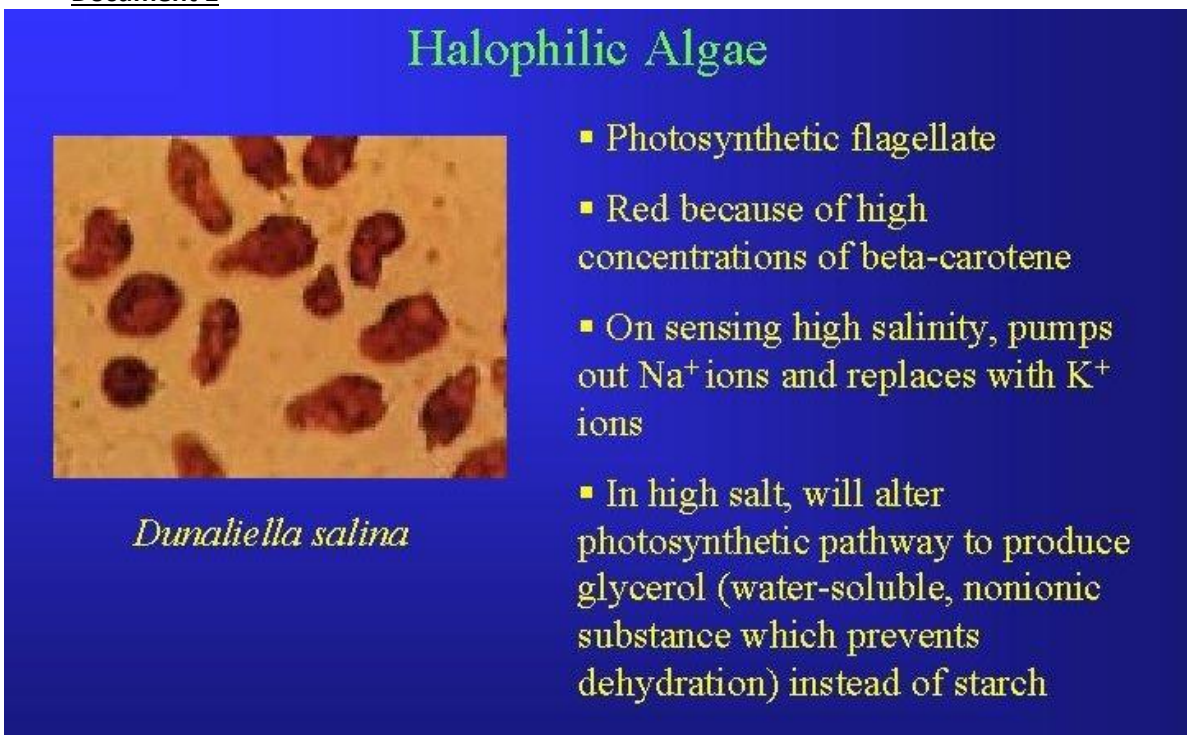
2- BIOTECHNOLOGY APPLICATIONS OF *Dunaliella salina*

Lea now knows that the pink colour of Hillier Lake is due to the presence of Dunaliella salina. Intrigued by this microalgae she doesn't know, she decides to meet an Ifremer engineer to learn more. The latter gives Lea 6 documents that will allow her to learn a lot about *Dunaliella salina*.

Document 1



https://slidetodoc.com/topics-types-of-extreme-environments-present-on-earth/

Document 2 : ***Dunaliella salina*** is known for its antioxidant activity because of its ability to create large amount of **carotenoids, it is used in cosmetics and dietary supplements**. Few organisms can survive like *D. salina* does in high saline conditions. To survive, these organisms have high concentrations of **β-carotene** to protect against the intense light, and high concentrations of **glycerol** to provide protection against osmotic pressure. This offers an opportunity for commercial biological production of these substances.

https://en.wikipedia.org/wiki/Dunaliella_salina

Document 3 : The **biofuels** are receiving considerable attention as a substitute for petro diesel. For microalgae, biomass and lipid contents are key components for biodiesel production. This study was conducted to develop favorable culture conditions for *Dunaliella salina* to maximize its biomass and lipid accumulation.

https://www.nature.com/articles/s41598-017-07540-x

Axe 6 : Innovations scientifiques et responsabilité.

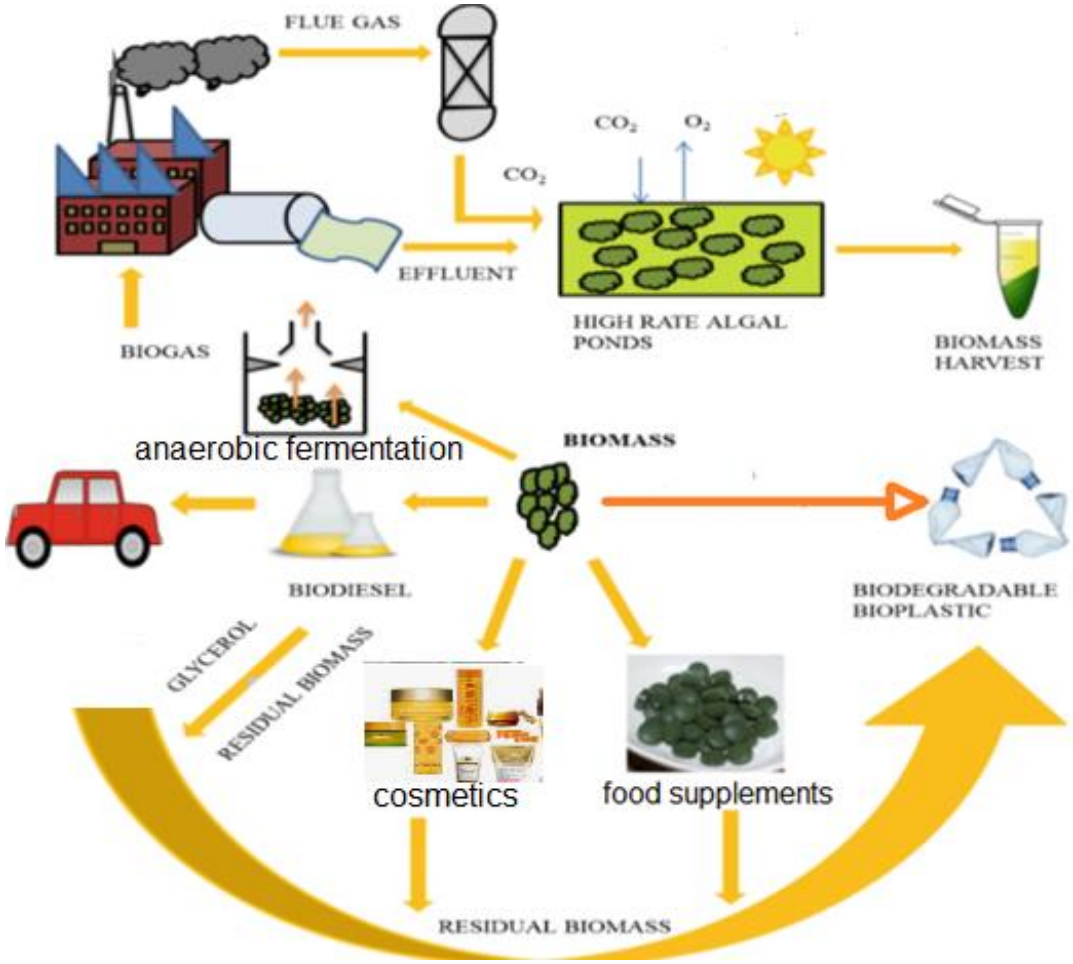
Document 4 : Polyhydroxyalkanoates (PHAs) are the biopolymer of choice if we look for a substitute of petroleum-based non-biodegradable plastics. Microbial production of PHAs as carbon reserves has been studied for decades and PHAs are gaining attention for a wide range of applications in various fields. Microalgae/cyanobacteria, being photoautotrophic, prove to have an edge over heterotrophic bacteria for PHAs bioproduction. They have minimal metabolic requirements, such as inorganic nutrients (CO_2, N, P, etc.) and light, and they can survive under adverse environmental conditions.

https://www.frontiersin.org/articles/10.3389/fbioe.2021.624885/full

Document 5*: D. salina* as a microalgal biomass resource was employed for the production of biogas. This biogas production involves multiple steps of microbial reactions. Initially, organic compounds of biomass are converted to polymeric substances (polysaccharides, proteins…). Thus, this polymers should be hydrolyzed into small compounds, which are then converted into biogas (methane = CH4) via anaerobic fermentation..

https://www.researchgate.net/publication/274962332_Dunaliella_salina_as_a_Microalgal_Biomass_for_Biogas_Production

Document 6 : Biotechnology applications of dunaliella salina



https://link.springer.com/chapter/10.1007/978-981-15-0169-2_11

Axe 6 : Innovations scientifiques et responsabilité.

By answering the questions from exercises 1 to 3, help Lea in her questioning

Exercise 1

Find in the document 1 the physiological characteristics of *D. salina* allowing it to live in hyper-salted environments

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……..

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Exercise 2.

Complete the following table using the documents 2 to 6

Name of the final bioproducts					
Molecule produced by *D. salina* used to manufacture bioproducts					

Lea has now understood all interests of *D. salina* in the fight against climate warming. Therefore she decides to pass on this information to a biofuel company. In writing exercise 3, helps Lea to write arguments to convince the company of the interest in launching this

Exercise 3 : Explain (in a few lines) using document 6 why the use of D. salina for manufacture of bioproducts is virtuous to the environment.

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BIOTECHNOLOGY APPLICATIONS OF *Dunaliella salina*

Correction elements

Exercise 1

Find in the document 1 the physiological characteristics of *D. salina* allowing it to live in hyper-salted environments

D. Salina is able to live in a hyper saline environment because it possesses sodium pumps that reject this ion in the extracellular environment and also because it contains glycerol which protects it from deshydration.

Exercise 2

Complete the following table using the documents 2 to 6

Name of the final bioproduct	bioplastics	Food supplements	cosmetics	biodiesel	biogas
Molecule produced by *D. salina* used to manufacture bioproducts	Glycerol PHAs	carotenoids	carotenoids	Lipids biomass	Biomass

Lea has now understood all interests of *D. salina* in the fight against climate warming. Therefore she decides to pass on this information to a biofuel company. In writing exercise 3, helps Lea to write arguments to convince the company of the interest in launching this

Exercise 3 : Explain (in a few lines) using document 6 why the use of D. salina for manufacture of bioproducts is virtuous to the environment.

Once the most interesting components (glycérol, carotenoids, PHAs, lipids)have been extracted from D. Salina (glycerol, carotenoids, PHAs, lipids) the rest of the biomass is used to produce renewable energy (biogas). The combustion of these biogasses produces CO2 but a part of it is recaptured by D. salina when it is grown in big basins. It is thus a virtuous circle without accumulation of wastes and using renewable resources.