Selection and optimisation of a method for efficient metabolites extraction from microalgae

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Nine disruption techniques were tested on two microalgae models. Image analysis was used to evaluate the efficiency of disruption techniques. The best grinding method was the mixer mill with polypropylene grinding jars. The disruption method was optimised in the objective of high throughput screening. Pigments were good candidates to follow extraction of fragile metabolites.

Over the last decade, the use of microalgae for biofuel production and carbon dioxide sequestration has become a challenge worldwide. Processing costs are still too high for these methods to be profitable though, leading to a need to find high value by-products to optimise the added value of this biomass. For high-throughput screening of such metabolites, it is essential to reach the inner content of the cell. This paper presents research and development of a technique enabling a high extraction yield of any metabolite, taking into account the difficulty of extracting bound and or inaccessible molecules with a wide variety of polarities. To this end, several disruption techniques were tested at laboratory scale on two biological models: Porphyridium purpureum and Phaeodactylum tricornutum. A mixer mill gave the best results, offering access to a broad diversity of metabolites from microalgae for high-throughput screening.

1. Introduction

Microalgae are nowadays considered to be the best source for biofuel production due to their ability to produce large amounts of triglycerides or to be converted into biogas. These photosynthetic micro-organisms are capable of converting carbon dioxide into lipids representing up to the half of their dry weight (Chisti, 2007). While primary metabolites are the result of the unity of life on earth, secondary metabolites are the expression of its biodiversity (Kornprobst, 2005). Many of them have a high added value (Harun et al., 2010), such as isoprenoids, alkaloids, toxins, polysaccharides, polyunsaturated fatty acids, oxylipins, enzymes, phycobiliproteins and non-ribosomal peptides, which find applications in health, pharmacology, nutrition and biotechnology. Among all new marine molecules identified, the proportion produced by