The zeolites prepared will be fully characterised and their activity tested in the transesterification of vegetable oil and the esterification of oleic acid (a simulated free fatty acid found in waste cooking oil). A full set of results showing catalytic testing of all prepared catalysts will be presented at the conference.