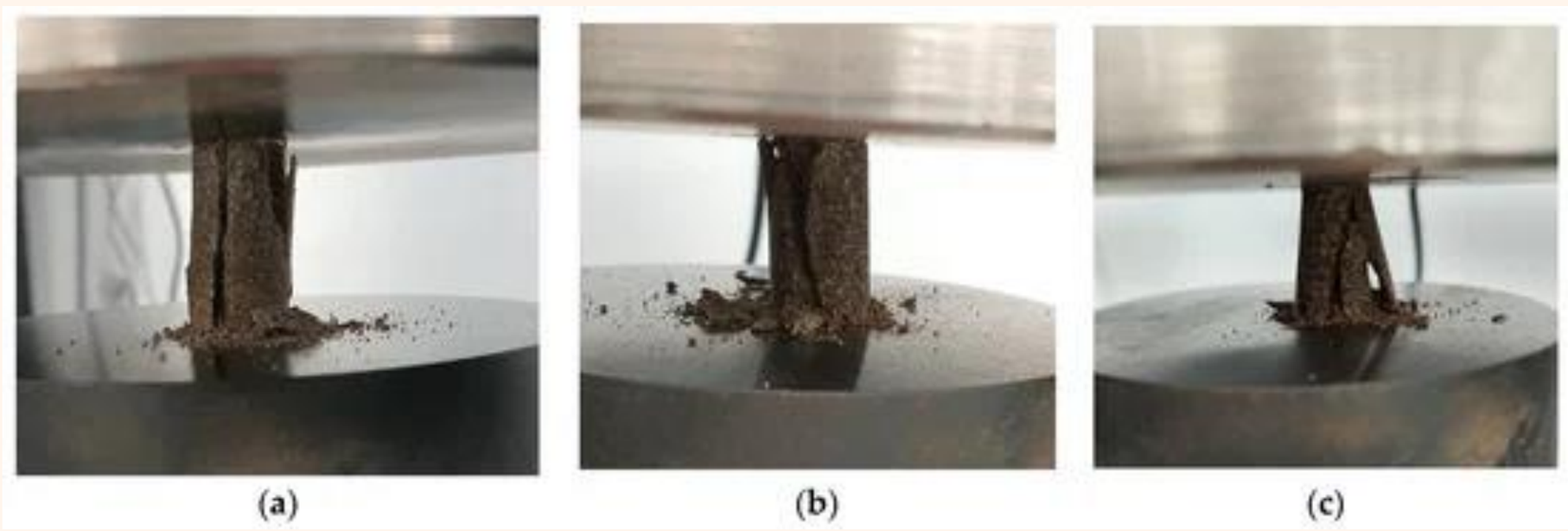
Rimal

Process Book

Sand as a building material

Sand and other granular materials are particularly intriguing since they do not belong to a single phase of matter and can operate in different situations as a liquid, solid, or gas. The addition of sand as a filler can help to enhance the mechanical and physical properties of the composite, including its strength, stiffness, toughness, and thermal stability.

- Silica sand, a form of silicon dioxide (SiO2) and is commonly known as quartz sand,
- Okra demonstrated good adherence characteristics to sand silica particles, where the test results indicate that adding okra significantly affects the mechanical properties.
- The best mechanical properties have been achieved at a 15% weight ratio of the okra bio-binder



(a) (b) (c)

Experimenting with sand and okra

At first we experimented by shaving the slime off the okra. It was very time- consuming and labor- intensive. Then we tried crushing the okra after removing the seeds and that is the approach that seemed to work

Experimenting with sand and okra

Ingredients

1 tbsp - sand

shaving of 2 okras

Squeezed Lime

Prototype 1

Process

The mixture is put in the oven at a temperature of 80 for 20 minutes

Prototype 2

Process

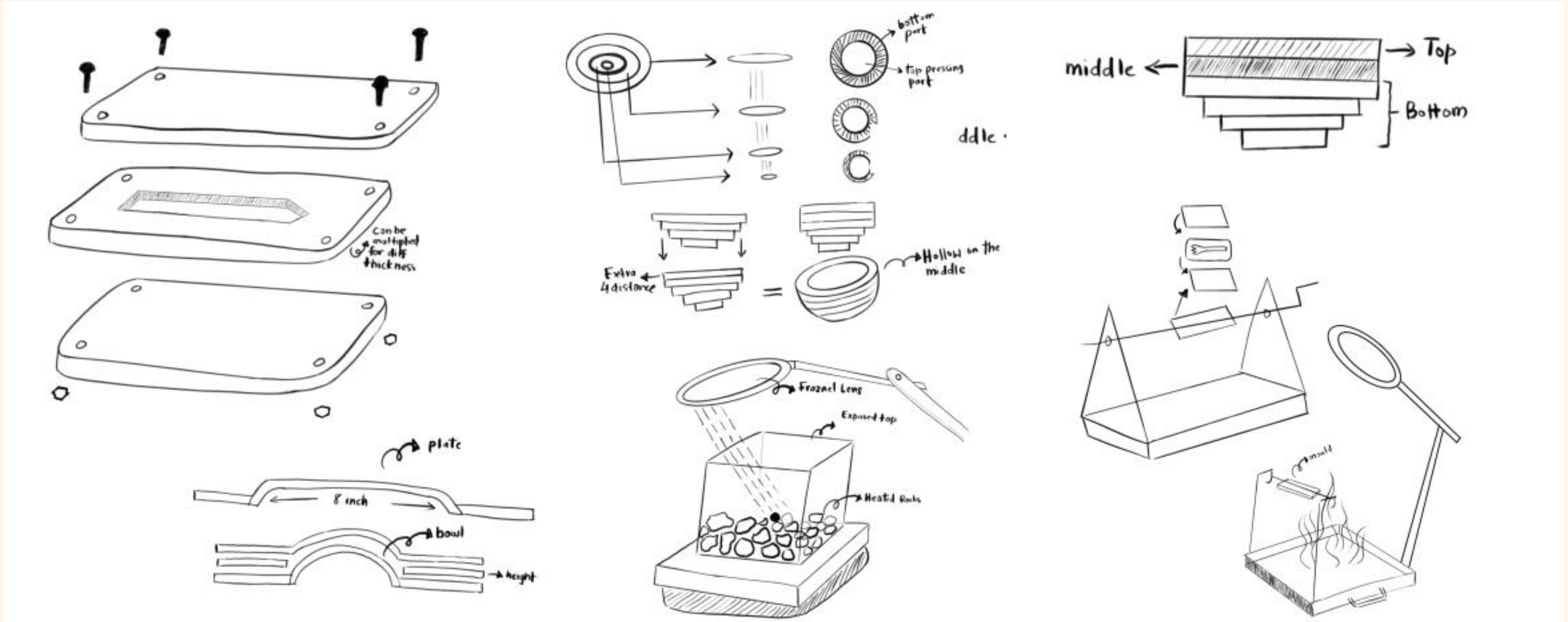
Same as the first one but we add a tsp of sugar and mix it over heat for barely a minute until the sugar dissolves then we cook it

We crush the okras into a slimy paste and then mix it together with sand and lime.

For the water absorption test, the specimens are dried in an oven for a specified time and temperature and then placed in a desiccator to cool. Immediately upon cooling the specimens are weighed. The material is then emerged in water at agreed upon conditions, often 23°C for 24 hours or until equilibrium.

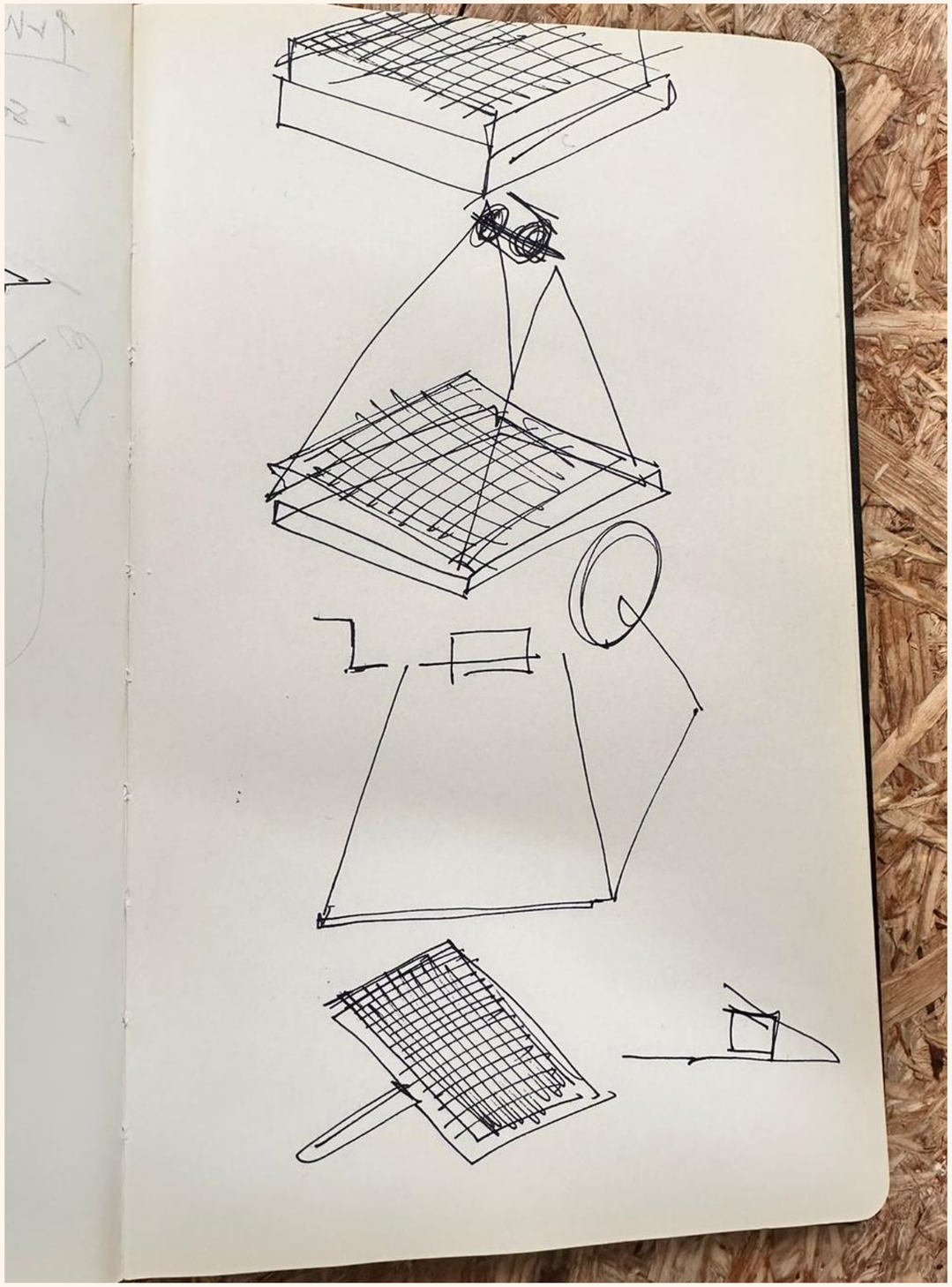
Water absorption is expressed as increase in weight percent.
Percent Water Absorption = [(Wet weight - Dry weight)/ Dry weight] x 100

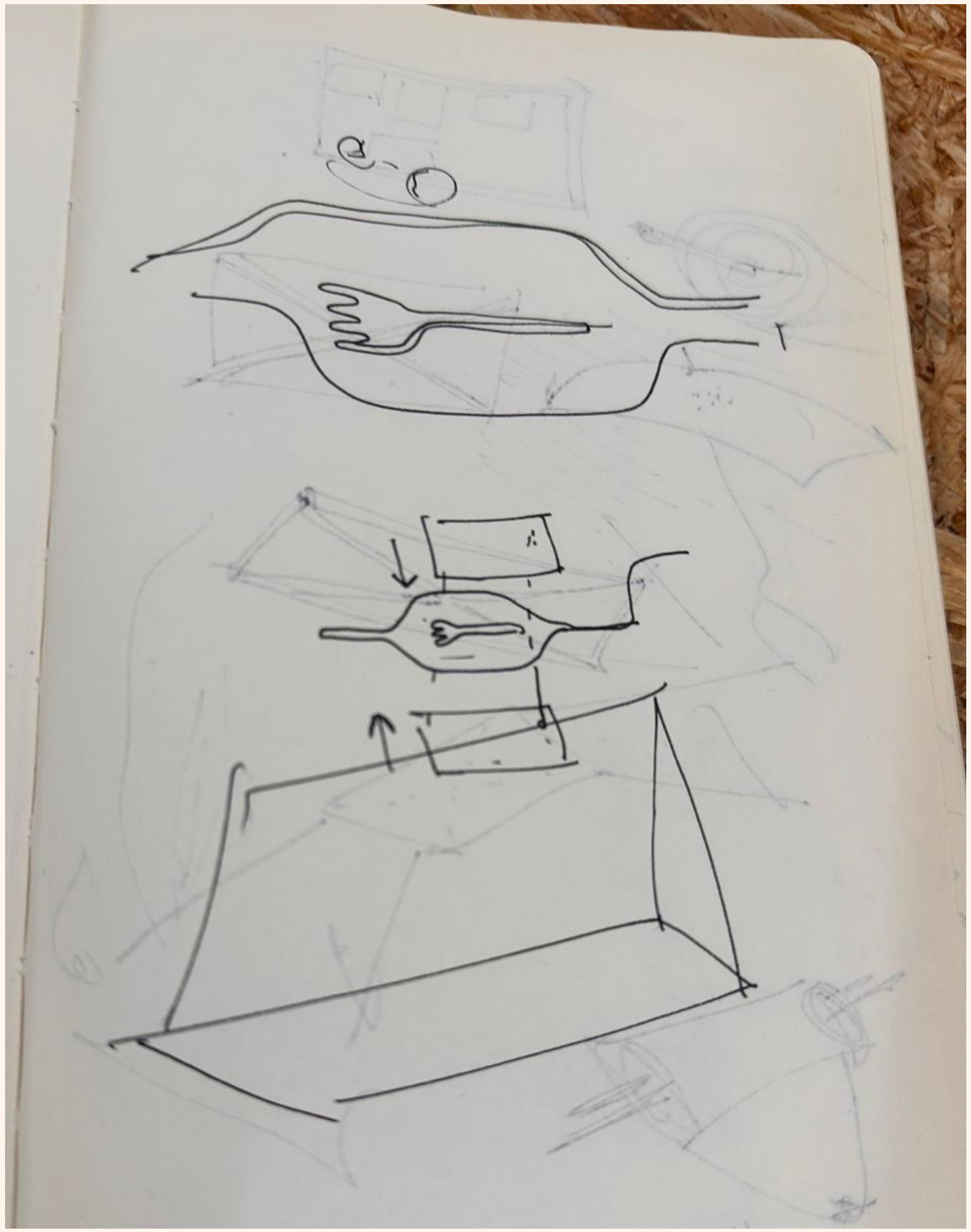
Initial Sketches



These sketches shows our initial brainstorming session on making the moulds and cooking device itself. There were a lot of iteration for the cooking device and the moulds

Initial Sketches





Bowl – Iteration 1

We put the material in the negative space and then pressed the positive

Bowl – Iteration 2

We laser cut concentric circles and them attached them together and sanded them. The second iteration was just a hollow positive and since the mixture was clay-like texture, It was easy to mold

Bowl – Iteration 3

For this mould, we wanted to have a hollow structure and then something to keep the material pressed and in place. So we 3d printed it to quickly test the idea

Bowl – Iteration 4

We used the CNC to make the previous mould out of MDF and then manually cut out the top part into two pieces.

We wanted to hollow out the positive part in order to allow the material to dry faster

These images shows the cross section of the mould made using CNC
There are 3 parts to the mould:

- The positive
- Presser part 1
- Presser part 2

Plate mould

We experimented with the same method we used for the bowl; we laser cut concentric circles in different sized and then glued them together.

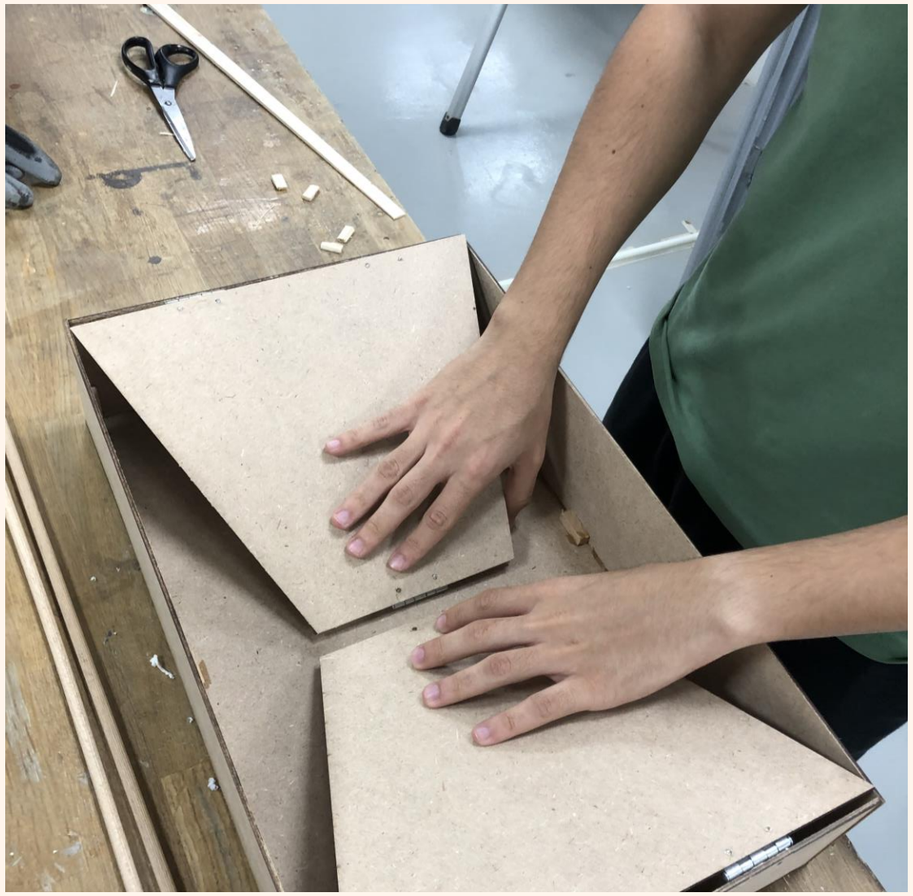
We then sanded them to get the smoothness and finish we want. We used about 6 hollow circles to make the mould

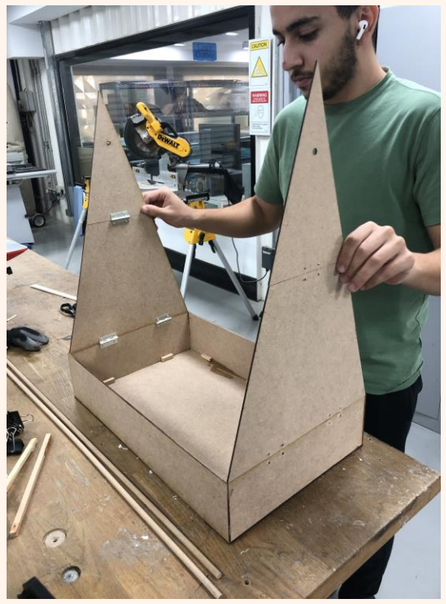
Renders

The first render shows our initial concept of the cooking device where the whole experience is to cook the cutlery you eat with.

The second render shows one of our bowl moulds

Cooking Device Iteration 1





Spoon – Iteration 1

We made 3 layers to get the bowl of the spoon and sanded it .But the Handle we made was only one layer

Initial spoon mould – Findings

- The spoon was very thin, it broke
- Did not wax the mould, so it was harder to get it out after cooking
- Had to avoid sharp edges in the design to avoid breakage

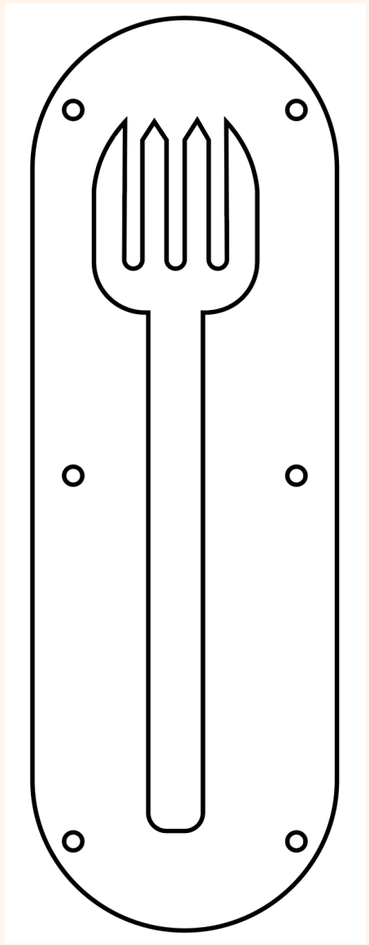
Spoon – Iteration 2 and 3

we made the handle deeper. Then we realized we had to distribute the weight and make the spoon wider and more ergonomic.

Fork– Iteration 1

This fork had very sharp edges, which made it break apart very easily. And it was too thin to be used

Fork – Iteration 2



In this iteration we tried to reduce the sharp edges to avoid breakage. We also tried to reduce the thin areas. But the fork was still too thin and brittle.

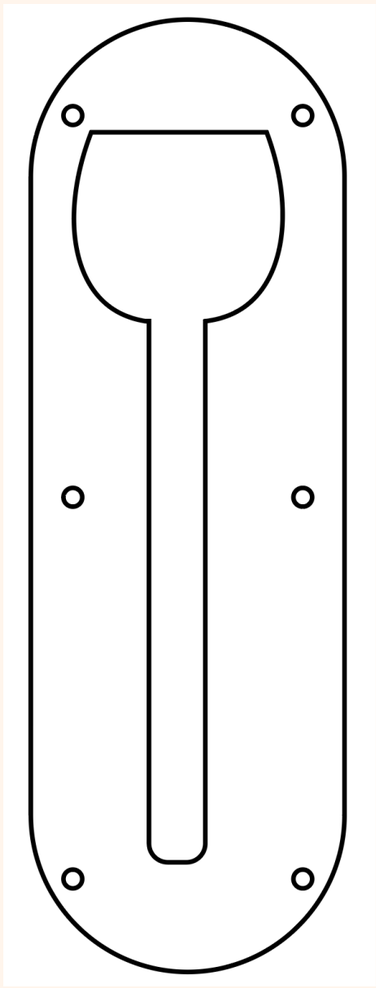
Fork– Iteration 3

In this iteration we tried to redesign a fork to work for our biomaterial. We also tried to make the design more wider, organic and ergonomic

Knife– Iteration 1

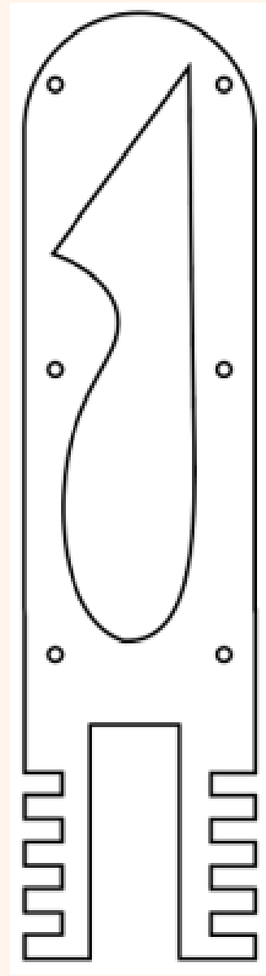
This pencil shaped knife was only one layer deep and it was very thin. The pointy edges broke after cooking

Knife– Iteration 2



In this knife, we tried to avoid sharp edges altogether. But this knife was also only one layer deep which made it thin, brittle and easy to break

Knife– Iteration 3



In this knife, we made it 3 layers deep and we tried to make in more organic, and ergonomic

Spoon – Iteration 1

Remoulded Plate

We put the used plate in water for 24 hours and then drained the water to get a slimy mixture. We remoulded the plate again. But there was shrinkage from the original plate due to some material being lost in water.

Dubai Design Week

Sand from 7 Emirates

The concept is to have a piece of cutlery from each emirate; 7 spoons from 7 Emirates. We collected sand from AbuDhabi-24.191275N, 54.833203E, Dubai, Sharjah-25°10'20.5"N 55°38'38.5"E, Ajman and Fujairah-25°07'19.1"N 56°18'01.7"E

Process

Recipes

Main Recipe: Sand, Okra, Lime

Recipe for Spoon, Knife and Fork

Ingredients for Spoon, Knife, Fork

Sand	-	2.5 tbsp
Crushed Okra	-	1.5 tbsp
Lime	-	½ juice

Preparation

Step 1:	Crush the Okra skin into a slimy paste after removing all seeds
Step 2:	Mix sand, Okra and lime in the mentioned proportion and mix to get a clay-like consistency
Step 3:	Wax The mould, press the mixture onto the mould and fill the mould
Step 4:	Secure the mould and cook it for 15 mins

Recipe for bowl and Plate

Ingredients for bowl

Sand	-	4 tbsp
Crushed Okra	-	3 tbsp
Lime	-	1 whole

Ingredients for Plate

Sand	-	6 tbsp
Crushed Okra	-	5 tbsp
Lime	-	2 whole

Preparation

Step 1:	Crush the Okra skin into a slimy paste after removing all seeds
Step 2:	Mix sand, Okra and lime in the mentioned proportion and mix to get a clay-like consistency
Step 3:	Wax The mould, press the mixture onto the mould and fill the mould
Step 4:	Secure the mould and cook it for 30 mins

Recipe 1

Ingredients :

Turmeric	-	½ tsp
Cornstarch	-	½ tbsp
Lime	-	½ juice
Egg white	-	1 tbsp
Sand	-	2 tbsp

Preparation

Step 1: Mix sand, egg white, cornstarch and lime in the mentioned proportion. Add turmeric for the color and mix to get a clay-like consistency

Step 2: Wax The mould, press the mixture onto the mould and fill the mould

Step 3: Secure the mould and cook it for 15 mins

Recipe 2

Ingredients :

Cocoa powder	-	½ tsp
Egg white	-	1 tbsp
Lime	-	½ juice
Sand	-	2 tbsp

Preparation

Step 1: Mix sand, egg white, and lime in the mentioned proportion. Add cocoa powder for the color and mix to get a clay-like consistency

Step 2: Wax The mould, press the mixture onto the mould and fill the mould

Step 3: Secure the mould and cook it for 15 mins

Recipe 3

Ingredients :

Summak powder	-	1 tsp
Cornstarch	-	½ tbsp
Sand	-	2 tbsp
Lime	-	½ juice

Preparation

Step 1: Mix sand, cornstarch, and lime in the mentioned proportion. Add summak powder for the color and mix to get a clay-like consistency

Step 2: Wax The mould, press the mixture onto the mould and fill the mould

Step 3: Secure the mould and cook it for 15 mins

Recipe 4

Ingredients :

Charcoal	-	½ tsp
Okra	-	1 tbsp
Sand	-	2 tbsp
Lime	-	½ juice

Preparation

Step 1: Mix sand, okra, and lime in the mentioned proportion. Add charcoal powder for the color and mix to get a clay-like consistency

Step 2: Wax The mould, press the mixture onto the mould and fill the mould

Step 3: Secure the mould and cook it for 15 mins

Recipe 5

Ingredients :

Sand	-	2 tbsp
Crushed Alovera	-	1 tbsp
Cornstarch	-	½ tbsp

Preparation

Step 1: Mix sand, crushed Alovera, and cornstarch in the mentioned proportion and mix to get a clay-like consistency

Step 2: Wax The mould, press the mixture onto the mould and fill the mould

Step 3: Secure the mould and cook it for 15 mins

Recipe 6

Ingredients :

Sand	-2 tbsp
Lime	-½ juice
Cornstarch	-½ tbsp
Beetroot/Blue	food coloring

Preparation

Step 1: Mix sand, cornstarch and lime in the mentioned proportion. Add Beetroot for the pink and Blue food coloring for the blue color and mix to get a clay-like consistency

Step 2: Wax The mould, press the mixture onto the mould and fill the mould

Step 3: Secure the mould and cook it for 15 mins

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