Multi-parameter flow cytometry as a tool to monitor microbial oil production towards biofuel

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Abstract

Up to date, most of the published works studying microbial oil production processes for biofuels use traditional gravimetric lipid analyses, which are time consuming and generate high amounts of waste (organic solvent) which are harmful to the environment if not recycled by distillation. Enough amounts of biomass must be obtained for subsequent lipid extraction and derivatization. In addition, these processes are still monitored by traditional microbiological methods, which beset a number of problems and limitations, and do not provide information on the physiological states of microbial cells. Importantly, lipid content data is only available a considerable time after the sample is taken, and thus do not allow changes to process control strategy during the process development, as information is only available when the bioprocess is over. Multi-parameter flow cytometry coupled with the fluorescent Nile Red can monitor total microbial lipid content and cell viability, near real time (at-line), and with a high degree of statistical resolution, during growth (Lopes da Silva et al., 2011). If the cell lipid content information is available during the time course of the bioprocess, decisions on process control strategy can be readily made (for example, adjusting the carbon/nitrogen ratio of the medium, based on the output from the flow cytometry), so that lipid productivity can be increased. Hence, it is crucial to measure accurately and quickly cellular oil content when optimizing microbial oil so that informed decisions on process control can be made. In addition, it is essential to understand the physiological microbial response as a result of the micro-organism interaction with the environment, so that the optimal growth conditions can be achieved and the lipid production process enhanced. Yeasts and microalgae have been referred as potential oil producers for biodiesel production. Such processes, when monitored by multi-parameter flow cytometry allow quick microbial strains selection for oil production (a necessary but fastidious step when using traditional techniques), optimization of the microbial oil production process and biofuel production process scaling up. The oral presentation will show a few examples of yeast and microalgal growth aiming at oil production towards biodiesel, in association with multi-parameter flow cytometry, referring the advantages of this approach, comparing to traditional techniques currently used for microbial biofuel production process monitoring. Teresa Lopes da Silva, Daniela Feijão, José Carlos Roseiro, Alberto Reis. 2011. Monitoring Rhodotorula glutinis CCMI 145 physiological response and oil production growing on xylose and glucose using multi-parameter flow cytometry. Bioresource Technology, 102 , 2998–3006.

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