

Two invasive brown algae as potential sources of alginates

Quéguineur B¹, Salaun Y¹, Dehail M¹, Canivet F¹, Moppert X², Hennequart F¹

1-ALGAIA, R&D Centre, 91 rue Edouard Branly, 50000 Saint-Lô
2-Pacific Biotech, ZONE INDUSTRIELLE DE LA PUNARUU 98713 PUNAAUIA, Tahiti, French Polynesia

Introduction

Invasive species such as *Turbinaria ornata* (Turner) J. Agardh in French Polynesia (Fig.1) and *Sargassum muticum* in Normandy, France (Fig.2) have raised environmental concern (reef destruction, ecosystem alteration, biodiversity impact¹) as well as sparked industrial interest in particular with regards to the standing stock and harvestable potential volumes. Sodium alginate is generally extracted from cold-water species such as *Laminaria digitata*, *Laminaria hyperborea*, *Macrocystis pyrifera*, *Lessonia trabeculata*, and new alginophytes have the potential to either match existing current products or develop new ones. Eventhough previous study² have focused on alginate potential before, there was a need for further characterisation for industrial application. Hence a commercial benchmarking was carried out between the current alginate portfolio at ALGAIA (over 70 different products) and alginate extracted from 2 invasive species. Seasonality, sites and differences between individuals hand harvested on the reef or cast on the beach are investigated. This study is part of the FENUALG project lead by Pacific Biotech and combines data from the SNOTRA project with the help of the SMEL for *Sargassum muticum*

Material and methods

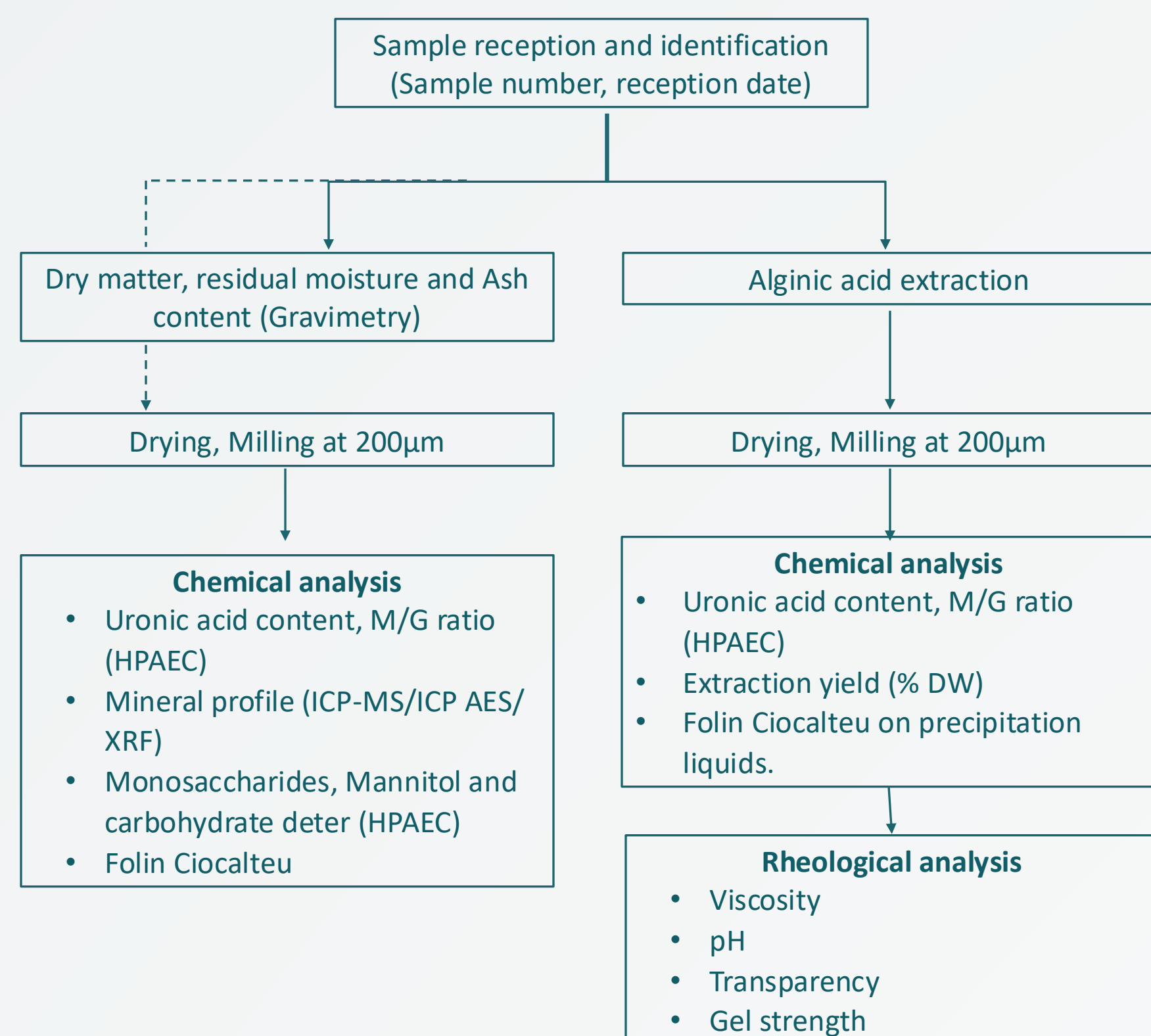


Figure 3. Overall methodology

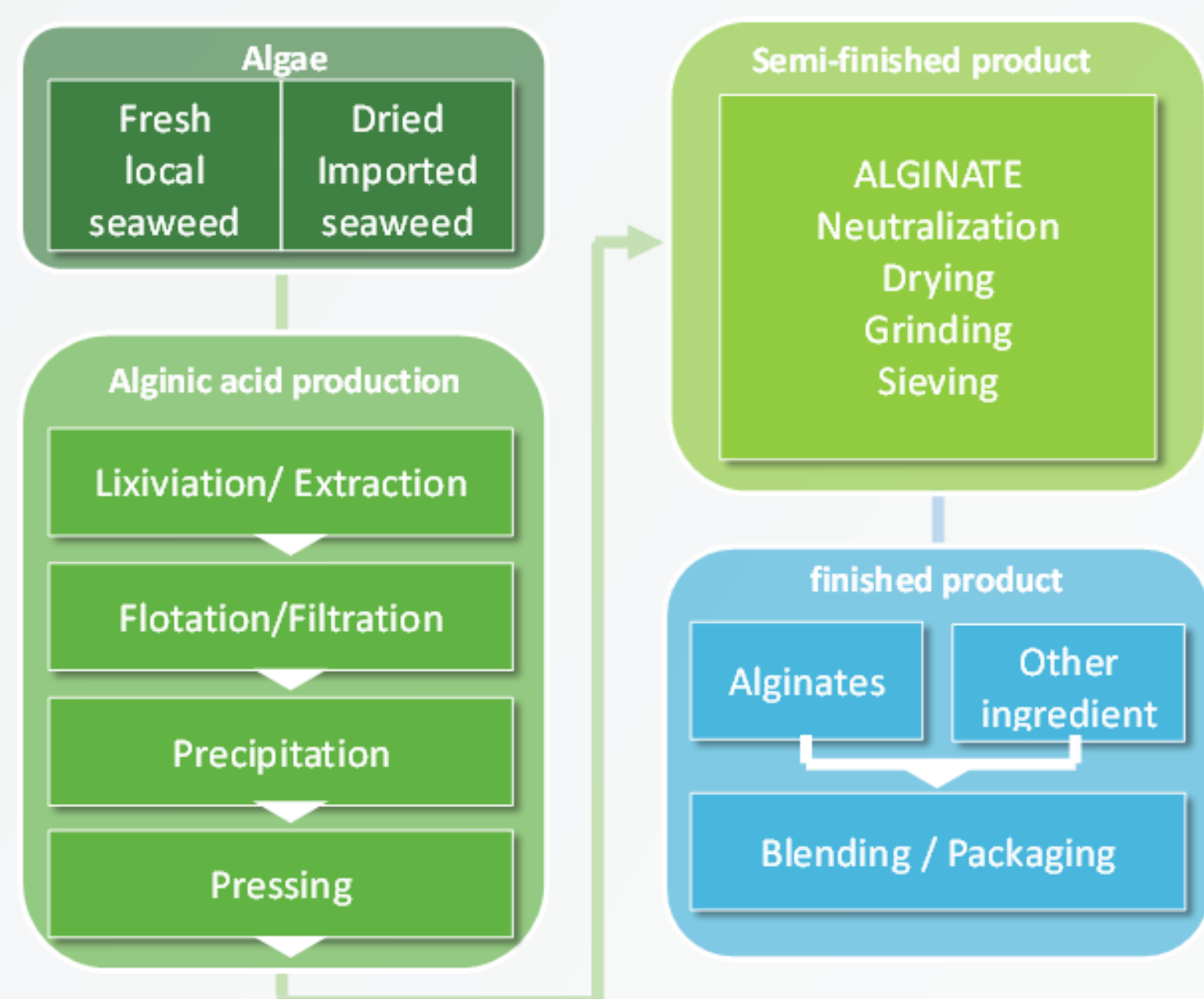


Figure 4. Alginate extraction - Industrial process

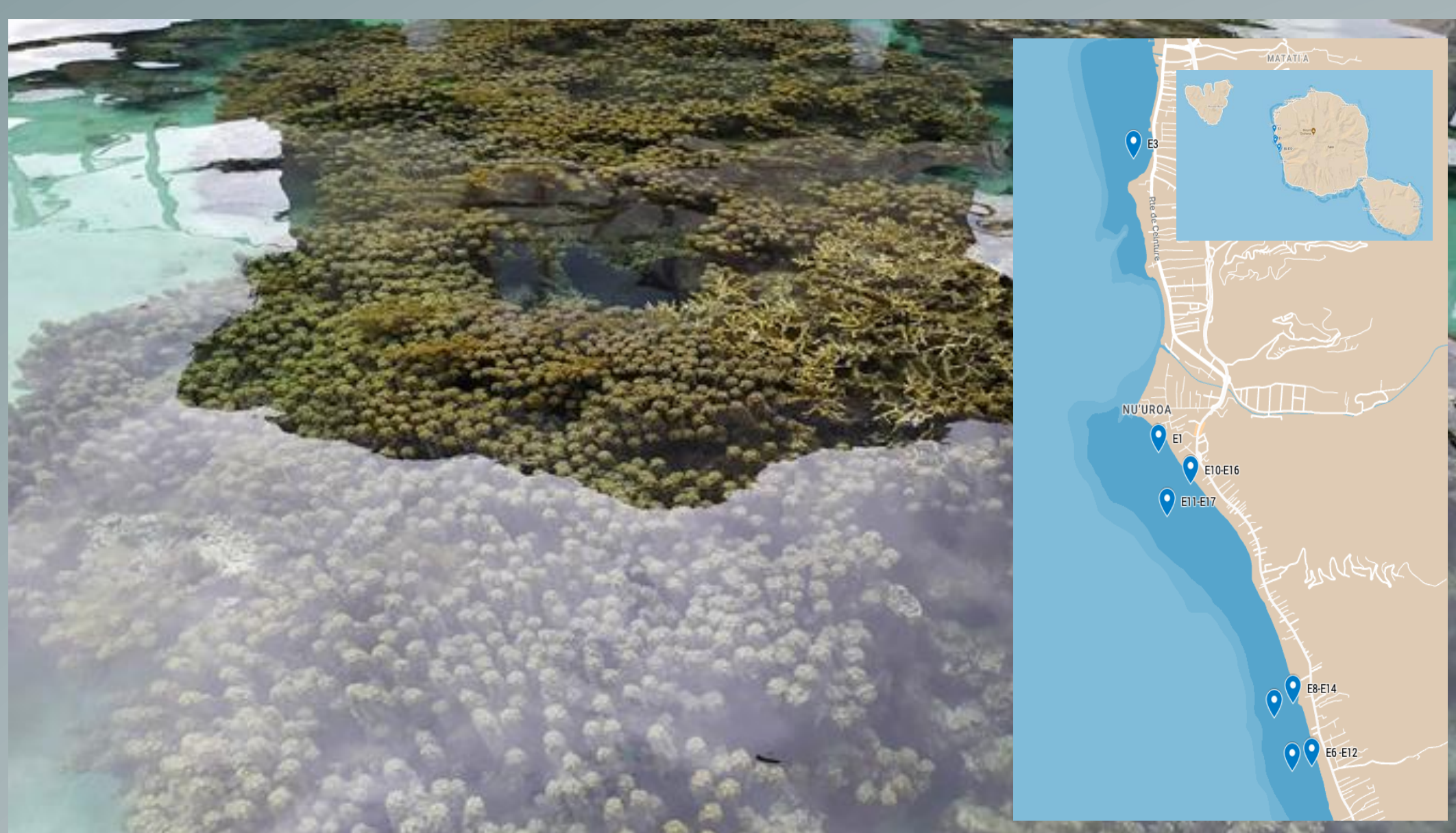


Figure 1. Habitat and sampling sites for *Turbinaria ornata* in French Polynesia

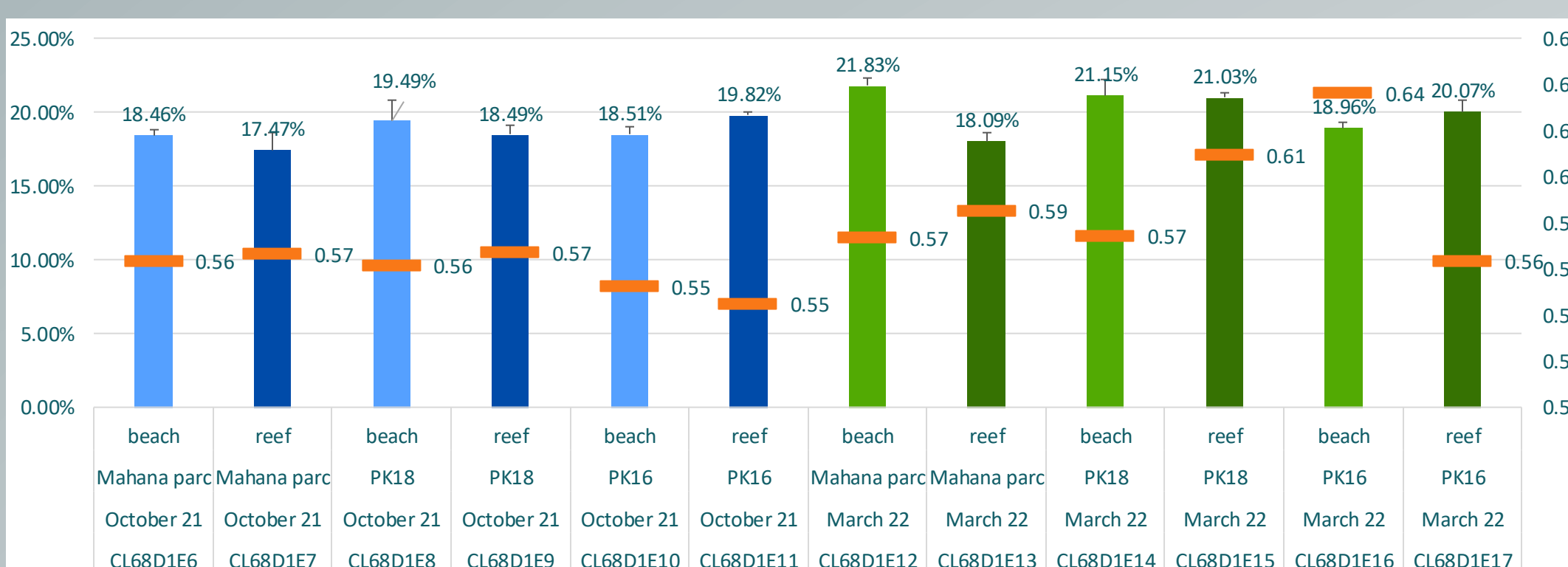


Figure 5. Seasonality study for *Turbinaria ornata* - alginic acid (% DW) and MG ratio



Figure 2. Habitat and sampling sites and abundance for *Sargassum muticum* in France

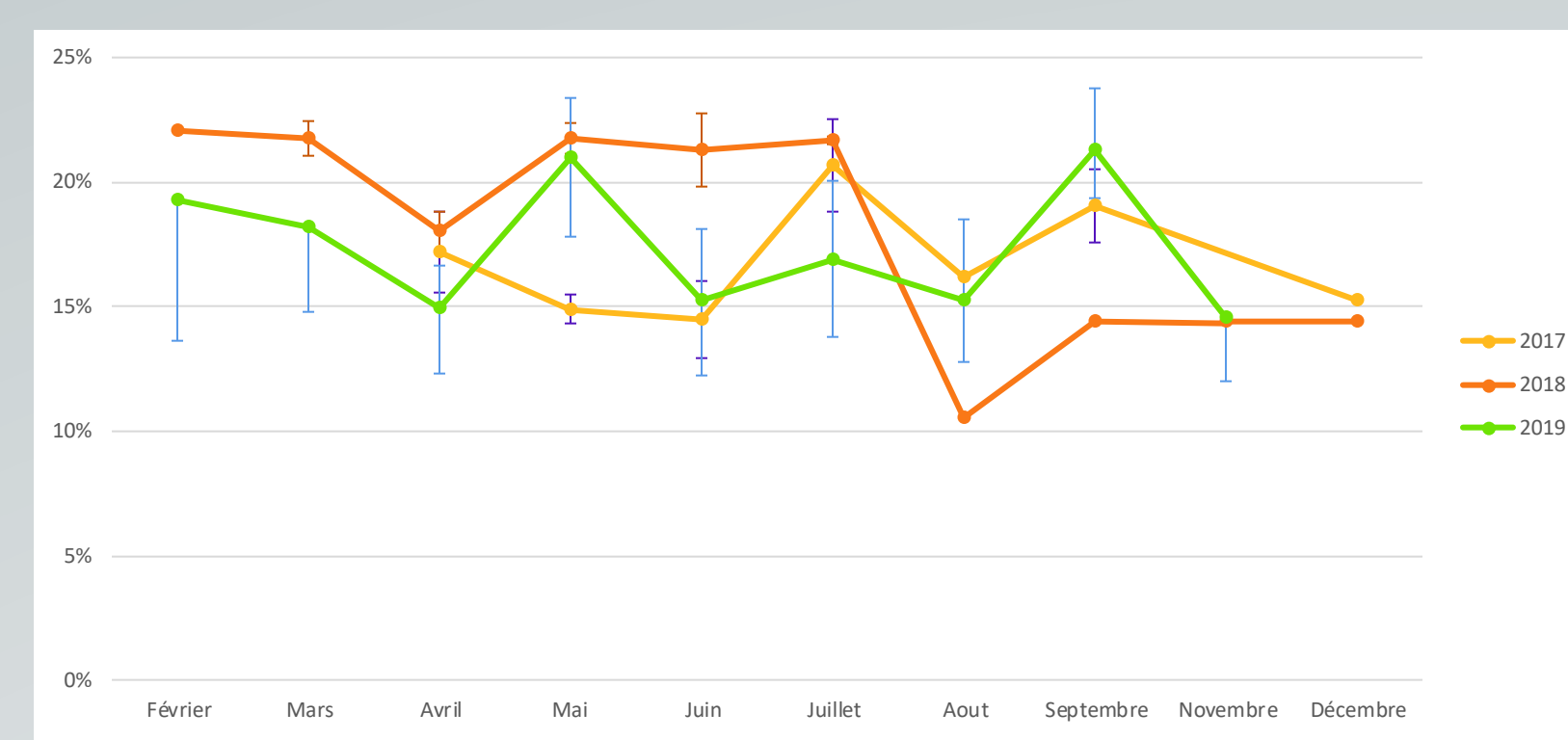


Figure 6. Seasonality study for *Sargassum muticum* between 2017 and 2019 across 6 sites in Normandy - alginic acid (% DW)

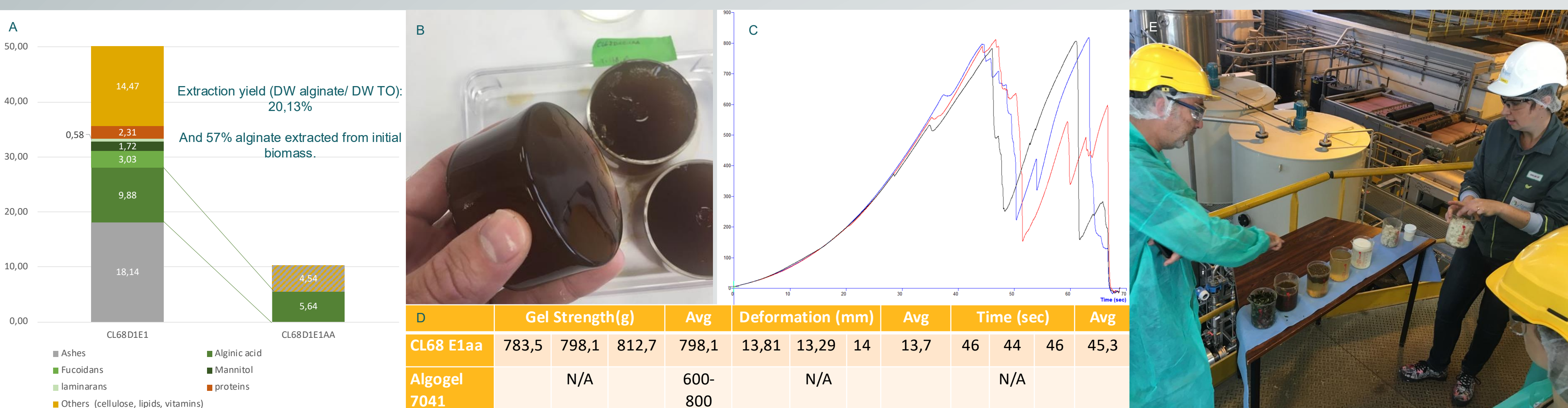


Figure 7. A- Extraction yield for TO; B- Gel obtained from TO alginate; C- Gel strength curve from texturometer and D- result table E- industrial extraction process with the various stages

Results

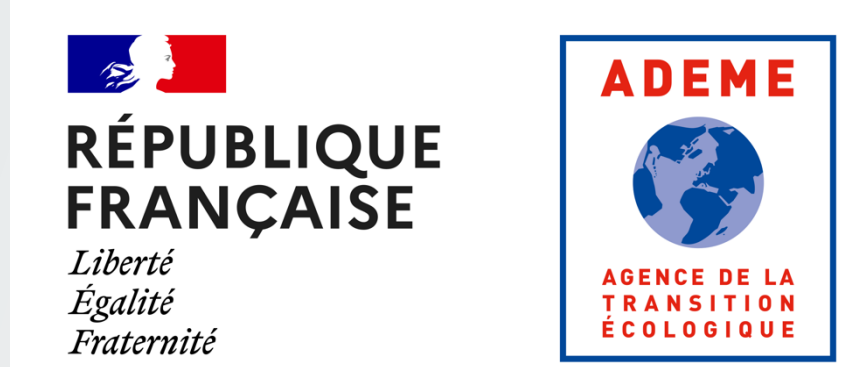
-*Sargassum*: a study over 3 years and 6 sites around Normandy showed an alginate content around 20% of the dry matter in all years and there are generally no seasonal variations. The highest levels are observed between May and July with variation. Extraction yield (% DW) 49,75% over 3 replicates with an average M/G ratio of 0,86. The results obtained for *Sargassum muticum* in terms of M/G ratio are close to those obtained for *Laminaria hyperborea* but with lower viscosity finding potential in pharmaceutical application such as anti-reflux remedy.

-*Turbinaria*: Alginate extraction was carried out on oven-dried samples and the protocol applied in this study followed the main steps of the industrial process, deployed at the ALGAIA plant. Mass balances indicate that 57% of the alginates present in the initial biomass were recovered and the final extract contains 55g of alginate per 100g of dry matter (55%/DM) (compared to 70%/DM in our finished products). The M/G ratio obtained on the extracts is 0.48. The low M/G ratio is interesting for the development of meat application (vegetable casing, meat analog), and any application requiring significant gel strengths (alginate beads, bubble tea). Rheological analyses have reinforced the specifications linked to a low M/G ratio, namely a gel strength of 800g and a medium viscosity around 575 Cps.

Conclusion and future work

These results seem promising for opening new possibilities in terms of sourcing for alginate extraction and moreover offers a solution to the problems caused by these algae, especially combined with a biorefinery approach (work not shown).

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References:

- Payri CE, Stiger V (2001) Macroalgal community changes on French Polynesian reefs, 1980–2000. *Phycologia* 40:111
- Zubia M, Payri C, Deslandes E (2008) Alginate, mannitol, phenolic compounds and biological activities of two range-extending brown algae, *Sargassum mangarevense* and *Turbinaria ornata* (Phaeophyta: Fucales), from Tahiti (French Polynesia). *Journal of Applied Phycology*, 20(6), 1033–1043.

