Ionic Liquid-Based Extraction of Fatty Acids from Blue-Green Algal Cells Enhanced by Direct Transesterification and Determination Using GC × GC-TOFMS

Abstract

Blue-green algae commonly referred to as cyanobacteria are known to grow in freshwater bodies when they are provided with suitable growth conditions such as nutrients, temperature and light. Algae biomass is known to contain a large amount of lipids, such as saturated and unsaturated fatty acids. In this study, fatty acids from algal cells were extracted using a newly developed extraction protocol using ionic liquid enhanced by direct transesterification at an elevated temperature. The identification and quantification of fatty acids was performed using gas chromatography coupled to a time-of-flight mass spectrometer (GC × GC-TOFMS). The extracted fatty acids were dominated by those with carbon chain of C16 and C18; [i.e. 7-hexadecenoic acid (C16:1) and hexadecanoic acid (C16:0) for C16, whereas C18 includes γ-linolenic acid (γ-C18:3); linoleic acid (C18:2); linolenic acid (C18:3); 6,9,12,15-octadecatetraenoic acid (C18:4); oleic acid (C18:1) and octadecanoic acid (C18:0)]. The obtained fatty acid composition was then compared with that obtained by organic solvent extraction using a mixture of chloroform and methanol. Statistical evaluation was performed using one-way ANOVA and found that there was no statistically significant difference ($P = 0.908$) between the two extraction methods, a finding which indicates the usefulness of ionic liquid as a solvent to replace volatile organic solvent to minimize environmental pollution.

Keywords

Two-dimensional gas chromatography with time-of-flight mass spectrometry Blue-green algae Fatty acids Ionic liquid