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Lipids behaviour in aqueous solution of disrupted microalgae : molecular simulation of representative synthetic mixtures

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Context

The use of microalgae for the production of biofuels and renewable feedstocks is an extremely promising sustainable technology. However, there are still challenges for its large scale implementation. The harvesting and extraction steps are two main areas of improvement. Harvested microalgae have to be grinded and lipids extracted, concentrated and purified. This downstream processing can be implemented by several processes within **membrane filtration**.

Microalgae : **Culture and harvesting**

Cells disruption



Membrane module



The understanding of local organization of lipids and valuable compounds in the complex solution and during the separation is a great challenge to optimize the fractionation processes. The Coarse-grained molecular dynamics simulation is a powerful tool to achieve this goal. The first compounds that are studied at local scale are neutral lipids (triglycerides, free fatty acids) produced by microalgae and biofuel precursor, polar lipids (phospholipids, glycolipids), and polymeric membrane (polyamide or polyethersulfone) used for separation.

Material and methods

A synthetic mixture based on real products analysis was proposed containing pure compounds: trioleate and oleic acid. Interfacial tension is a key parameter for the oil droplets coalescence during the fractionation processes. The objective was to link the water-oil interfacial tensions measured with synthetic solutions to coarse-grained molecular simulation.



Neutral and polar lipids composition from nitrogen starved Parachlorella kessleri disrupted samples and its suppernatant after centrifugation 100% 80%









The main total fatty acids found are: oleic, linoleic, linolenic and palmitic acids.



50% TOG + 50% OA				100% Oleic acid: OA		
water phase	oil phase	water phase	¹ water phase	oil phase	water phase	