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Recovery of Aqueous Phase of Sub-critical Water Extraction (SWE) from Nannochloropsis gaditana

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Abstract. Microalgae had been proven to be rich in valuable biochemical components such as antioxidants and omega-3. Sub-critical water extraction (SWE) is considered an excellent technology for extraction as the process involves shorter extraction period with high efficiency and it uses a green solvent which is only water. Additional benefit of SWE would be the potential to recover the aqueous extracts which is rich in compounds such as sugar and organic carbon. Sugar could be used in fermentation process for bioenergy production and total organic carbon (TOC) could be used for nutrient recycling for microalgal cultivation. In this experiment, the process conditions of SWE include temperature (156°C-274°C), biomass loading (33 g/L-117 g/L) and retention time (6.6 min-23.4 min) were investigated to quantitatively determined the yield of the aqueous products, focusing on sugars and TOC. The experiments were designed using Central Composite Design (CCD) and the statistical analysis was performed using Design-Expert 7.0. The responses and interactions of each parameter towards the content of the aqueous phase were discussed. A second order polynomial model was chosen for both carbohydrates and TOC content with R2 = 0.9835 and R2 = 0.9845 respectively. The statistical tool also generates predictive equations which could be used to predict future experiments.

Keywords: Microalgae, biochemical components, green extraction, response surface methodology (RSM), central composite design (CCD)