P-5: Ultrasound-Assisted Extraction of Oil from Microalgae Using Terpenes as an Alternative to n-Hexane

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Microalgae are known to contain high level of lipids, and they represent a great interest in the research of sustainable sources for biodiesel production. Lipids extraction process from dry or wet microalgae biomass and its efficiency represent an important key step in the process of biodiesel production. So it is essential to find an extraction one with an efficient device to increase the lipid extraction yield. During the last decades, application of ultrasound to extraction has found increasing attention. The mechanical effect of ultrasounds promotes the release of soluble compounds from the matrix body by disrupting cell walls, enhancing mass transfer and facilitating solvent access to the cell content. Currently, n-hexane, derived from petroleum, is the solvent of choice for extraction of oils. However, this solvent can be emitted during extraction and recovery and has been identified as an air pollutant. The most feasible alternative to n-hexane as solvent for extraction seems to be the replacement of this solvent by bio-solvent recognized as environmentally safer such as terpenes.

The aim of this study was to compare a conventional extraction technique of crude oil from microalgae with a new technique involving the use of ultrasounds in combination with terpene solvents such as d-limonene, α-pinene and p-cymene. These extractions allowed us to determine lipid yields by gravimetry and fatty acid profiles after GC/FID analysis. Microalgae residues have been observed in optical microscopy. The results show that extracts obtained by ultrasound-assisted extraction provided higher lipid yields than conventional extraction method.

Table 1

Properties of n-hexane and green solvents

Properties	n-hexane	d-limonene	α-pinene	p-cymene
Molecular weight (g/mol)	86.17	136.24	136.24	134.22
Density (g/ml)	0.660	0.837	0.854	0.856
Ebullition point (°C)	68.7	176	155	177
Dielectric constant (ε)	2.0	2.3	2.7	2.3
Environmental impact	++	-	-	-