DYPP
exploring the future potential of seaweed as bioplastic through strategic use of design

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APPENDIX A: Seaweed exploration
FORAGING

PICKING SEAWEED: to get to know seaweed as a material, we went out foraging at Halden brygge.
CATEGORIZING: We sorted the different types of seaweed into different piles and left some to dry.
BOILING: The rest we cut into smaller pieces and boiled in water with bicarbonate. We were trying to follow a guide we had found online on how to make paper from seaweed. After a while the “pulp” started to smell so bad we had to exit the room for hours.

FUN FAILURE: The substance looked quite promising, but it turned out that it wouldn't adhere when dried. The “sheets” were really fragile and most broke apart. But, we had a lot of fun and learned more about the material qualities of seaweed.
APPENDIX B:
Alginate exploration
SWEDEN

WORKSHOP: We participated in an exciting workshop in Sweden, facilitated by Julia Lohmann and Kristineberg Marine Research and Innovation Centre.

ECOSYSTEM: We learned a lot about the marine ecosystem in Nordic countries and how all the different organisms are dependent on each other. Right before going to Sweden, we had decided to focus on how seaweed can be used as a future biomaterial. In Sweden we learned how we could make bioplastic from alginate.
Then we could start our experimentation! We tested out different percentages of alginate in the solutions.

FMC BIOPOLYMER: When we got back from Sweden, we contacted FMC Biopolymer. They were kind enough to give us two different samples of sodium alginate.

MIXING: Then we could start our experimentation! We tested out different percentages of alginate in the solutions.
RECIPE

ALGINATE SOLUTION:
10g sodium alginate
490g water

We used a blender to mix the alginate with the water. Important to pour the alginate slowly into the water. Otherwise the alginate will not mix with the water.

CACl² SOLUTION:
15g calcium chloride
500g water

DIPPING: dip the shapes in the alginate solution, then in the CaCl² solution. It’s easier to get the layers to stick if the shapes are left to dry in between (if you want multiple layers=thicker shapes).
2% SOLUTION: The results varied. Some experiments ended up very fragile, while others were more solid. We got the most successful results from using 2% alginate in the solution.

Drying: We have tested different ways of drying the experiments, both in room temperature and in an oven set to temperatures between 30-70 degrees.
ICE CREAM: We wanted to use the real experiments for the final 2020 scenario. We went to Torggata Mathall and to Deli de Luca and asked if they could help us with some ice cream, to test out the material qualities. It was very exciting to see how the shapes changed and “adapted” to the ice cream. The material we have made is supposed to be edible, but it is very hard to chew (we discovered).
APPENDIX C:
Roadmap iterations
BELONA: The first version of the map was brought to Bellona to discuss content and structure. In this map we included drivers such as; technology, CMS, marine Industry and resource scarcity.
FUTURE SCENARIOS: Simultaneously we worked on future scenarios. These are the early sketches were our main focus was seaweed production.
WORLD ECONOMIC FORUM: We used World Economic Forum’s “Mapping Global Transformations” tool when we started mapping. It was valuable to start on a very holistic level and see how “everything” is connected.
VISUALIZING: We wanted to make the map more engaging. Therefore we visualized our understanding of the situation today by including actors within government, research and industry. We also tried to illustrate the vision of 2050, through elements and objectives described in several reports.
MAIN STEPS: We identified the main steps, from previously written reports and during interviews, we believe will be essential towards the goal of 2050. As our understanding broadened the map got more complex.
VISUALIZING: We started by thinking of the map as a linear model, we soon realized that multiple steps and measures will influence each other and overlap. We therefore rearranged the steps in a more “random” order. We tried to illustrate how smaller steps needs to be fulfilled and connected in order for the development to succeed.
APPENDIX D: Ideas
EARLY OPPORTUNITY AREAS

From the first interviews we summarized 8 early opportunity areas. The first one is: How to use seaweed as a substitute in food?

1. **How to use seaweed as a substitute in food?**
   - **Idea:**
     - Tang som salatstopping
     - Tang i laksbiff
     - Tang i fisketvang
   - **Plan:**
     - Næringsinhold og effektivitet (reduksjon fettsyrer)

2. **How can Norwegian seaweed be used in sushi?**
   - **Idea:**
     - Norsk nor i (sči,bins, B2)
     - Produktivitet i det forbrukermarkedet med suktinaktiverte tangprodukter
   - **Plan:**
     - Økede trenden av nordmenn spiser asiatiske mat. Mange sushi restauranter i Norge som bruker asiatiske tangprodukter.

3. **How can we enlighten the next generation about seaweed?**
   - **Idea:**
     - Undervisning i barneår (inkludert tang eksklusjon i naturfag og/eller med tang i helse kurset)
     - Barne- og ungdomsaktiviteter
   - **Plan:**
     - “Om vi skal sette må vi også tenke på neste generasjon som må se muligheter og vi må sørge for at de ser muligheter.

4. **How can one motivate the next generation of seaweed entrepreneurs / founders?**
   - **Idea:**
     - IMTA/NTNU
     - Mer og mer akseptert som en del av næringslivet
   - **Plan:**
     - “Om vi skal sette må vi også tenke på neste generasjon som må se muligheter og vi må sørge for at de ser muligheter.


5. How to utilize by-products from the alginate industry

6. What can Norwegian oil platforms be used for when we run out of oil?

7. How can we facilitate for harvesting and production of seaweed in Norway?

8. How to build networks/communication between seaweed producers and the market?
FUTURE OF FOOD & TEXTILE: For inspiration we created moodboards for the early opportunity areas. Later on we used them to discuss and to share ideas. We tried to imagine what food would look like in the future. We also got inspired by living textiles and tactile surfaces.
ENERGY & PACKAGING: Seaweed is predicted to be a source for biofuel in the future. What else might be the future of energy? We also got inspired by new materials and products mimicking nature.
EARLY IDEAS

IDEOATION BASED ON MATERIAL PROPERTIES: As we learned more about the possible material properties of seaweed, we developed ideas focusing on how these could be put to use.
IDEA: Flowerpot

Using seaweed as a material to make flower pots that can be planted in your garden: reducing plastic and giving nutrients to the soil.

IDEA: Single use cutlery from seaweed

IDEA: Seaweed as "protection" material

Using dried seaweed instead of bubble wrap to protect products in transportation.

IDEA: Wrapping paper

IDEA: Bulion with seaweed

Put the bulion through on the water.
WORKSHOP: We invited fellow students to a future workshop, where we wanted crazy ideas to challenge the world of packaging.
WORKSHOP SLIDES: Here are some of the slides we made for the future workshop. We wrote questions that we hoped would trigger imagination and new connections.

FIRST IDEATION:

What might packaging be in the future?

What does living packaging mean?
5 minutes ideation

What is local packaging in a Norwegian context?
5 minutes ideation
GARBAGE ROOM: In action, taking the pictures for our final scenarios. We set out on a mission to find a suitable room to take pictures. And we finally found it, in AHO's basement garbage room. Perfect lighting and stacks of wood.
FROM SKETCH TO CONCEPT
2025 CONCEPT: Why do we package food, like strawberries that expires in days, in packaging that never expires? We found the idea of packaging being perishable really fascinating. Here exploring different origami boxes that could change shape from three dimensional to flat.
FROM SKETCH TO CONCEPT
2030 CONCEPT: This is the early sketch for the 2030 concept. The idea of dipping rather than package made us think of new possibilities for food preservation.
FROM SKETCH TO CONCEPT

PACKAGING AS SPRAY

For freshness

spray on for takeaway
2030 CONCEPT: From one of the first ideas on how packaging could be something completely different. What if take away restaurants could spray the food to preserve it? This idea was further developed to involve Norwegian vegetables. What if Norwegian farmers could spray the vegetables, with locally farmed seaweed, to preserve them?
FRUIT STICKER: What if something small could have a big impact? One of our early ideas explored how to introduce alginate as small stickers to mark fruit and vegetables in stores. This idea was developed further when we found out that most of today’s stickers are edible.