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*Abstract*

# Purification of Biodiesel Produced by Lipase Catalysed Transesterification by Two-Phase Systems Based on Deep Eutectic Solvents in a Microextractor: Selection of Solvents and Process Optimization †

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**Abstract:** The most important and the most used process of biodiesel synthesis is transesterification. The main byproduct formed in the biodiesel synthesis by transesterification is glycerol. Biodiesel produced by transesterification is not suitable for application in engines since it contains soap (if biodiesel is produced by chemical catalysis), traces of the catalyst, methanol, metals, water, oil, and glycerides. All those impurities must be removed in order to reach the standards (ASTM D6751 and EN 14214). The most dominant industrial method for biodiesel purification is wet washing, which generates up to 10 L of wastewater per 1 L of purified biodiesel. Therefore, cheaper and more efficient solutions for biodiesel purification should be found. Deep eutectic solvents (DESs) have been already demonstrated as viable options in biodiesel purification. DESs, a mixture of two or more components with a lower melting point than each individual component, are considered less toxic to the environment, non-volatile, biodegradable, and more stable; in other words, they are economically and environmentally friendly in comparison with organic solvents. In this study, purification of biodiesel produced by lipase catalysed transesterification by DESs was performed by two-phase liquid extraction in a microextractor. A total of 13 different DESs were synthesized and used for biodiesel purification in order to find the one that provides the best glycerol extraction efficiency. After initial screening, three DESs were selected and used for the optimization of process conditions for extraction performed in a microsystem. A three-level-four-factor Box–Behnken experimental design was employed to define the optimal process conditions (biodiesel–DES mass ratio, temperature, residence time). At optimal process conditions, the glycerol content in biodiesel was reduced below 0.02% (*w*/*w*), which is the value specified by standards (ASTM D6751 and EN 14214).

**Keywords:** biodiesel purification; deep eutectic solvents; microextractors; process optimization

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