Osmosis: a "chemical garden"

Chemistry > Inorganic chemistry > Acids, bases, salts

Difficulty level	Group size	Preparation time	Execution time
easy	2	10 minutes	10 minutes

This content can also be found online at:

http://localhost:1337/c/5f56bf3e742d0c00034be33a

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Teacher information

Application

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chemical garden

In this experiment, coloured heavy metal salts are added to a sodium silicate solution. These salts precipitate as precipitation and form a plant-like structure.

The principle is based on the fact that silicates encase other heavy metal salts and form a membrane. This membrane is only for water, but not for permeable to salt ions. Therefore the concentrateson of the ions within the membrane is larger, which is why the water now diffuses through the membrane. This increases the pressure within the mambran. This breaks open, whereby salt ions escape and combine with the silicates present again a new membrane and as a result a plant-like structure is formed.

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Other teacher information (1/2)

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Prior knowledge

For the experiment it should be known that anions and many heavy metal ions form poorly soluble compounds and precipitate in aqueous solution as so-called precipitates. Furthermore, the working principle of a semi-permeable membrane, which is only permeable for one septic fluid, should be known.

Scientific principle

The silicate ions (anions) form poorly soluble compounds with many heavy metal cations. In aqueous solutions, heavy metal salts dissolve and form a shell or membrane with the silicate, which is only permeable to water but not to ions. Water therefore diffuses in, increasing the pressure within the membrane. Therefore, the formation of the "chemical garden" is the faster the more easily the heavy metal salt is soluble.

Other teacher information (2/2)

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Learning objective

This experiment shows that different salts in the silicate solution form plant-like structures. The cations of the metal salts react with the silicate anions to form a shell or membrane. This semi-permeable membrane is permeable to water, which is why the pressure inside the shell is higher than outside the shell due to the diffusion of water. The increasing pressure causes the shell to burst, with further cations escaping and forming a (further) shell again

Tasks

In this experiment the students add different heavy metal salts to a sodium silicate solution. This results in the formation of a so-called "chemical garden".

This experiment can be done independently within the topic "Properties of salts". However, it can also be used under the keyword "diffusion" or within the topic "reaction of salts with salts".

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Safety instructions




Dangers

- Heavy metal salts are harmful to health. Not swallow! Do not bring into contact with the skin!
- Wash your hands thoroughly after the test!
- Put on safety goggles during the test

For H- and P-phrases please refer to the safety data sheet of the respective chemical.

Student Information

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Motivation

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chemical garden

The formation of so-called "chemical gardens" shows very clearly how crystallization and diffusion work. The heavy metal salts added to a silicate solution dissolve in water. During this process the metal ions form with the Silicate anions poorly soluble compounds usually with characteristic coloration. In addition, plant-like structures are formed, with different colouring depending on the addition.

Tasks

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Create a chemical garden

- Make a "chemical garden" out of salt crystals here. Add metal salts to a sodium silicate solution.
- Observe how different salts dissolve in sodium silicate solution.
- Observe whether and how colour changes occur.

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Equipment

Position	Material	Item No.	Quantity
1	Iron-III chloride, 250 g	30069-25	1
2	Copper-II sulphate,cryst. 250 g	30126-25	1
3	Zinc sulphate 7-hydr. 250 g	30249-25	1
4	Manganese-II chloride,crys. 250 g	31556-25	1
5	Sodium silicate solution 500 ml	31653-50	1
6	Spatula, powder, steel, l=150mm	47560-00	1
7	Wash bottle, 250 ml, plastic	33930-00	1
8	Beaker, Borosilicate, low form, 250 ml	46054-00	1
9	Protecting glasses, clear glass	39316-00	1
10	Glass rod, boro 3.3, l=200mm, d=5mm	40485-03	1
11	Tweezers,straight,blunt, 160 mm	64610-02	1
12	Water, distilled 5 l	31246-81	1

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Set-up

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Pour about 100 ml sodium silicate into the beakersolution (top left) and approximately the same amount of distillation solution (top left).rt water.

Mixing both components well together (fig. bottom left)

Procedure

Take the sodium silicate solution (Fig. 1) and with the tweezers add a larger crystal of a salt carefully into the solution (Fig. 2). If necessary, take himthe glass rod to the bottom of the vessel. Add crystals of the other salts one after the other to the solution, make sure it's NOT right next doorlie within each other (Fig. 3)

Fig.1: Sodium silicate solution

Fig. 2: Addition of salt

Fig. 3: Growth

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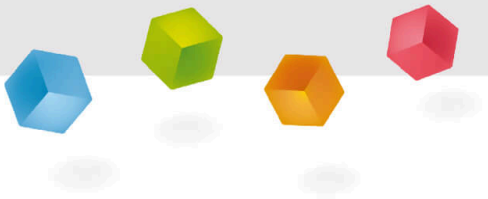

Report

Task 1

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Write down your observations

The added [ ] sink to the bottom. There a [ ] occurs, whereby from the crystals [ ] formations grow upwards. The [ ] shows that a [ ] has taken place here. Heavy metal salts react with the [ ] to form a colored solid.

- silications
- salt crystals
- chemical reaction
- plant-like
- discoloration
- color change

Check

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Task 2

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Draw the conclusions from the observations.

- ○ The sodium silicate solution itself does not contain any water
- ○ In sodium silicate solution the salts behave differently than in pure water.
- ○ Crystal growth can only be caused by negative pressure.

Check

Addition of salt crystals

Task 3

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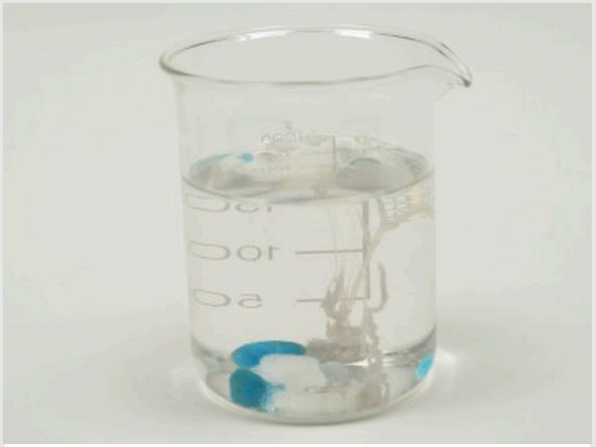
Explain the terms osmosis and diffusion on the basis of the experiment

[ ] diffuse [ ] diffusion [ ] osmosis*.

Check



chemical garden

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Slide	Score / Total
Slide 13: Observation of the salt crystals	0/6
Slide 14: Addition of salt crystals	0/1
Slide 15: Osmosis and diffusion	0/3

Total amount 0 / 10

Solutions Repeat

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