

Properties and Usage of Sheets Made from Agar

Group 3

Outline

1. Motive and purpose

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4. Summary

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3. 3. Water absorption

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1. Motive and purpose

Agar plastic

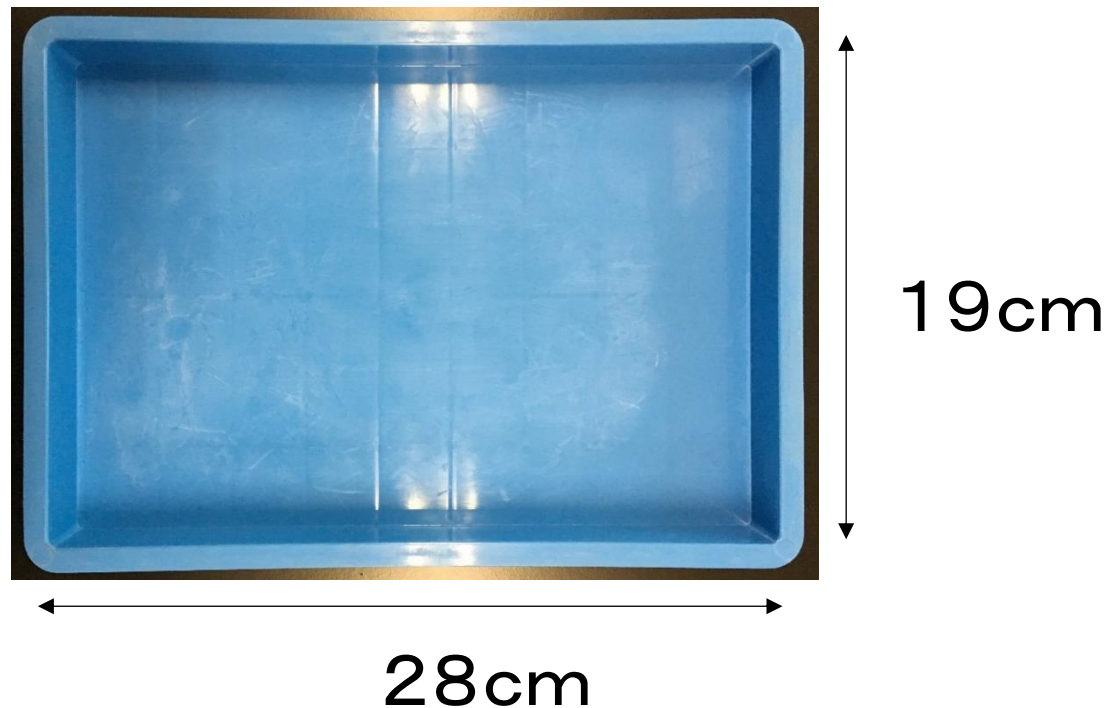
- Biodegrades
- Absorbs



Making useful agar plastic

2. How to make agar sheets

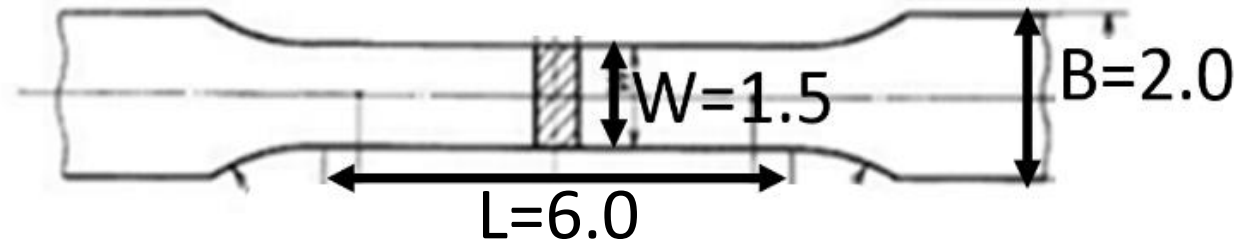
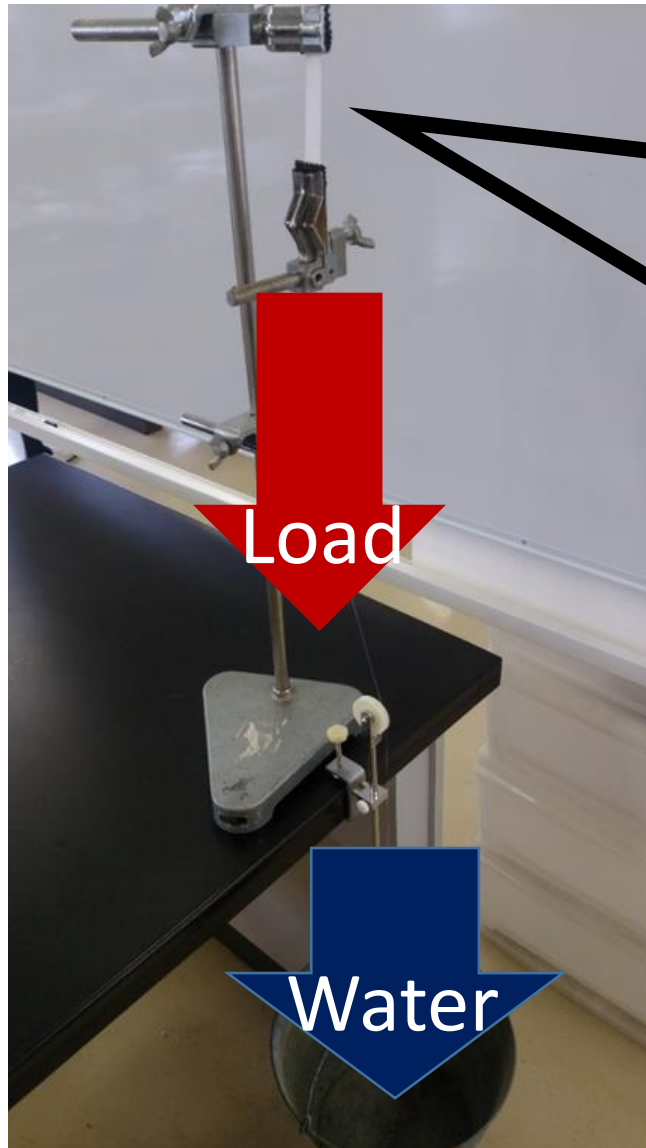
A	B	C	D
Agar 8.0g	Agar 8.0g + CaCO ₃ 2.0g	Agar 8.0g + (CH ₃ COO) ₂ Ca 2.0g	Agar 8.0g + CaCl ₂ 2.0g



3. Measurements

1. Tensile Strength Test
2. Test for Flammability
3. Test for Water Absorption

3. 1. Tensile strength test method



Size of test pieces (cm)

Width:1.5 Length:6.0

Breadth:2.0

(Quoted from <http://kikakurui.com/k7/K7127-1999-01.html>)

Device for tensile strength test

3. 1. Values of tensile strength test

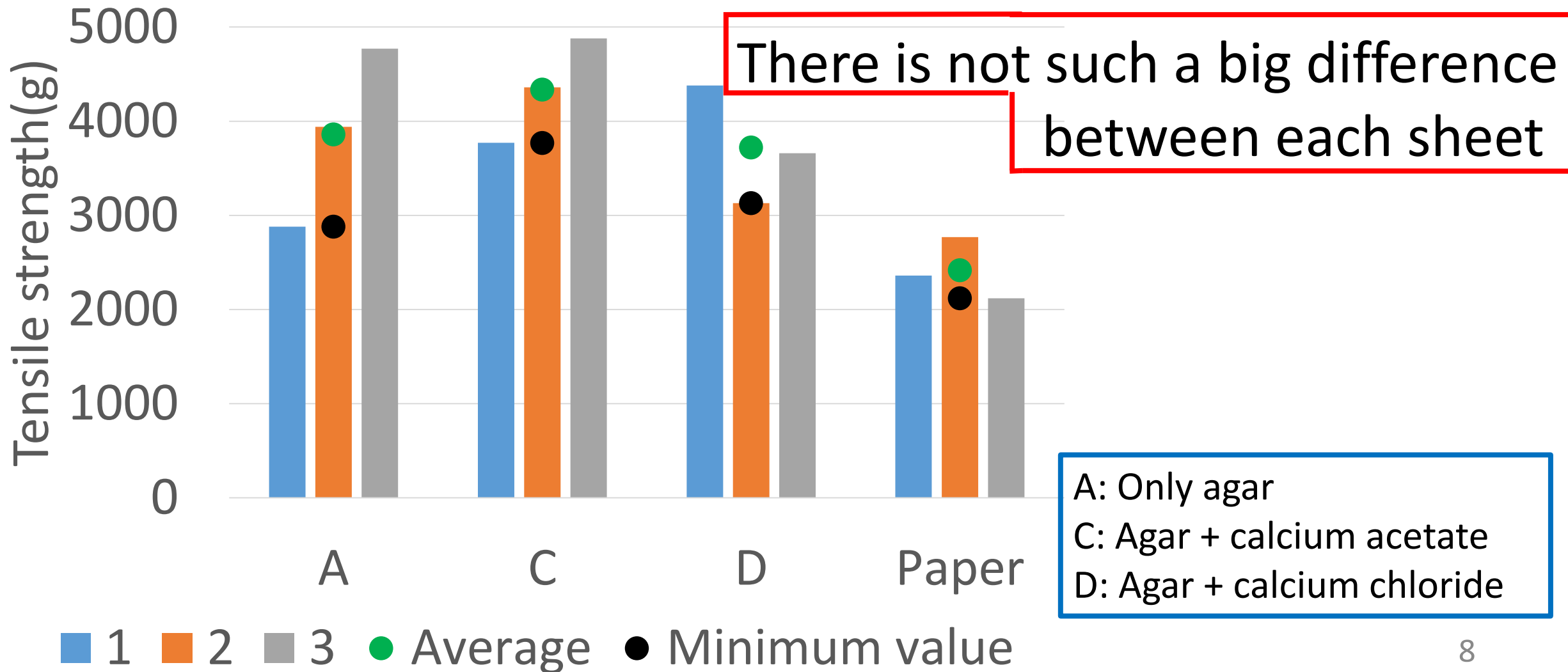
- The value of load when the pieces break
➔ Tensile strength(g)

$$\frac{L_1 - L_0}{L_0} \times 100 = \text{Permanent elongation(\%)}$$

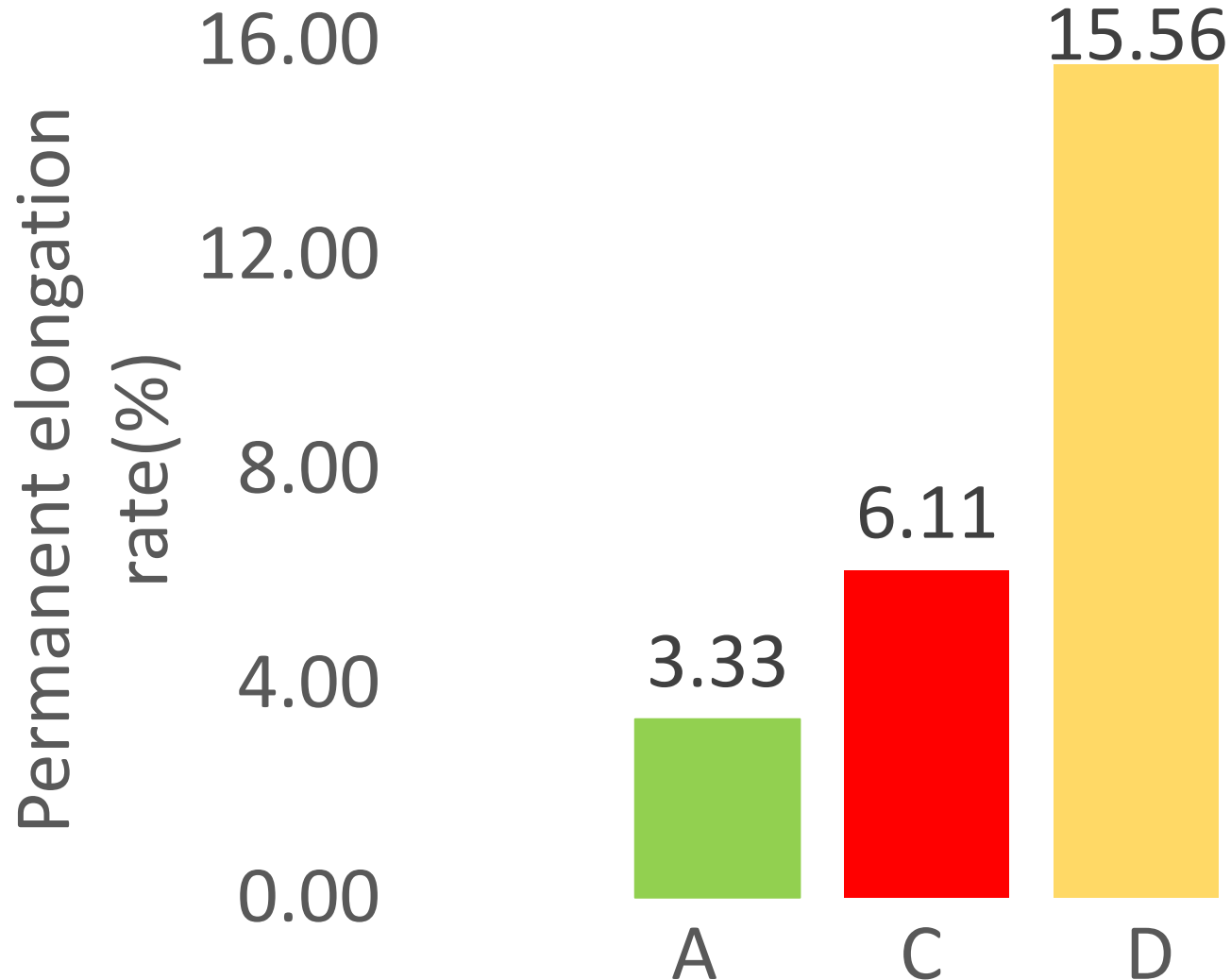
L_0 = The length of an original piece

L_1 = The length of a broken piece

3. 1. Result 1: Tensile strength



3. 1. Result 2: Permanent elongation

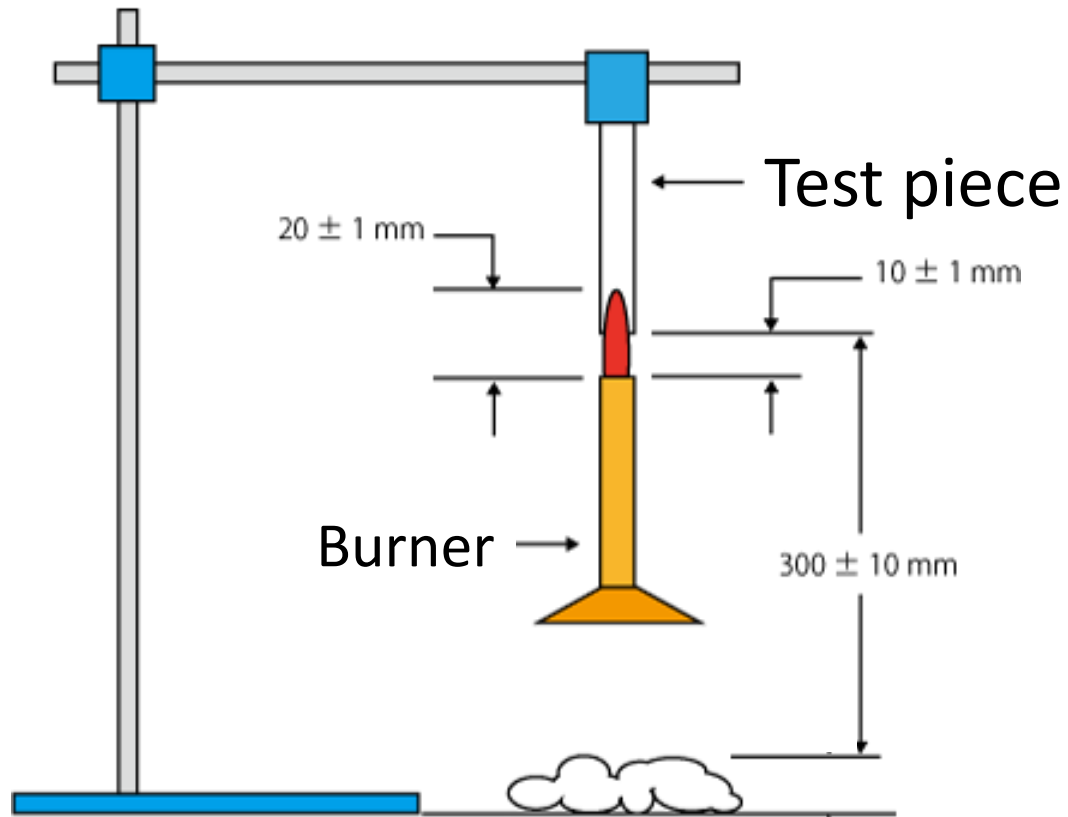


D has the largest permanent elongation

D is the most stretchable sheet

A: Only agar
C: Agar + calcium acetate
D: Agar + calcium chloride

3. 2. Burning test method



UL94V Flammability Standard



3. 2. Result 3: Burning test

	A		B		C		D	
	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2	Sample 1	Sample 2
Burning time	20	24	23	13	[12,11]	[10,10]	[10,10]	[10,10]
Stop burning	×	×	×	×	○	○	○	○

* [(first burning time) , (second burning time)]

A: Made from only agar
C: Mixed calcium acetate

B: Mixed calcium carbonate
D: Mixed calcium chloride

3. 2. Result 3: Burning test



Calcium carbonate

Easy to burn



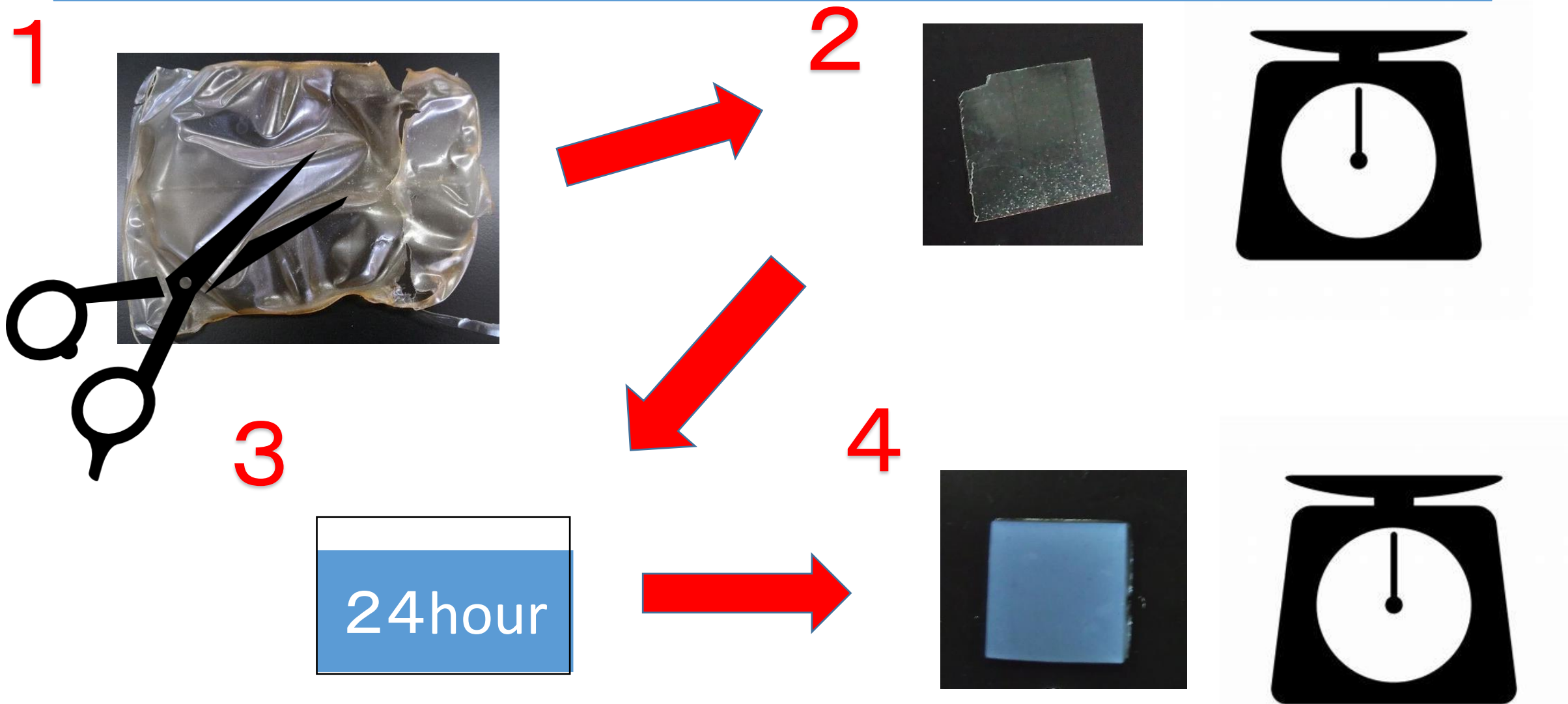
Calcium acetate

Difficult to burn

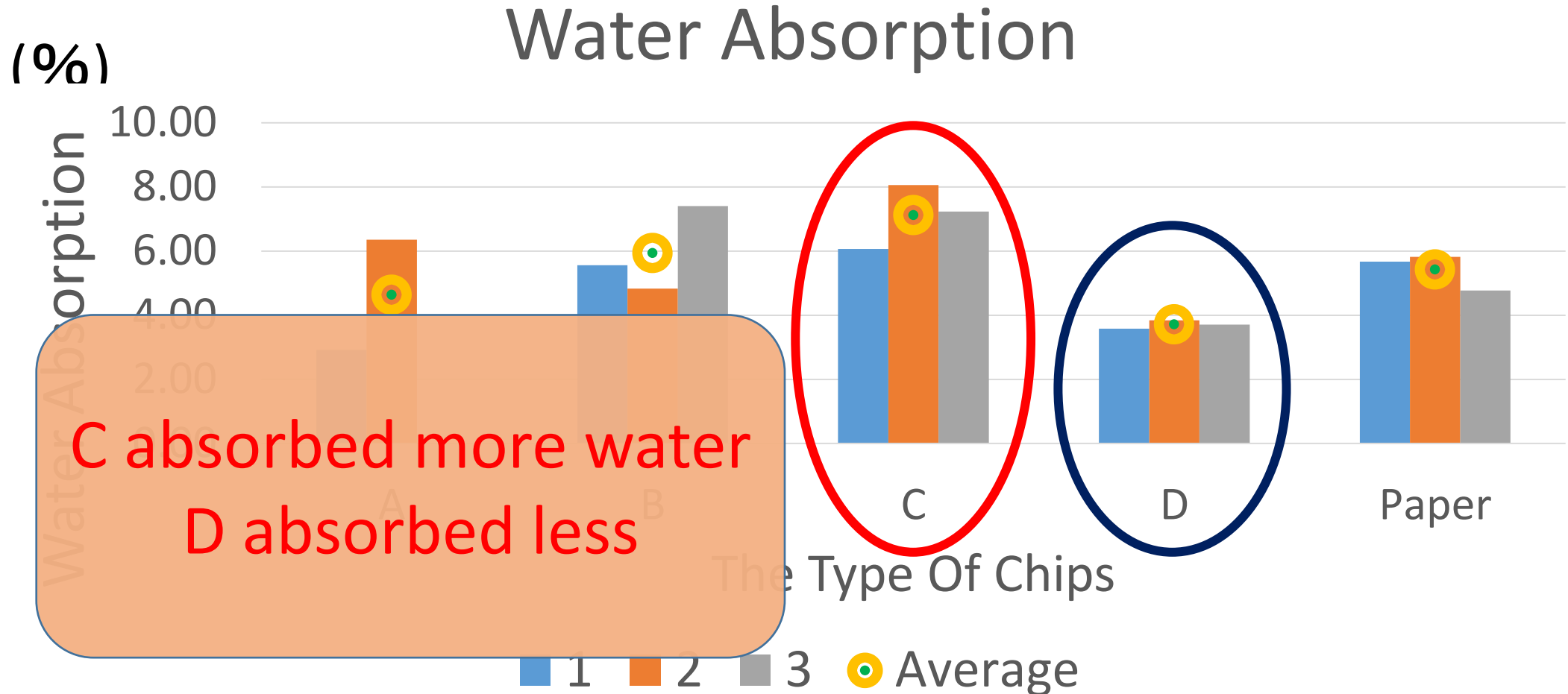


Calcium chloride

3. 3. Water absorption test method



3. 3. Result 4: Water Absorption



C absorbed more water
D absorbed less

- A: Made from only agar
- B: Mixed calcium carbonate
- C: Mixed calcium acetate
- D: Mixed calcium chloride

4. Summary and usage proposal

Sheet C (calcium acetate)

- High water absorption

→ Keep moisture in the soil for greening

Sheet D (calcium chloride)

- Flexible
- Difficult to burn
- Low water absorption

→ As food wrap, tableware, and so on

5. Problems

- Analysis of the results from the viewpoint of chemical structure
- Improvement of properties of sheets
- Measurement of other properties such as biodegradability

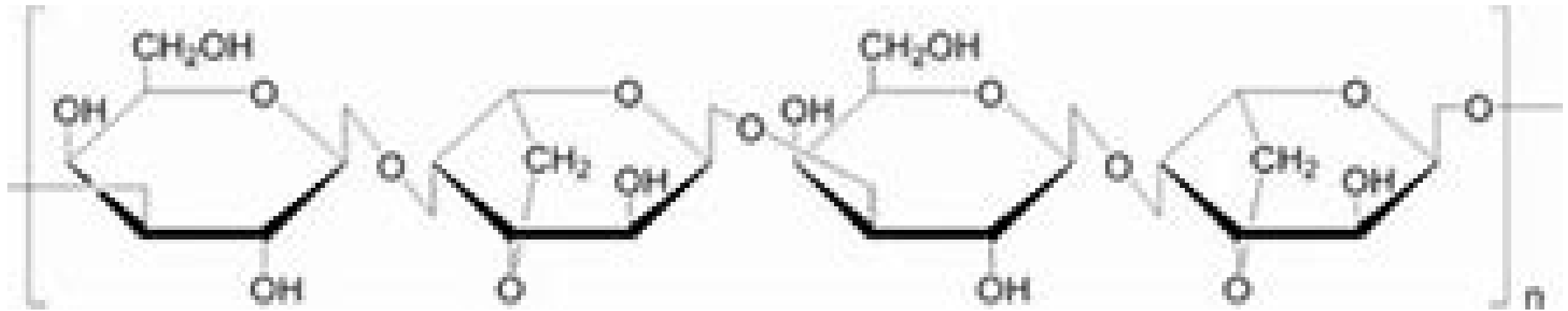
6. References

- Sekine, Ayano and Nakamura, Shogo. 2017. 'Stop the Spread of Desertification by Agar'
- Shoji, Tagawa. 1968. 'Chemical studies on manufacture of Agar-agar'
- JIS.-Plastics–Determination of tensile properties–Part 3 :Test conditions for films and sheets-, 1999
- DJK corporation. 'UL94burning test' |Flammability| DJK corporation : <https://www.djklab.com/service/koubunshibussei/597>



Thank you for listening!

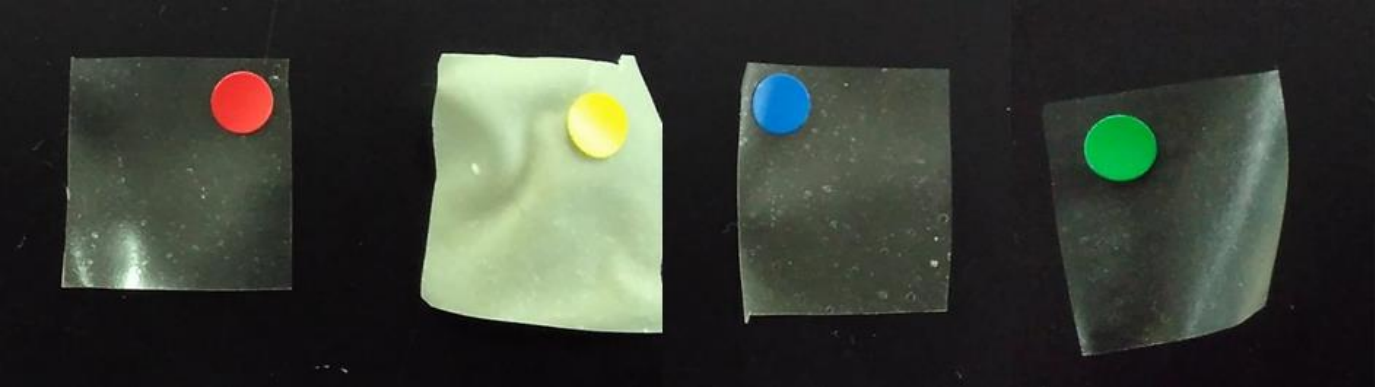
Main component of agar



agarose

Test for Water Absorption

Before

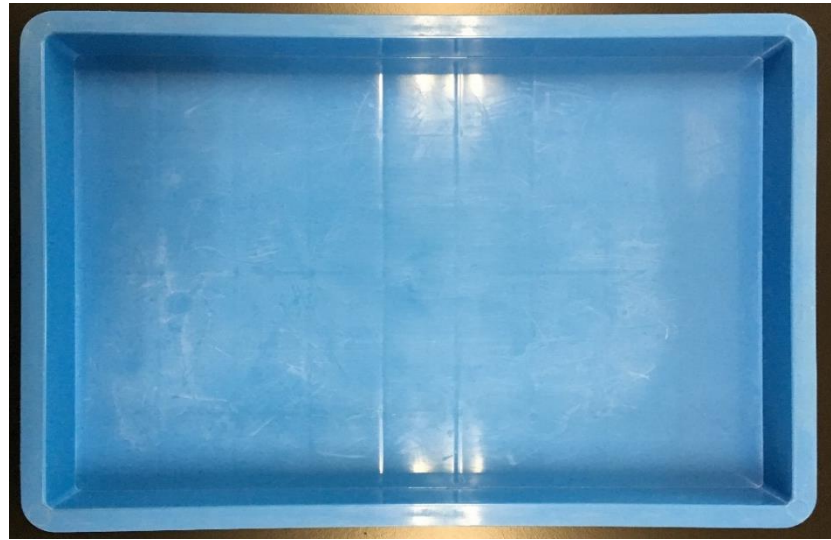


After



How to make agar sheets

Before



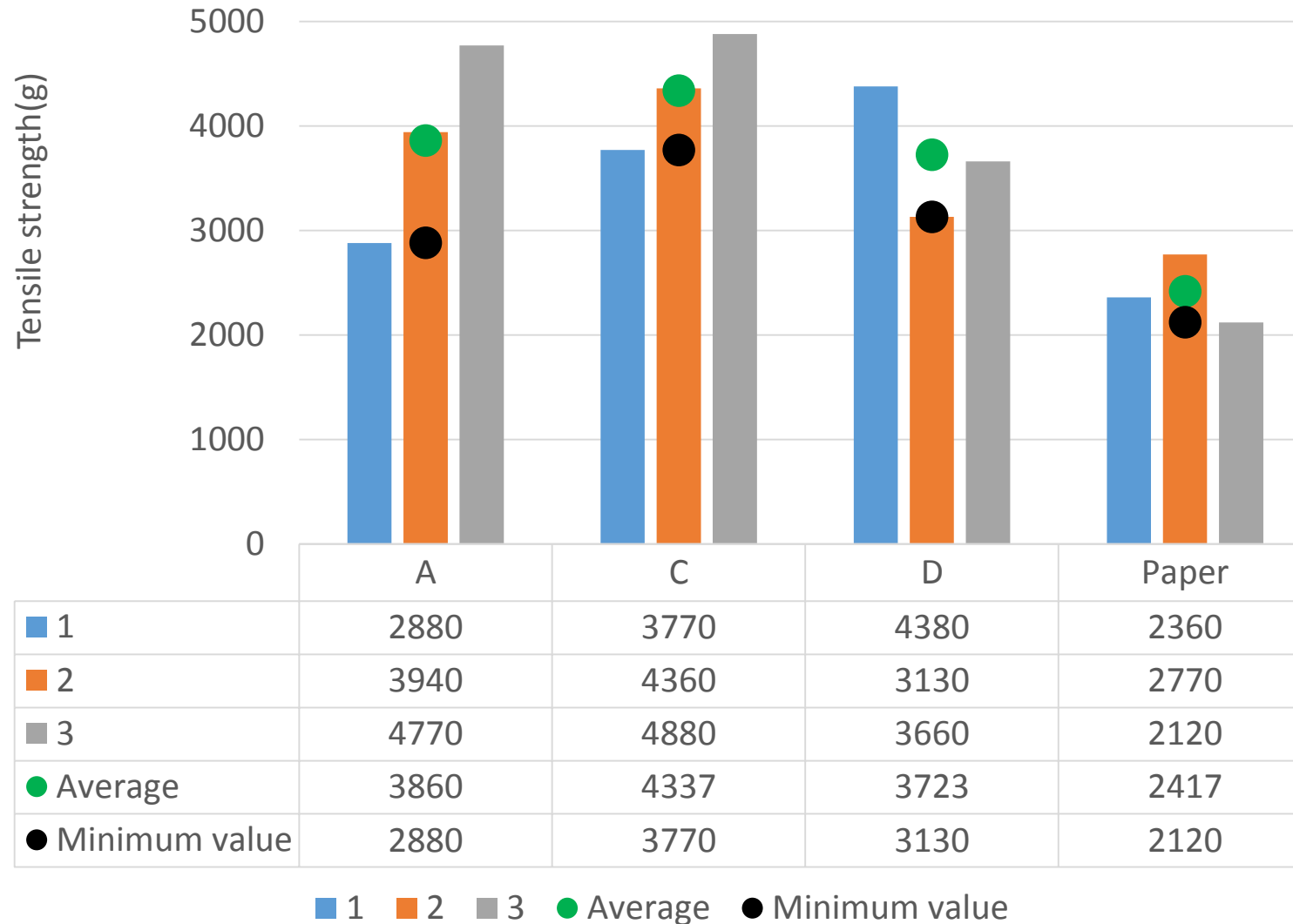
28cm

19cm

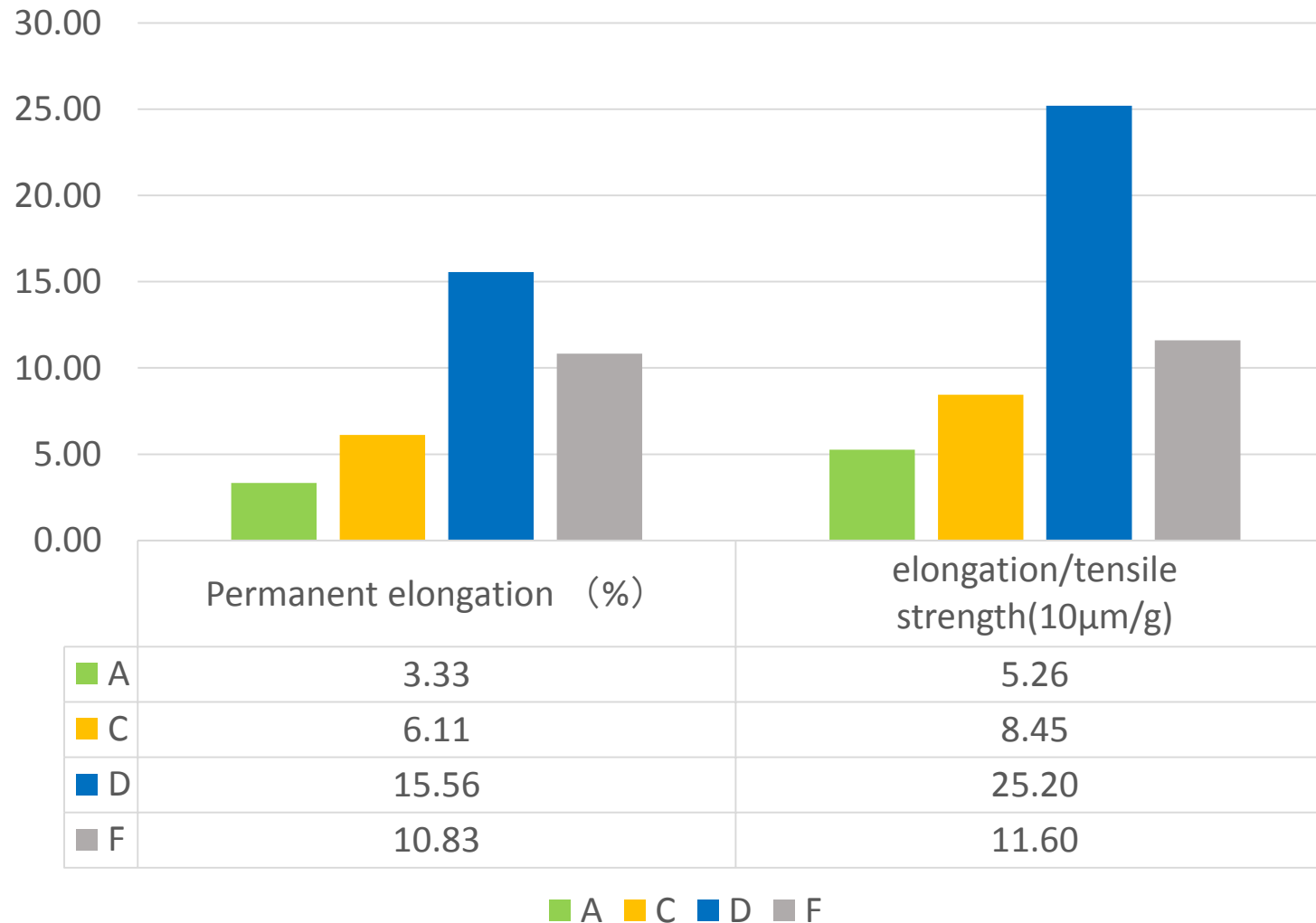
After



The result of Tensile Test



The result of Tensile Test



Result 3: Burning test



Calcium carbonate

Easy to burn



Calcium acetate

Difficult to burn

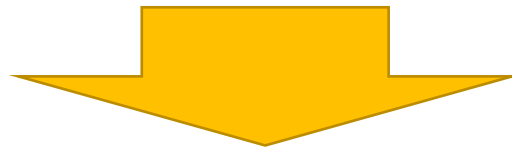
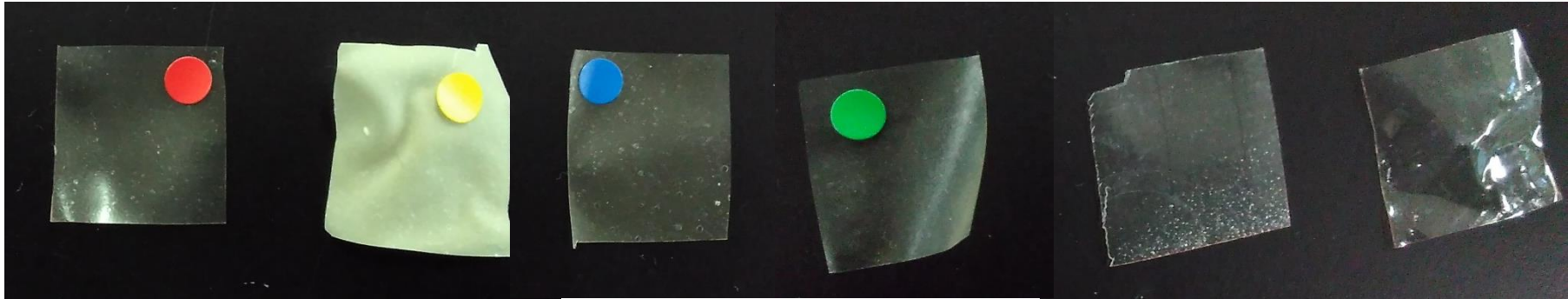


Calcium chloride

The Test of Water Absorption

C B D A E F

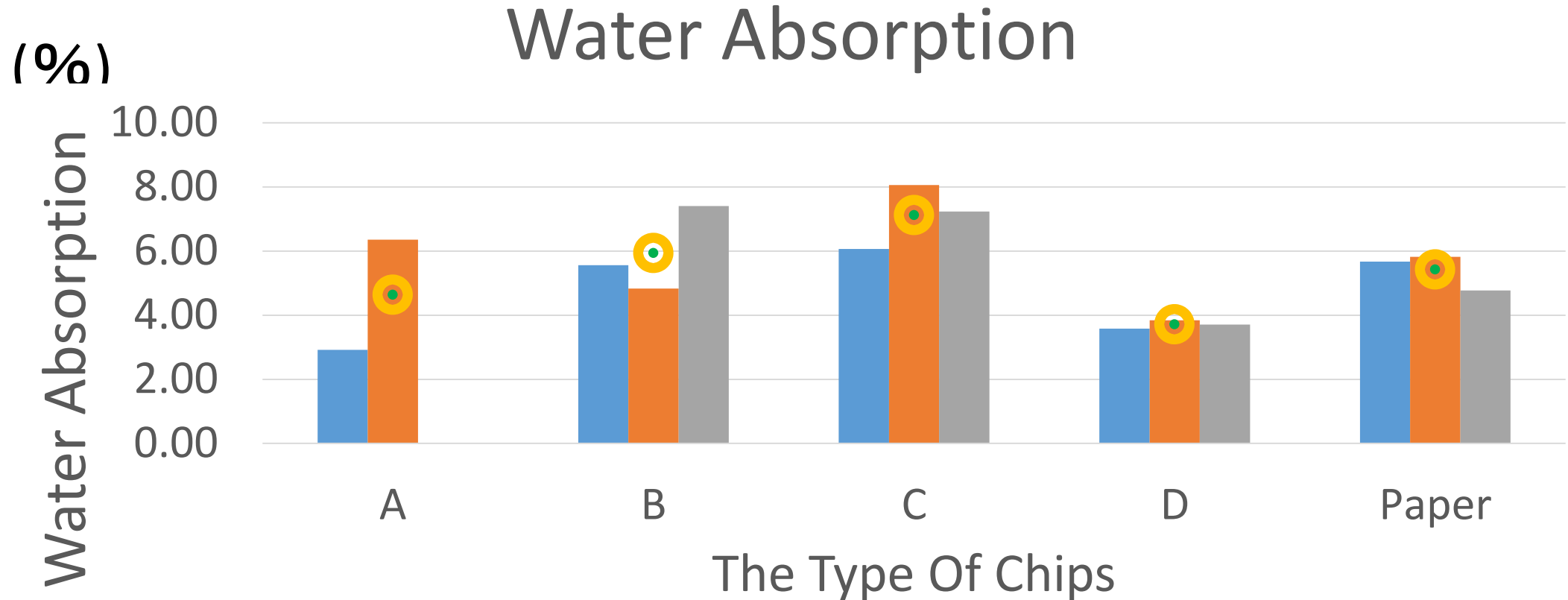
Before



After



Result 4: Water Absorption



■ 1 ■ 2 ■ 3 ● Average

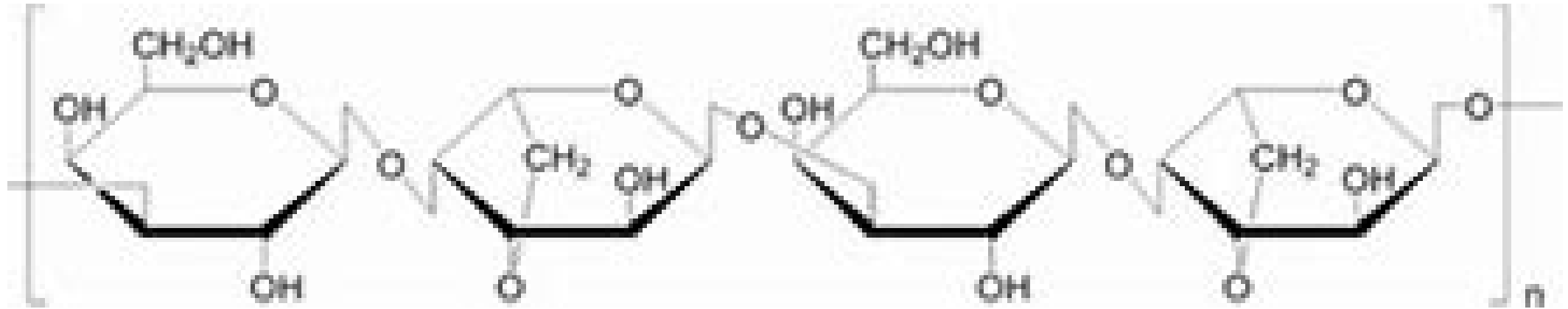
A: Made from only agar

B: Mixed calcium carbonate

C: Mixed calcium acetate

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Main component of agar



agarose