Lipid extraction from oleaginous microbe with ultra-sonication assistance

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Introduction

Biodiesel production from microorganisms includes microorganism cultivation, lipid extraction, and biodiesel synthesis. Lipid extraction is the critical step. Solvent mixture of chloroform and methanol is common used for lipid extraction. But there are concerns on flammability and high toxicity of chloroform.

The aim of the research work is to demonstrate the potential of ultrasonication aided lipid extraction from oleaginous fungus employing various solvents at different operating conditions.

Materials and Methods

Ultrasonication (520 kHz, 40 W) extraction was carried out in the device as shown in Fig. 1.

Different solvents including water, hexane, methanol, and chloroform:methanol (chlor:meth) were utilized.

The biomass concentration in the study was 30, 50 and 70 g/L for water as solvent, and 50 g/L for hexane, methanol, and chlor:meth as solvents, respectively.

The extraction temperature and time varied from 25 °C to 55 °C and from 5 to 30 min, respectively.

Fig.1. Ultrasonication reactor

The extracted lipid was then converted to fatty acid methyl esters (FAMEs) with methanol at 55 °C in the presence of NaOH (1 % NaOH w/lipid w).

The FAMEs were analyzed using a Gas Chromatography linked to Mass Spectroscopy (GC-MS) (Perkin Elmer, Clarus 500).

Results

In the system of water as solvents, the Scanning Electron Microscope (SEM) images of the strain before and after ultrasonication are shown in Fig. 2. It was observed that the cell disruption occurred after ultrasonication. After 20 min, the lipid recovery (w lipid/ w total lipid) was near to maximum which were 9.3% for water, 33.2% for hexane, 65.1% for methanol, and 99.7% for chlor:meth, respectively (Fig. 3). The FAMEs compositions of the ultrasonication extracted lipid were similar as that of conventional extracted ones.

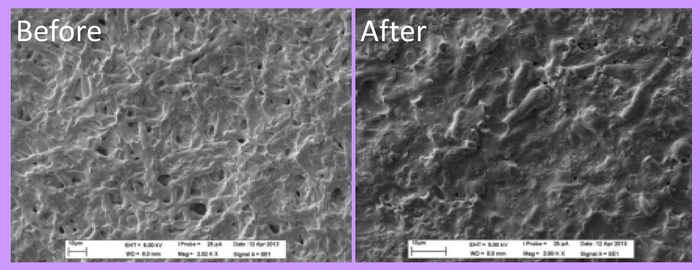

Fig. 2. SEM images of the strain before and after ultrasonication for 20 min

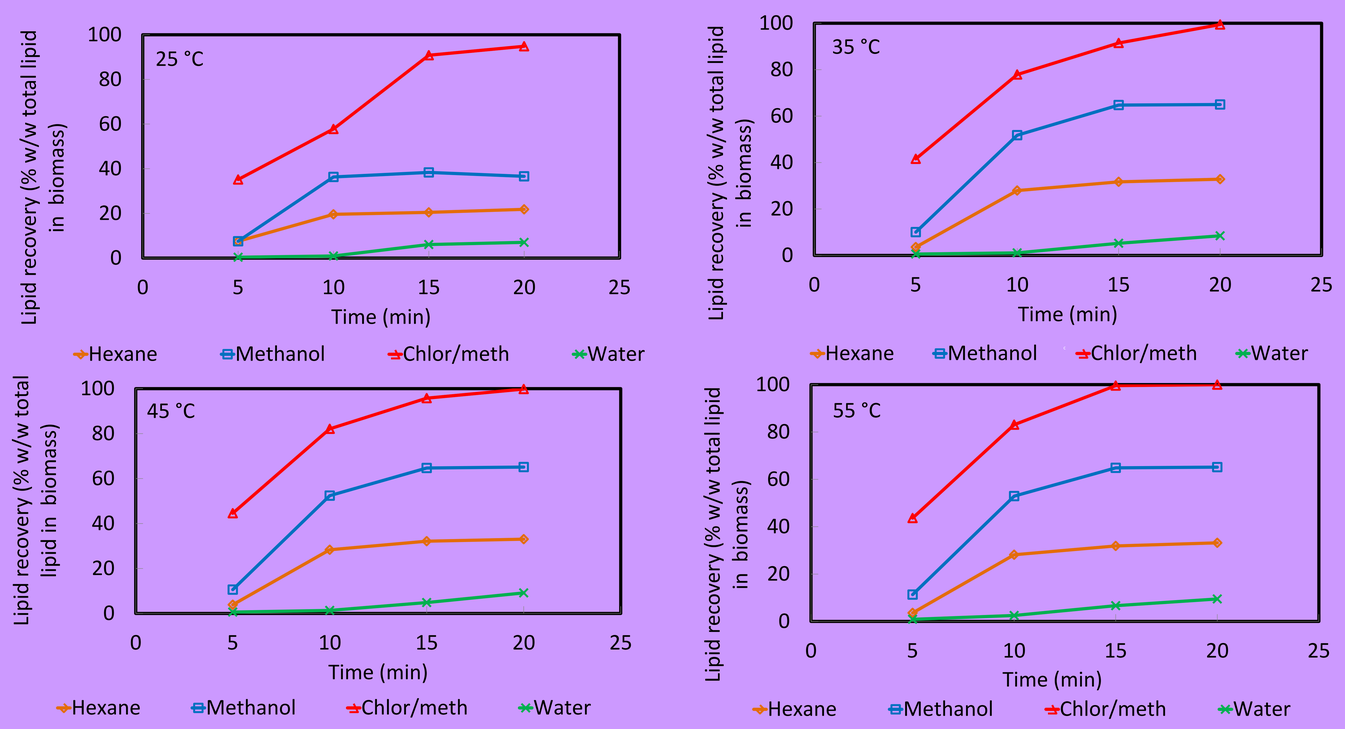

Fig. 3. Lipid recovery with ultrasoniation extraction at different temperature

Conclusion

Type of solvent has significant impact on ultrasonication aided lipids extraction from oleaginous microorganisms. The highest lipid recovery was obtained using chlor:meth. The lipids recovery was of the same order as that of conventional extraction. Ultrasonication aided chlor:meth method reduced extraction time to 15 min from 12 h used in the conventional method without affecting fatty acids profile.