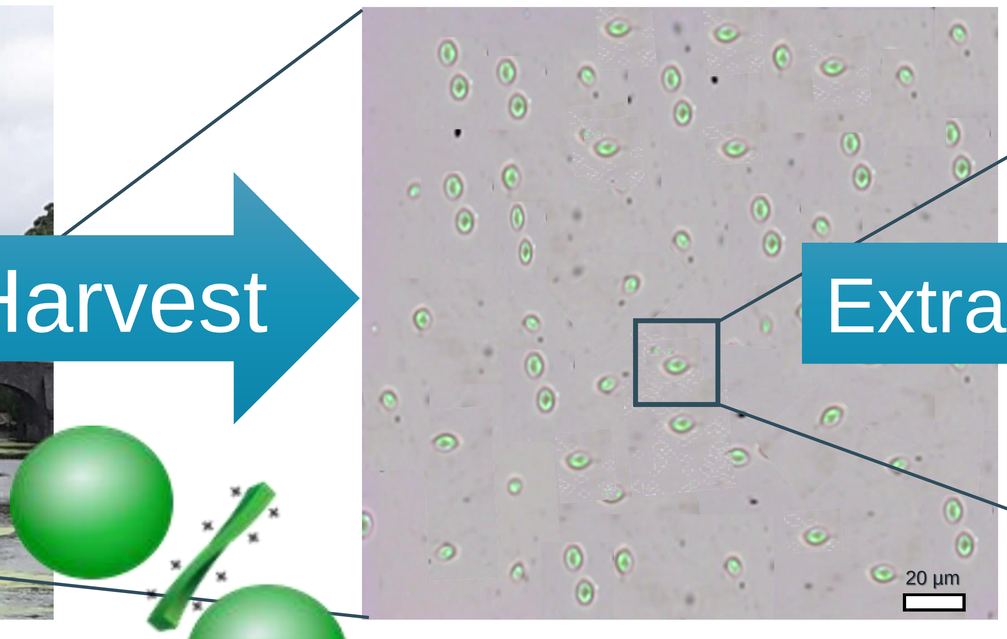
Sustainable Materials /Chemical engineering
Aquatic biology /Biology
an.verfaillie@kuleuven.be

Downstream processing of microalgae using nanocrystals

Although microalgae are a promising resource for biobased materials (such as natural colorants, medicine, biodiesel, “healthy” fatty acids, and plastics), large scale commercialization of microalgae is still limited. Downstream processing, especially harvest of the biomass after cultivation and extraction of components, contributes to a high energy cost.

We aim to combine harvest of the microalgae with extraction of fatty acids.

Harvest



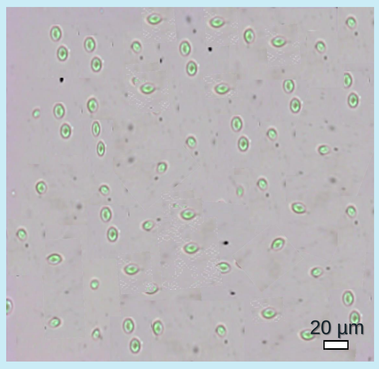
Harvest can be achieved via addition of a positive charge, which attracts the negative charged microalgae. Big flocs are formed which settles down and can be easily harvested.

Extraction

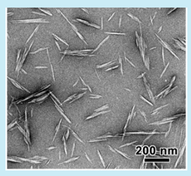
Extraction can be achieved via a long lipid chain, as a needle which perforates the cell wall. This enhances extraction of components like fatty acids, which we quantify after treatment of the algae with these “neeldes”.

Harvest

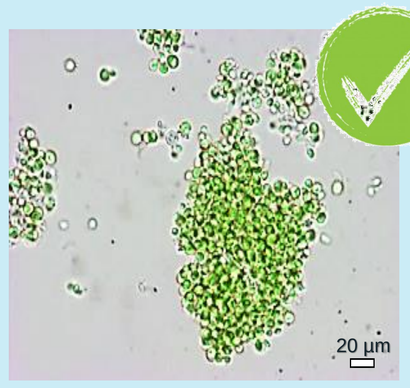
Extraction

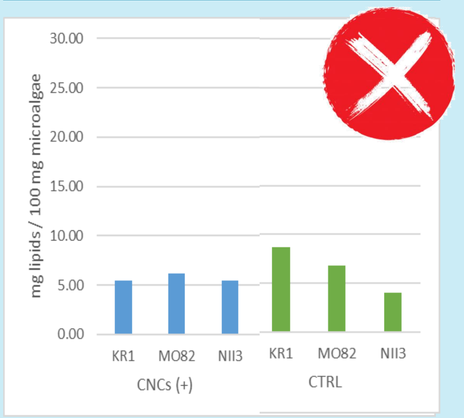


+

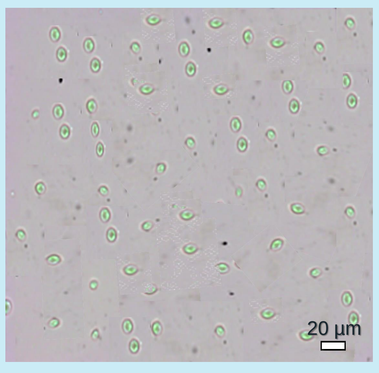


=

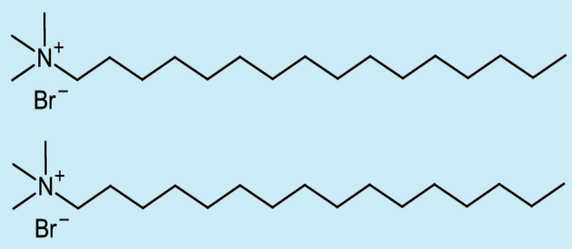




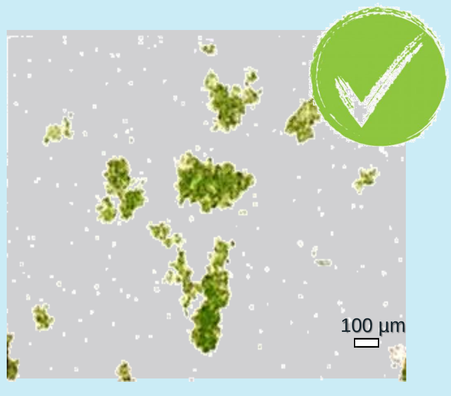
To combine harvest and extraction, we use cellulose nanocrystals. As most renewable polymer on earth, cellulose serves as renewable and sustainable template. We modify these cellulose nanocrystals with positive charges, as pyridinium. Results indicate that these crystals can harvest microalgae, as floc formation can be observed under the microscope. No extraction of lipids can be observed after treating the micoralgae with these cellulose nanocrystals. The amount of lipids extracted out of three different microalgae species (KR1, MO82, N113) is equal to the control (CTRL) without pretreatment of nanocrystals.



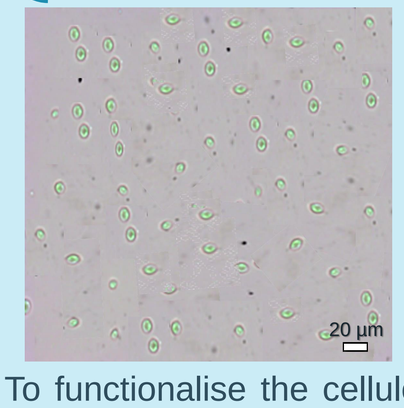
+



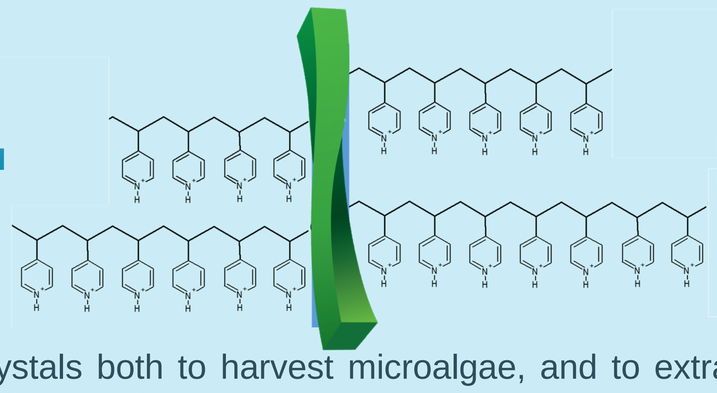
=



The chemical cetyltrimethylamonium bromide (CTAB), possesses both a positive charge as well as a long lipid chain. We achieve harvesting of the microalgae as floc formation is observed under the microscope. Also lipid extraction can be observed for two out of three micoralgae species (KR1 and MO82), which is higher compared to the control (CTRL).



+



=

?

?

To functionalise the cellulose nanocrystals both to harvest microalgae, and to extract lipids out of microalgae, we combine previous findings. We will modify the crystals with a long chain (“needle”) bearing positive pyridine charges. This would result in both floc formation under microscope, as well as lipid extraction after treating the microalgae with these cellulose nanocrystals.