Liesegang Phenomenon

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Introduction

Liesegang phenomenon makes clear striped pattern. In general, this phenomenon uses a petri dish or test tube. But we wanted to study if the Liesegang phenomenon can occur even with in a beaker. Also, we wanted to find a way to change Liesegang layer's form.

Figure 1 : Liesegang phenomenon using test tube

Purpose

1. The formation of Liesegang rings using a beaker
2. Compare distance of Liesegang layers formed in different containers
3. Find a way to change Liesegang layer's shape

Experiment 1. The formation of Liesegang rings using beaker

Materials
- Disodium phosphate 2.25 g
- Calcium chloride 1.0 mol/L
- Agar powder 3.0 g
- Pure water 300 ml

The chemical reaction formula for the Liesegang rings

$$Na_2HPO_4 + CaCl_2 \rightarrow CaHPO_4 + 2NaCl$$

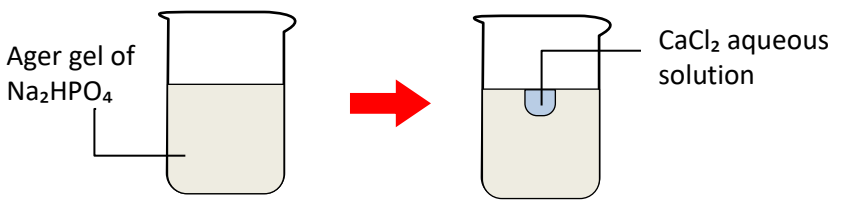

Figure 2 : Experimental method

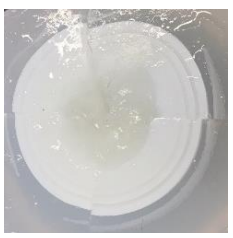

Figure 3 : Upper part

Figure 4 : Cross section view

Experiment 2. Change of layers when change concentration of aqueous solution

Components Chemical	Beaker	Petri Dish	Test Tube
Pure water	300 ml	60.0 ml	20.0 ml
Na_2HPO_4	2.25 g	0.45 g	0.15 g
$CaCl_2$	1.00 ml	0.500 ml × 2	5.00 ml
Agar powder	3.00 g	0.600 g	0.200 g

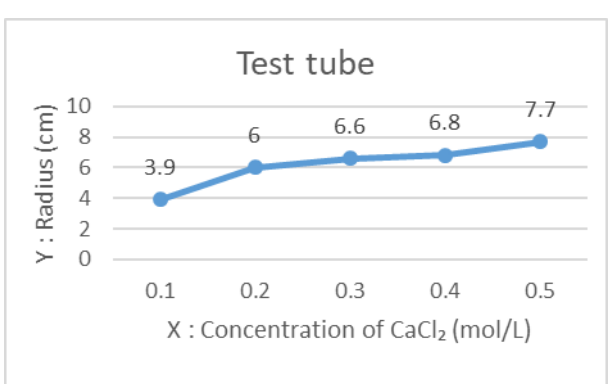

Figure 5 : Spreading of layers when using test tubes

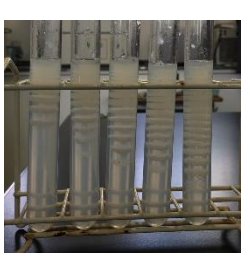

Figure 8 : State of layer spread

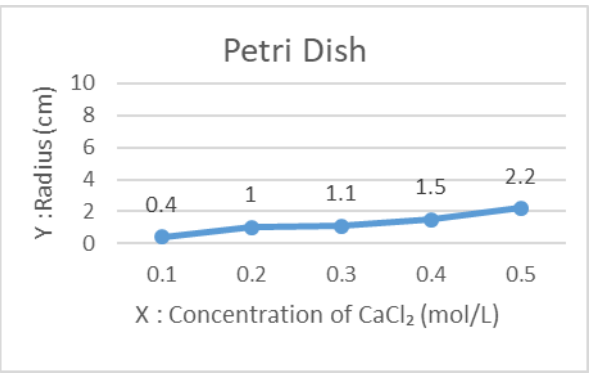

Figure 6 : Spreading of layers when using petri dishes

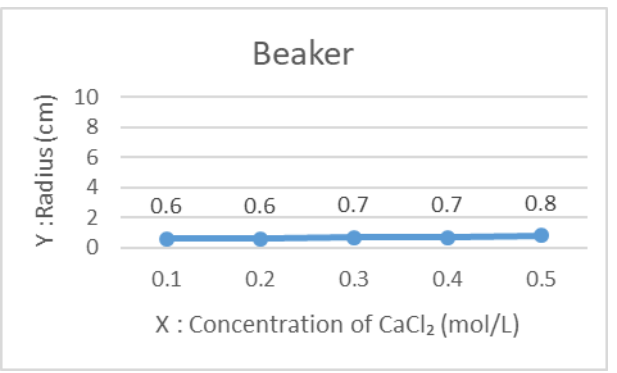

Figure 7 : Spreading of layers when using beaker

We focused on the difference in the spreading of layers among using beaker and petri dish.

→When using petri dish, the layers spread laterally, but the layers spread as a whole when using beaker. So, to expand layers when using beaker, it is necessary to increase the amount of solution.

Experiment 3. Change of layer's form when interrupt spread

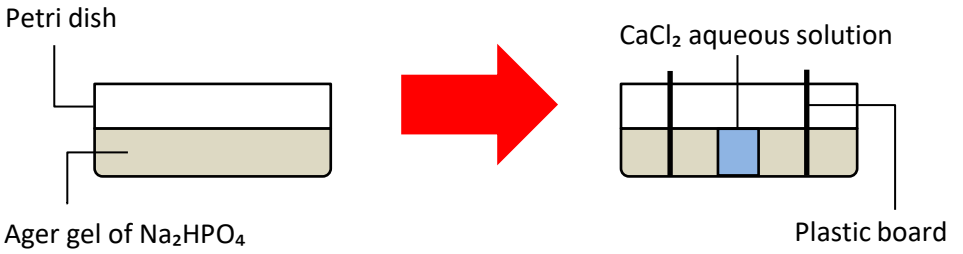

Figure 9 : Experiment ways

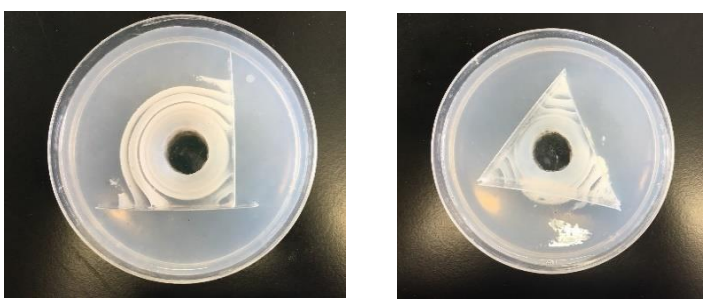

Figure 10 : Spread of layer when using plastic board

Stop spread of calcium chloride aqueous solution when using plastic board

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Change of layer's form

Conclusion

1. We were able to generate Liesegang rings using a beaker
2. In all of these experiments, spread of layers is larger when concentration of calcium chloride aqueous solution is higher
3. It is possible to change the form of layers

Future work

- To find the way to change the form of layers by modifying the solution rather than Inserting a foreign object
- To improve experimental method
  →ex) Optimizing the experimental condition
- To widen the spread of layers when using a beaker
- To research how to widen the spread of layers when using other solutions

Reference

1) 東京化学同人 「教師と学生のための化学実験」 2) https://keiji-ym.blog.so-net.ne.jp/2013-11-30
3) 仙台第三高等学校 「ゲル中での結晶作成 結晶生成の数理モデル化の可能性」