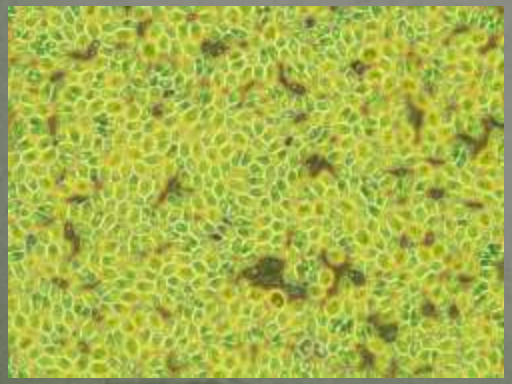
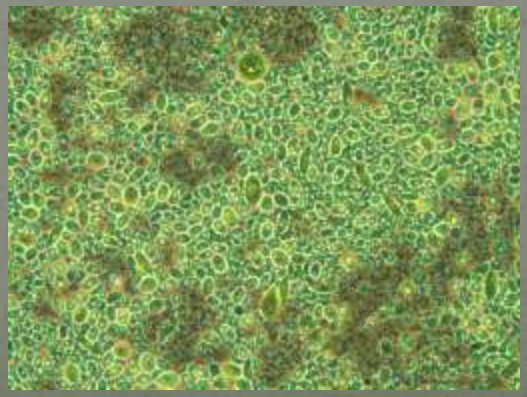
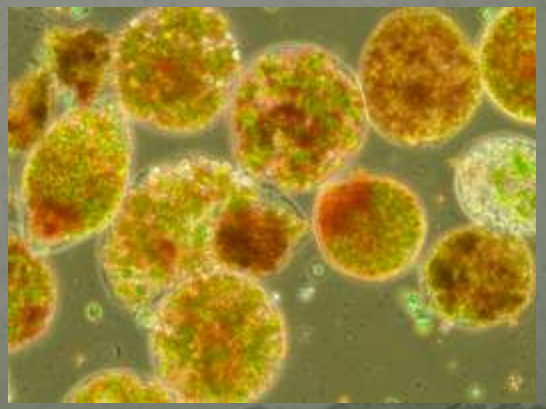
Breaking Algal Cells for Bioresource Extraction

By: Kaitlyn Summerfield







Project Overview

- Bioresource extraction and why is it important
- Project design
- Cell disruption methods
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- Implications of results
- Possible future developments

Bioresource extraction: project objective

Bioresource Extraction

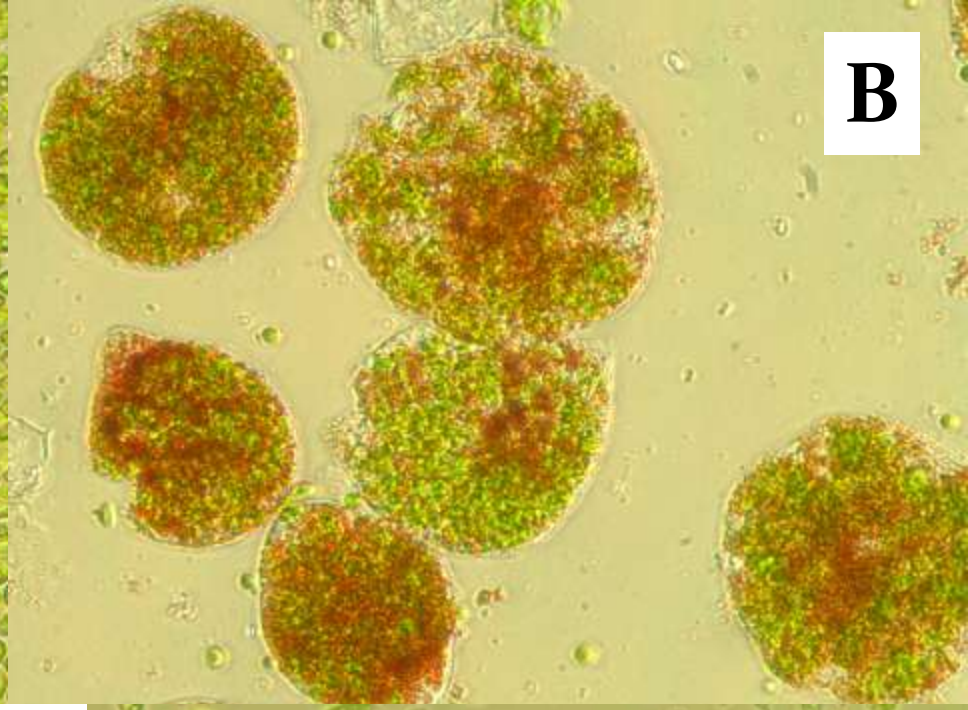
- sustainable technology
- Investigates natural avenues of resource capture
- Reduces our dependence on finite resources
- Implications for many industries

Objective

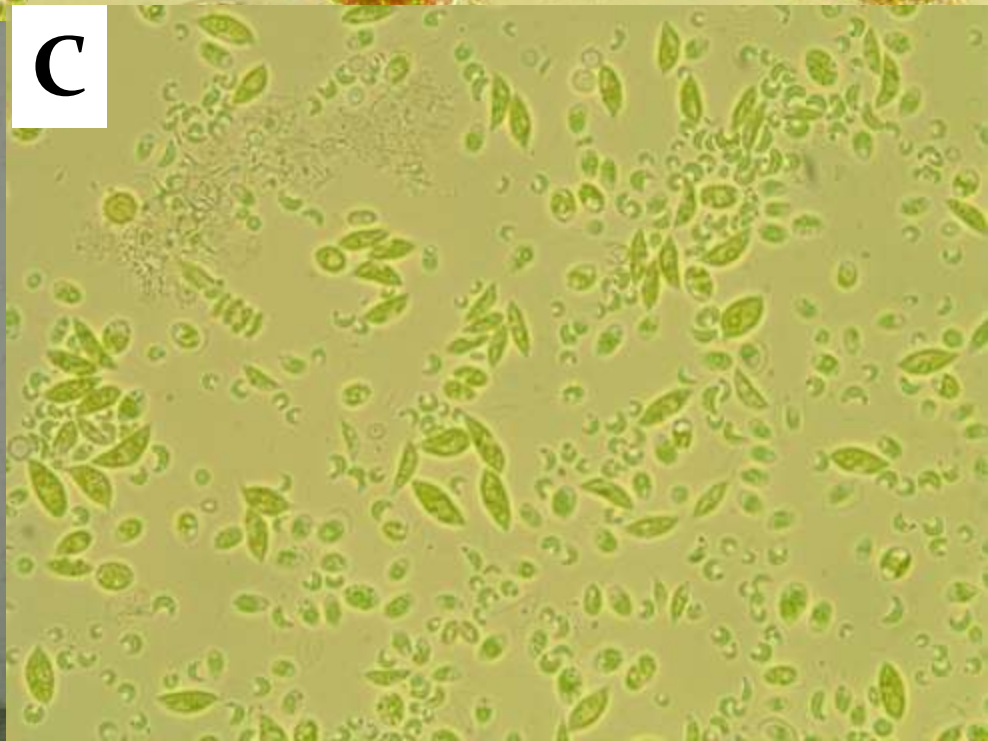
- Qualitative analysis of cell disruption methods on three distinct samples of algae

Project design

- **Organisms Investigated**
  - *Chlorella* sp. (ACW-1)- locally discovered species
  - Landfill polyculture, dominant species: *Kirchneriella* sp. And *Scenedesmus* sp.
  - *Euglena* sp. found at Crone's Cradle Conserve
- **Methods of cellular disruption**
  - Autoclaving
  - Freeze-fracture
  - Surfactant (TWEEN 80)
  - Cell grinding
  - Microwaving
  - Solvents : Octanol, Butanol, Isopropanol



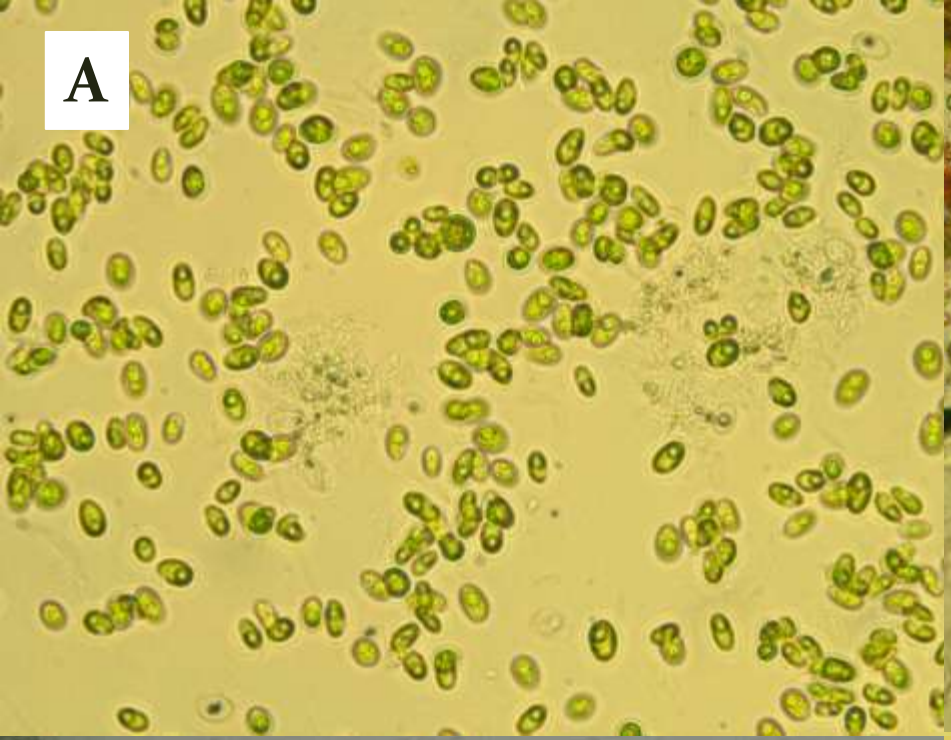
<u>Sample Species controls</u>: (A)- ACW-1 500x magnification, (B)- *Euglena* sp. 500 x magnification, (c)- LFS Polyculture 500x magnification

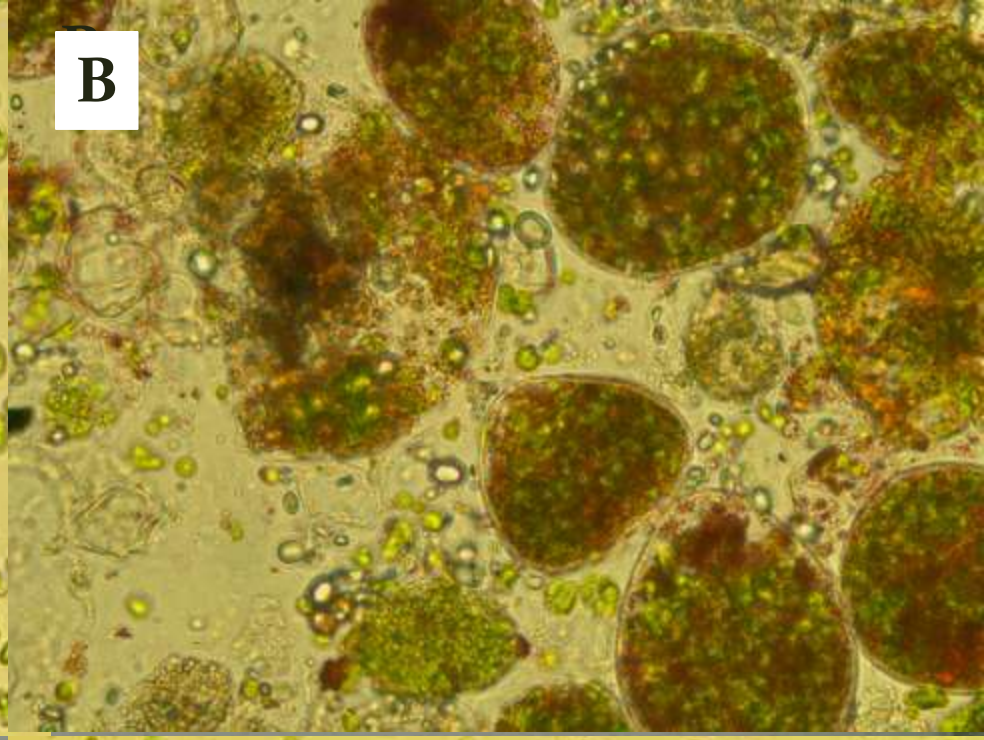


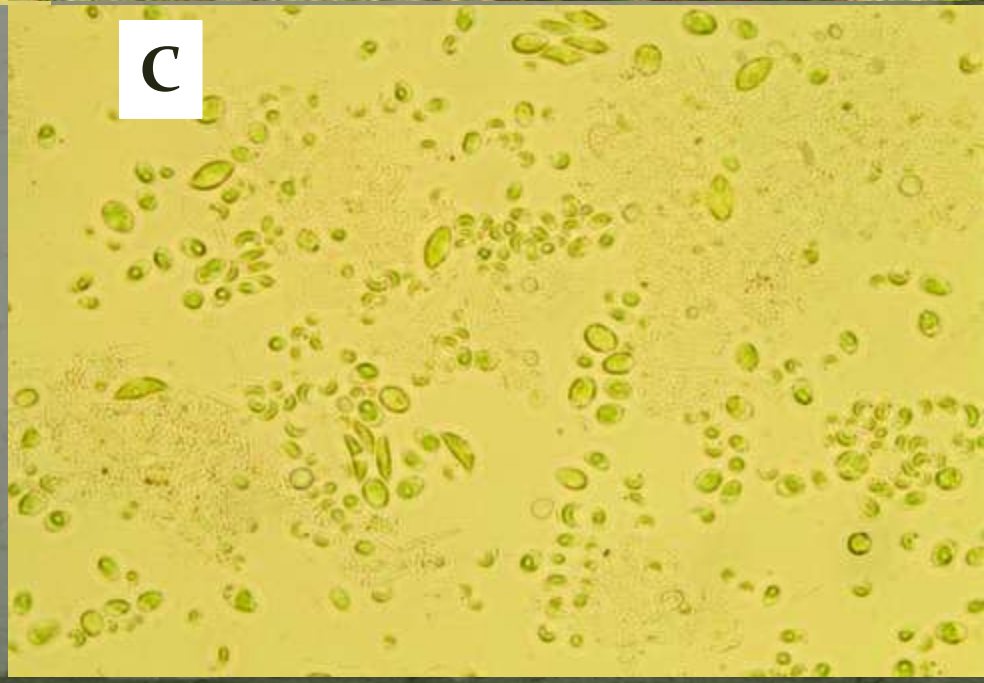
Freeze-Thaw fracture Study

- Creation of ice crystals with cellular structure during freezing, thawing process causes cellular expansion catalyzes rupture

- 4 separate trials of 15 minute freeze/15 minute thaw periods





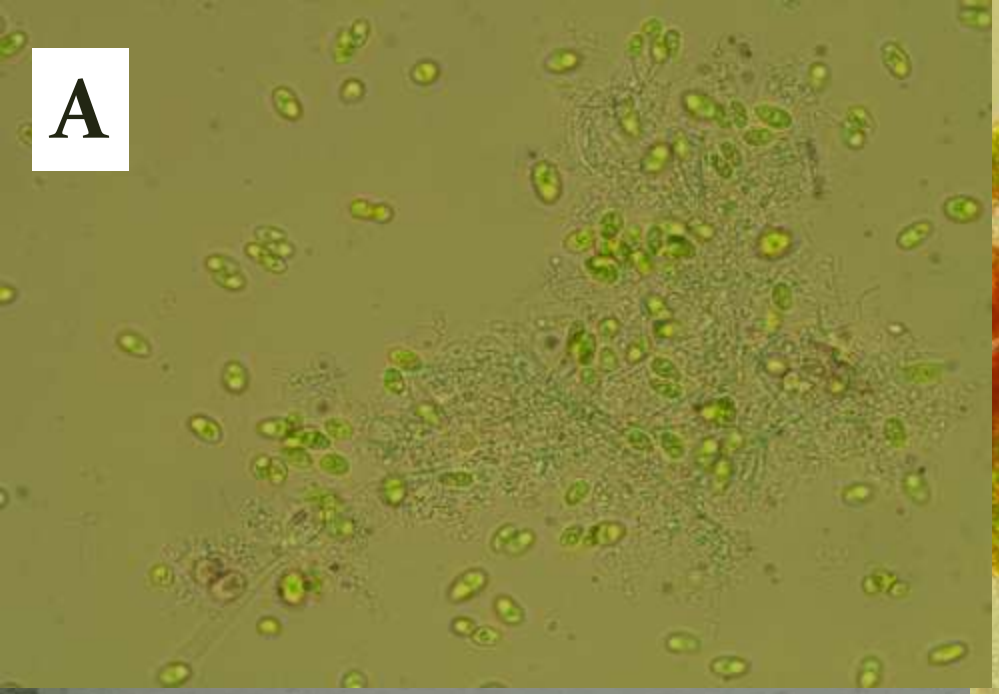


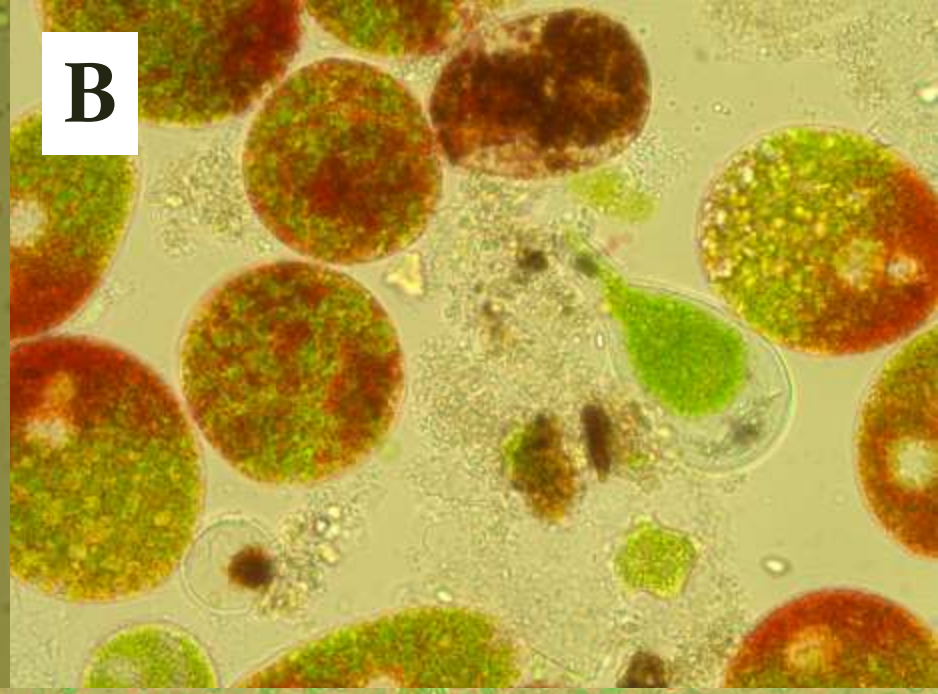
<u>Phase 4 of Freeze- Thaw Fracture Study</u>:
(A)- ACW-1 500x magnification, (B)- *Euglena* sp. 500 x magnification, (C)- LFS Polyculture 500x magnification

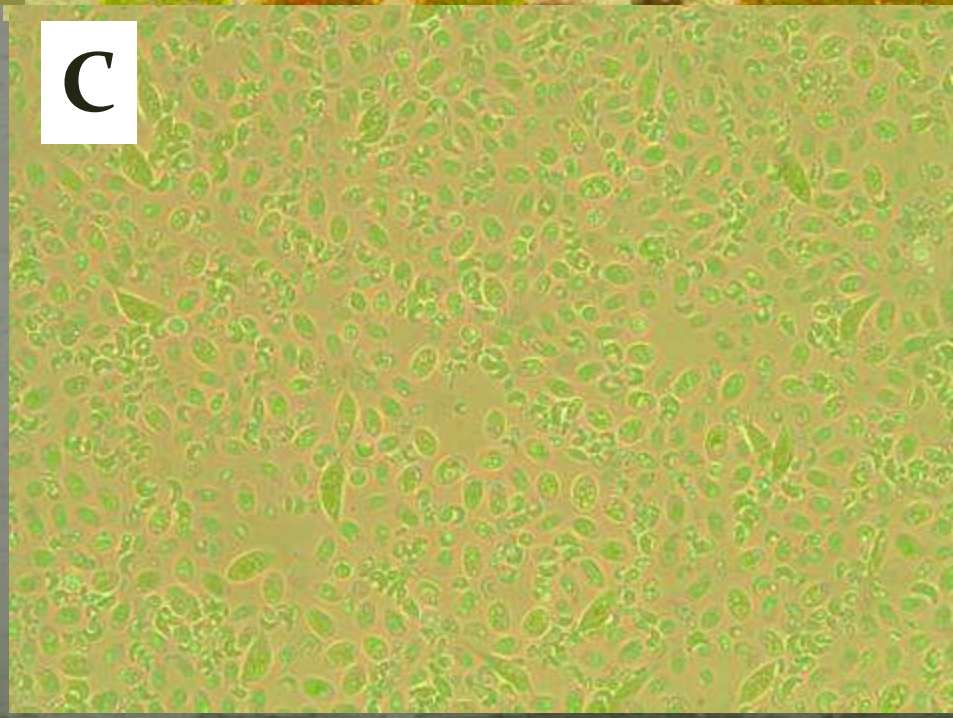
Surfactant (TWEEN 80)

- "Surfactant"- surface active agent, main ingredient in soaps, hydrophilic and hydrophobic components

- Works by increasing the solubility of the cellular membrane





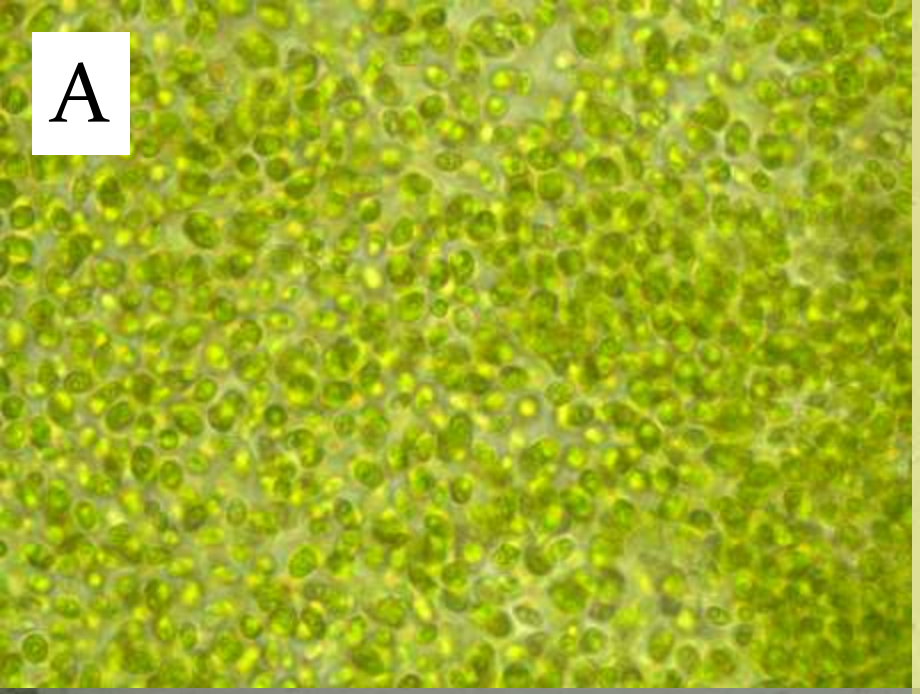


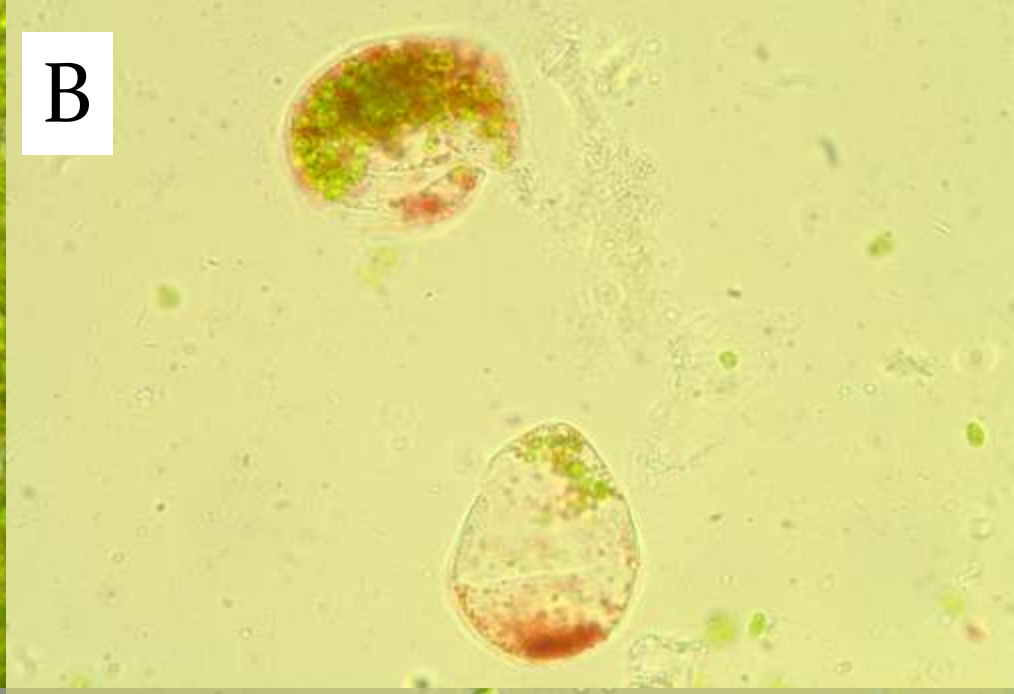
TWEEN 80 testing- (A)- ACW-1 500x magnification, (B)- *Euglena* sp. 500x magnification, (C)- LFS Polyculture 500x magnification

Cell grinding

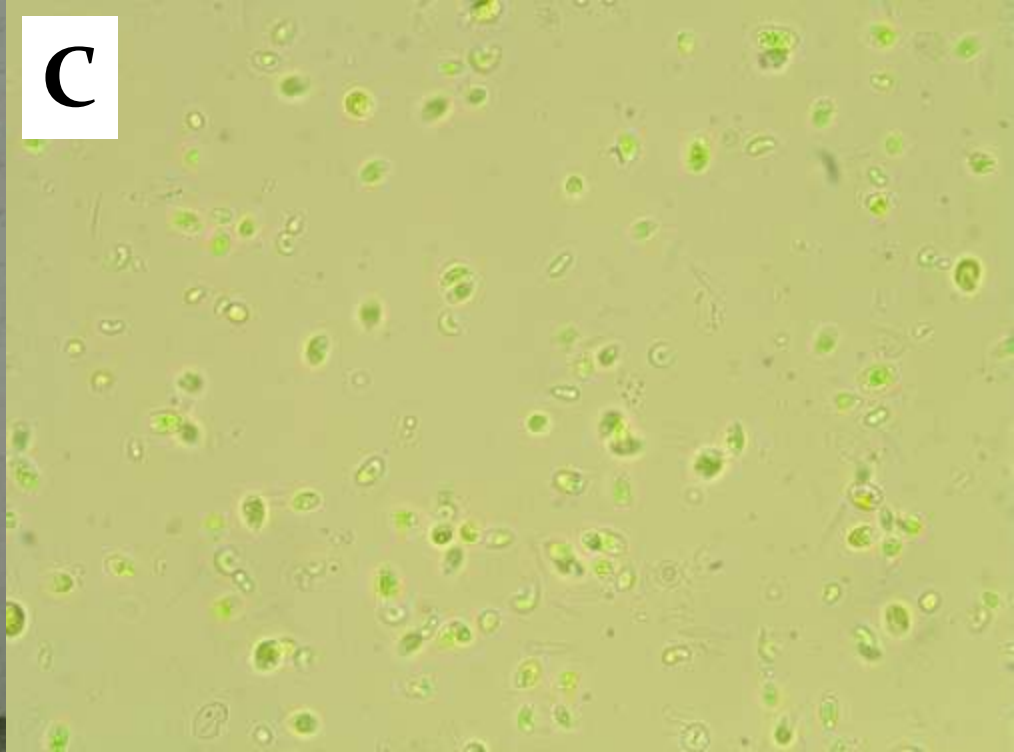
- Preferred method for cellular disturbance in plant tissues

- Tests conducted with and without surfactant





Cell grinding: (A)- ACW-1 500x magnification, (B)- *Euglena* sp. 500x magnification,(C)-LFS Polyculture 500x magnification

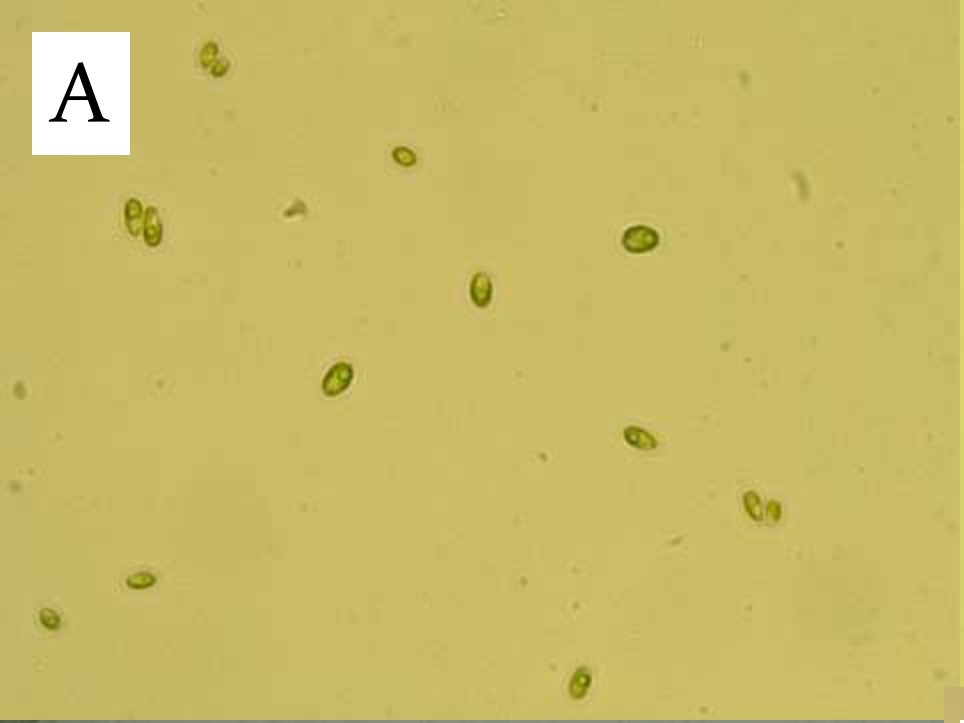


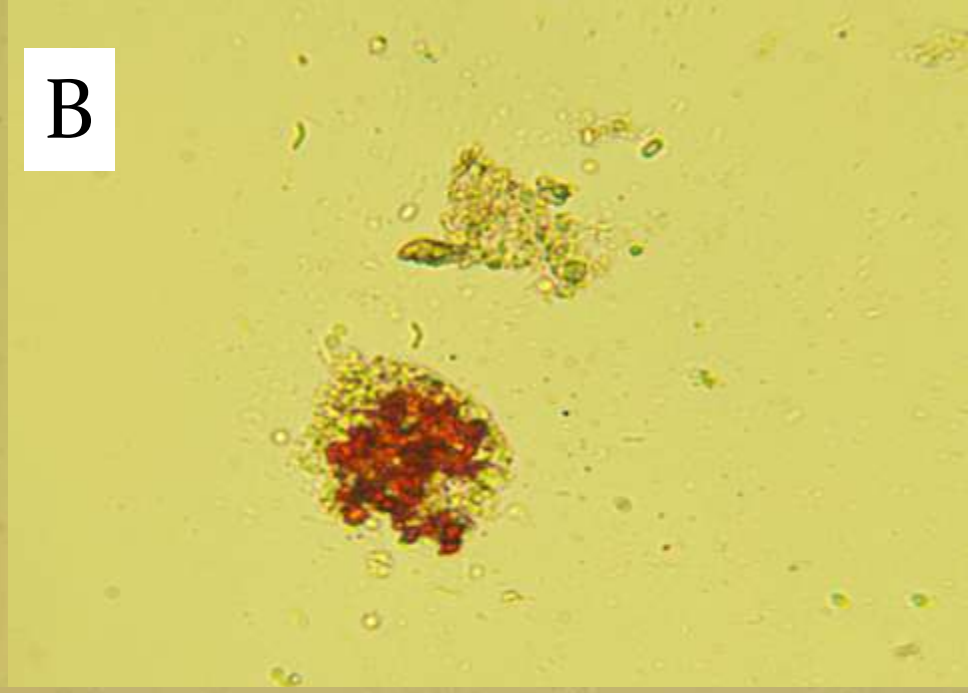
Microwaving

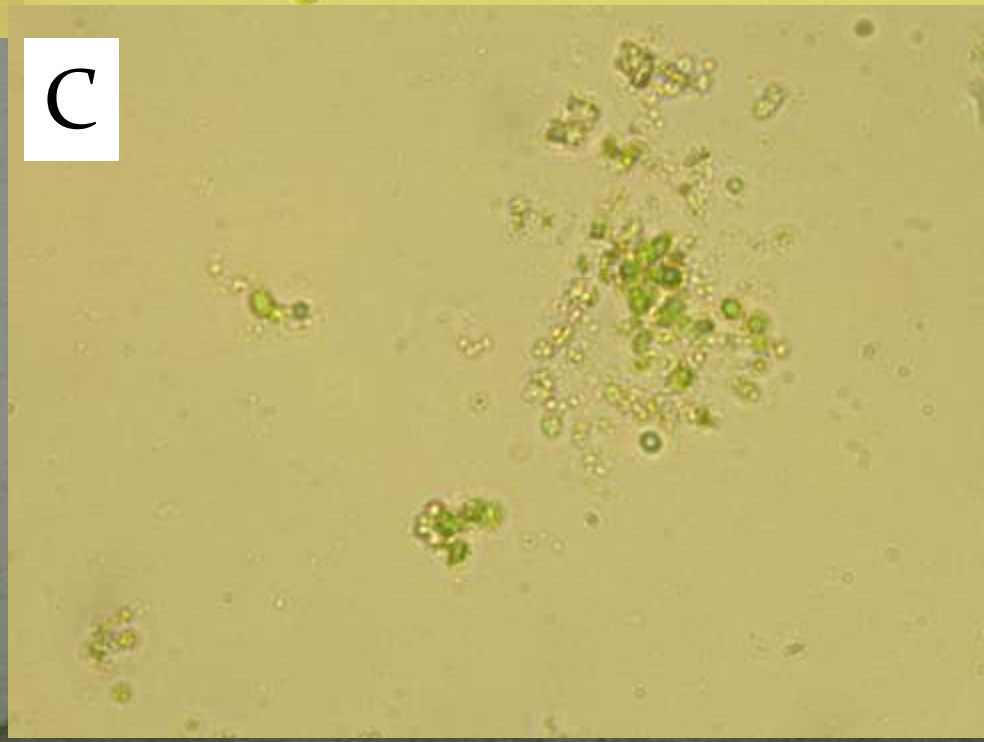
- Novel method for investigating the effects of heat on cellular disruption

- Tests conducted with surfactant (total time 6 minutes 40 seconds) and without (total time 2 minutes)

- Highly energy intensive- would not be economically viable on a larger scale







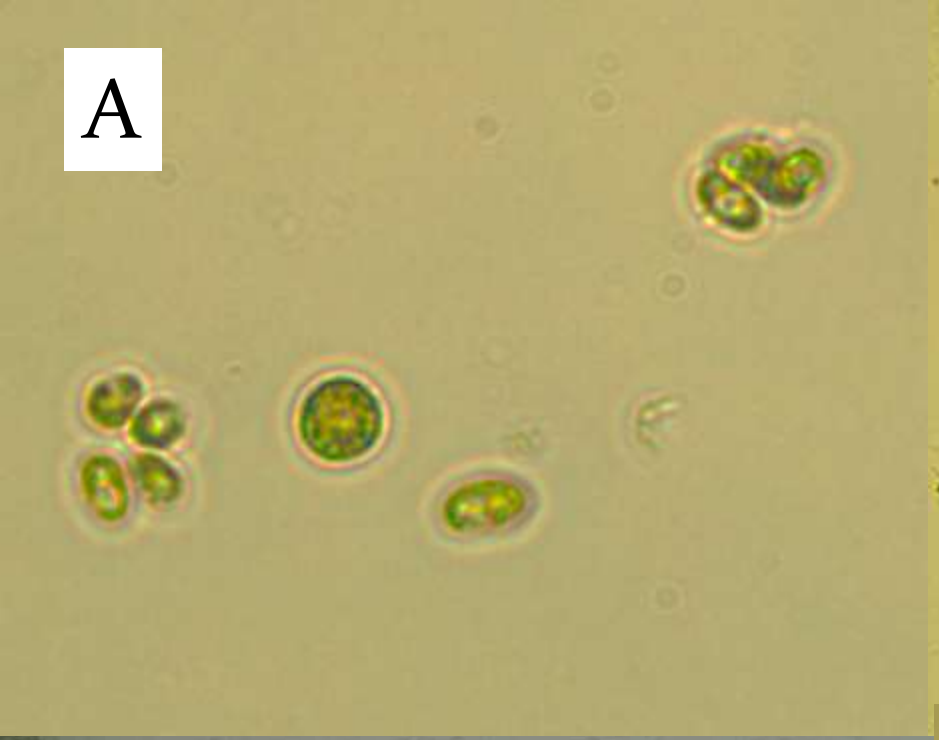
<u>Microwaving with Surfactant</u>:
(A)- ACW-1 500x magnification, (B)- *Euglena* sp. 500x magnification, (C)- LFS Polyculture 500x magnification

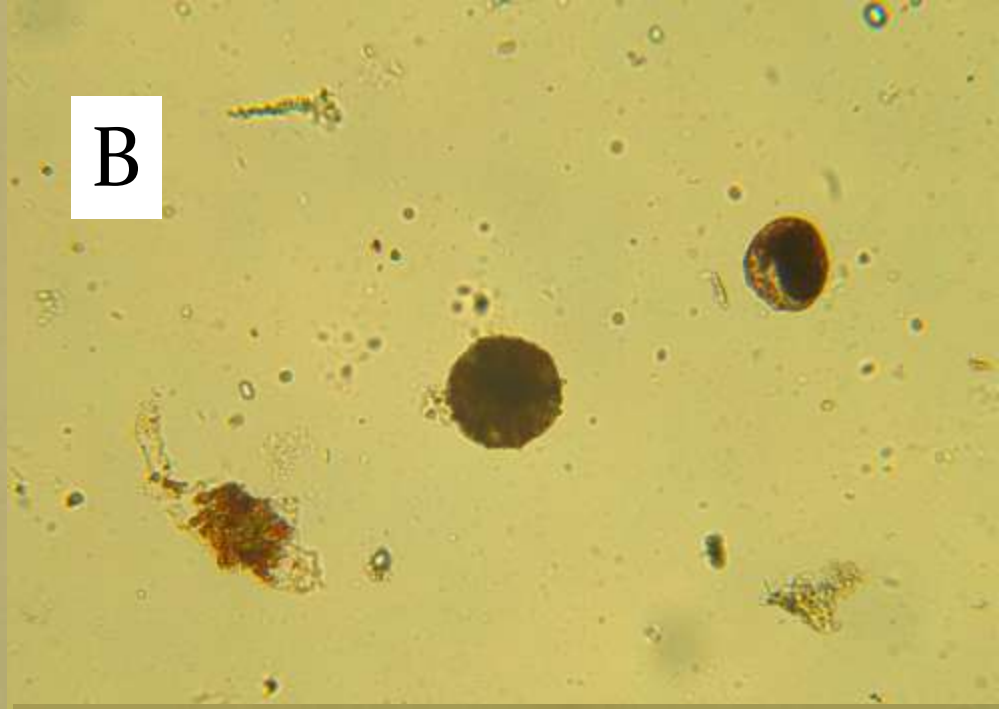
Autoclave

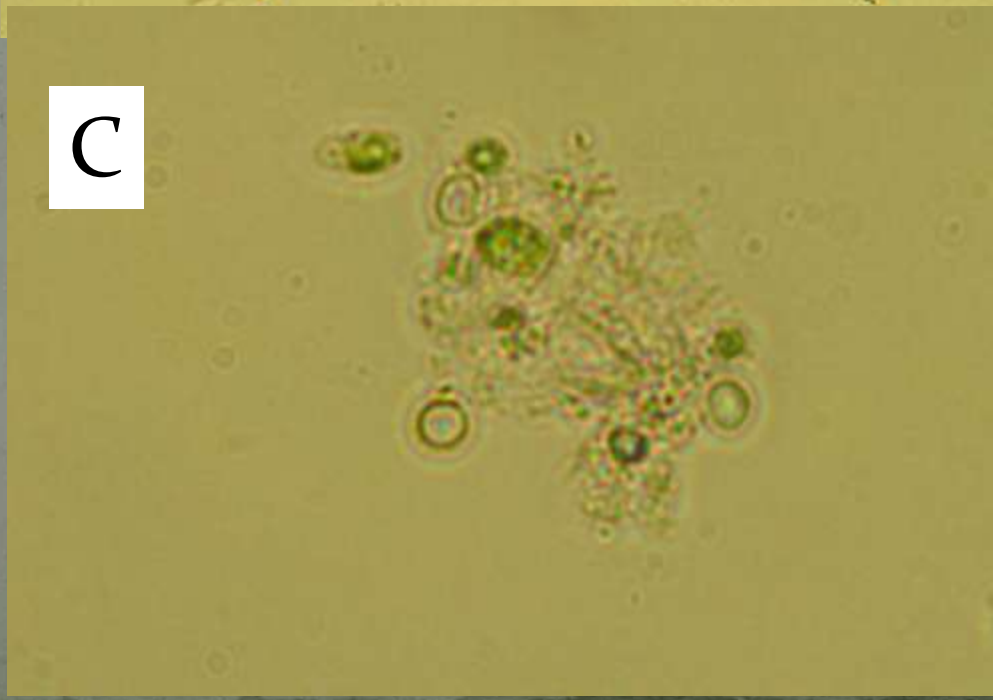
- Method of testing the effects of high heat and high pressure on cellular disruption

- 30 minutes, 120˚ c, 120 psi

- Another energy intensive disruption technique



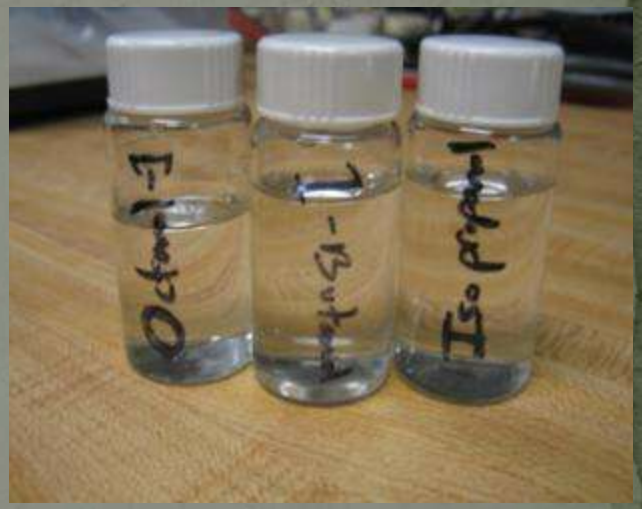


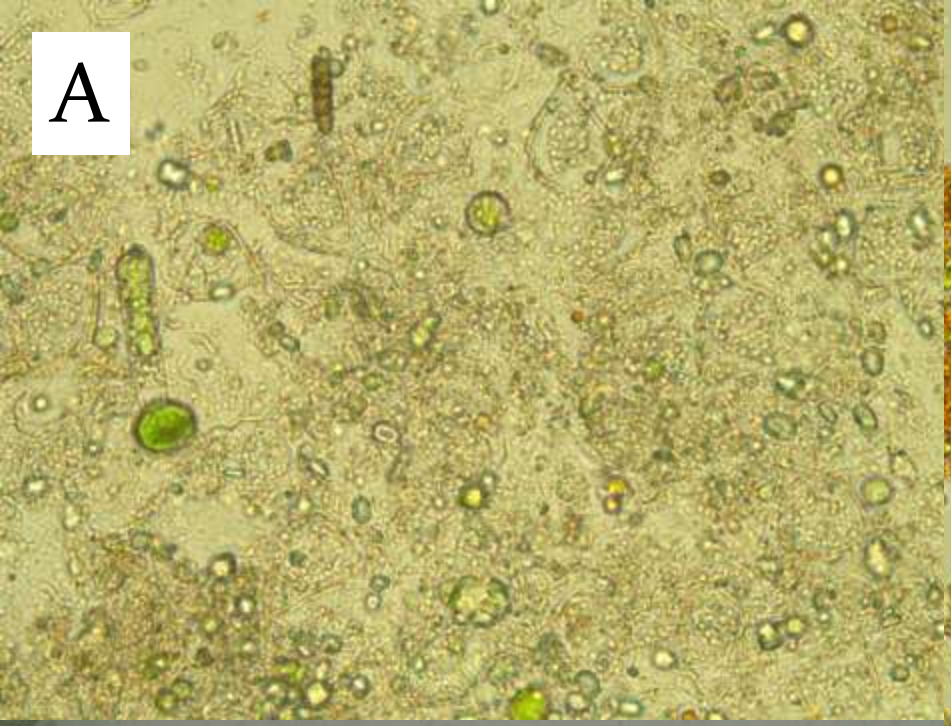


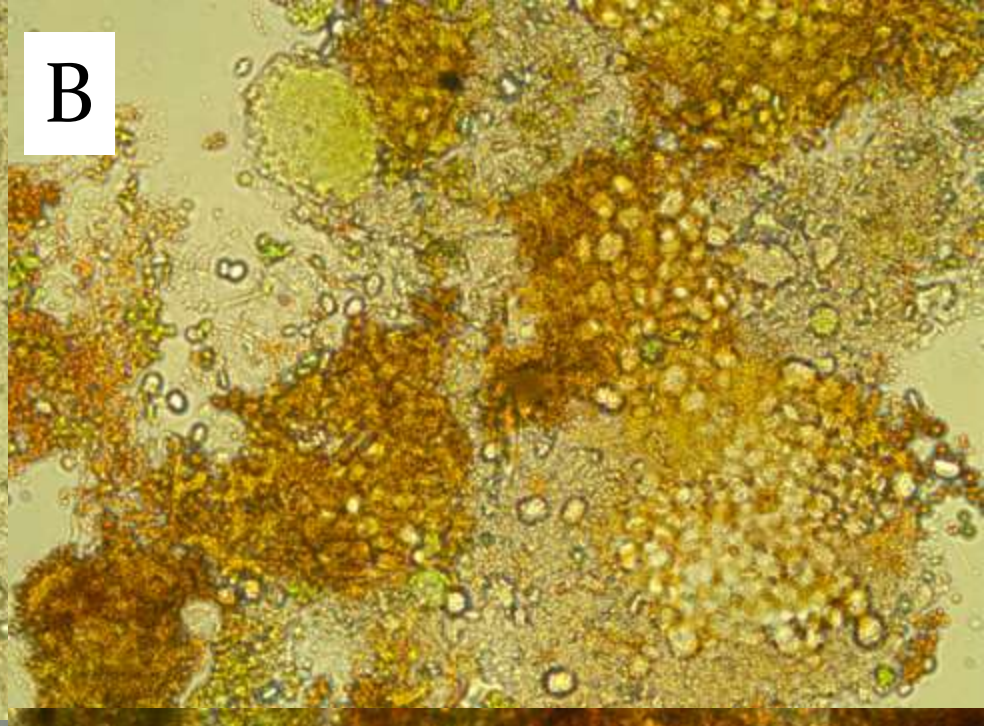
<u>Autoclave 30 min 120˚ C, 120 psi</u>: (A)- ACW-1 500x magnification, (B)- *Euglena* sp. 500x magnification, (C)- LFS Polyculture 500x magnification

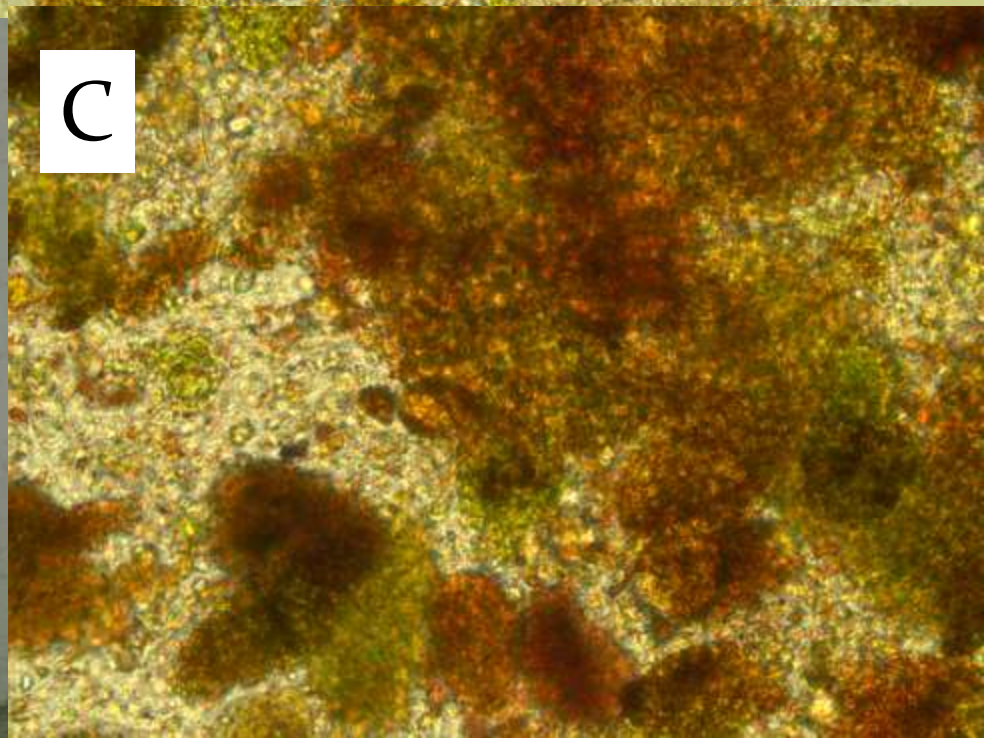
Solvents (Octanol, Butanol, Isopropanol)

- Disintegration of cellular membrane
- visible analysis of pigment extraction and microscopic observation of cellular disturbance
- Octanol- most promising and most environmentally friendly of the solvents tested

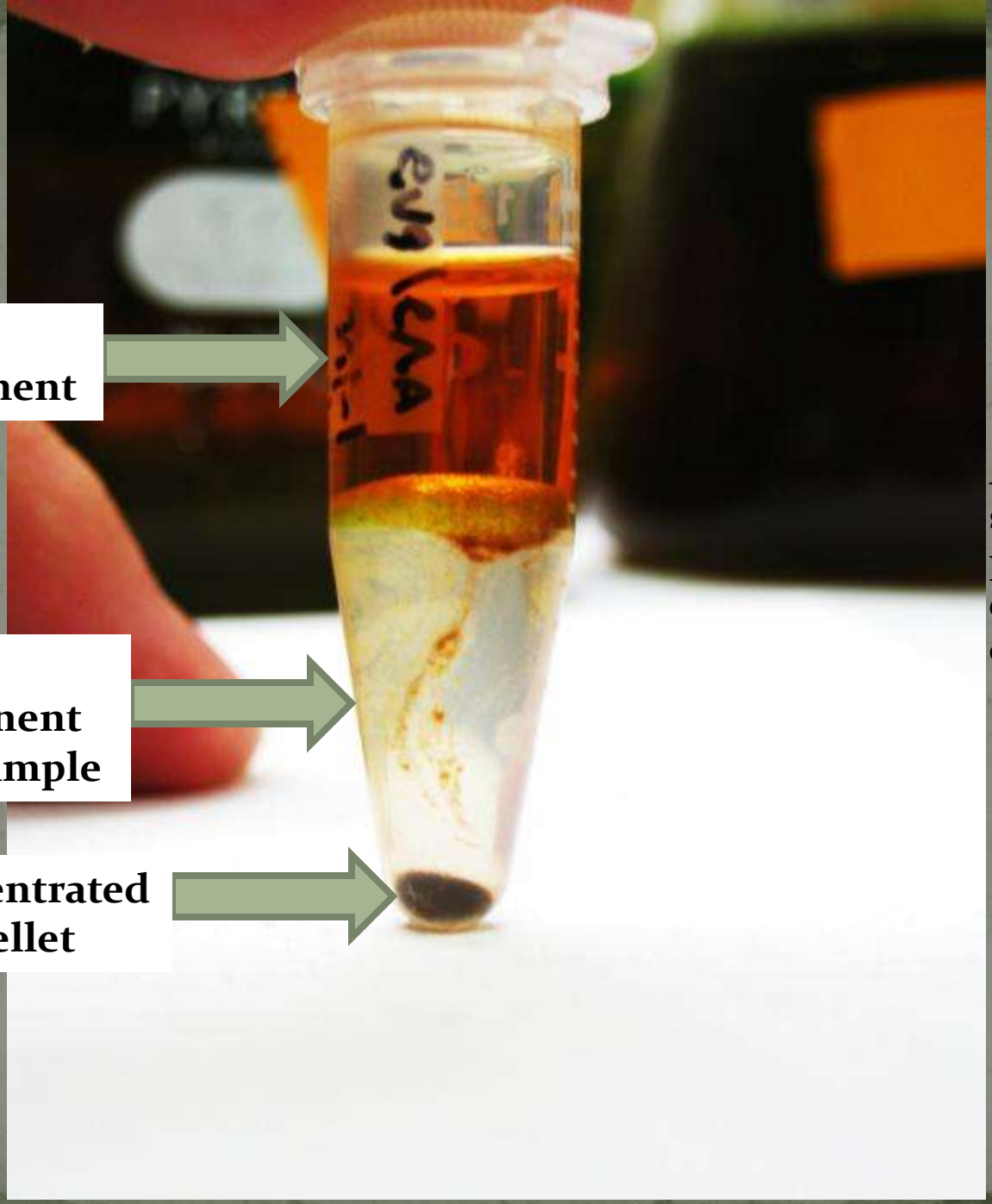








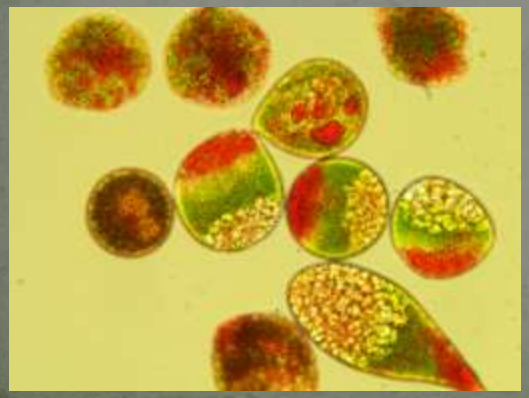
Euglena* sp. solvent results**: (A)- ***Euglena **after octanol addition 500x magnification, (B)-** ***Euglena*** **after butanol addition 500x magnification, (C)-** ***Euglena*** **after isopropanol addition 500x magnification**

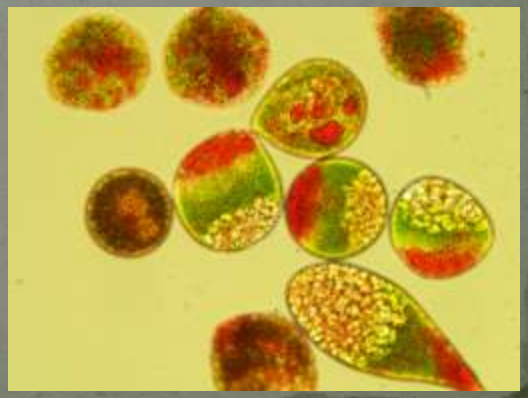


Euglena sp. sample after pigment extraction with octanol

Implications of this study

- Euglena responsive to every cell disruption test
- Cell wall compositions responsible for results differentiation
- Use of *Euglena sp.* could increase the economic viability of bioresource extraction



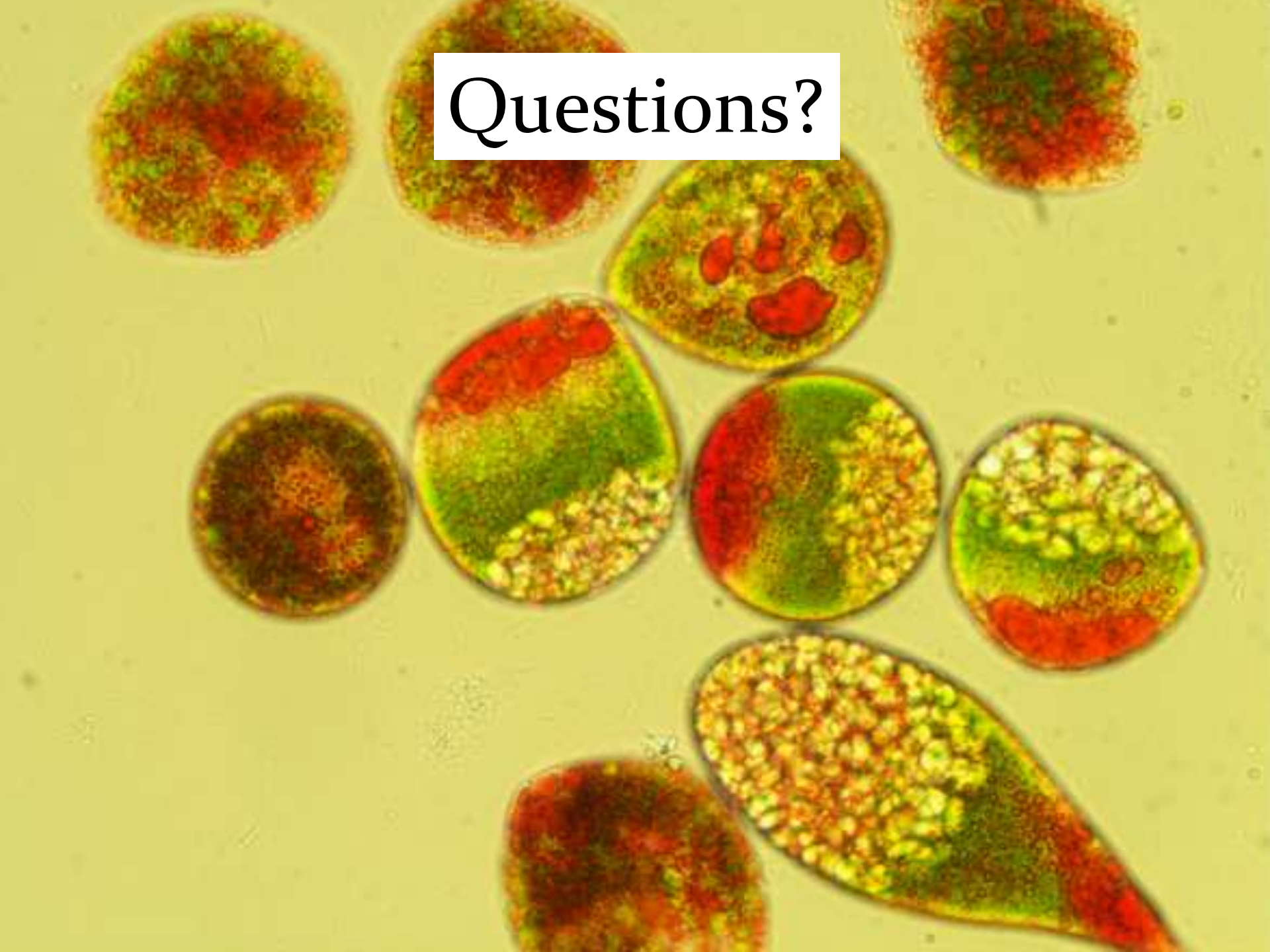


Possible future developments

- Commercially valuable resources:
-Astaxanthin- antioxidant and pigment enhancer used in aqua culture and food industry
-paramylon- cosmetic industry

- Octanol- pigment extraction recycling loop- reuse after extraction

- Possible exploration of other routes of environmentally friendly pigment extraction- vegetable oils


Questions?

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