

## Teacher guide: Production of table salt from brines

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### Abstract

The students get a brine (with selected impurities) and have to develop an experimental set-up to separate the different substances from each other. The experiment should result in a clean substance (table salt) which might be used for cooking. The experimental set-up is compared to production processes in industry and evaluated.

**Discipline:** elementary chemistry

**Age group:** 13-15 years

**Time:** 90 minutes

### WoW context: Food industry

Students are introduced to the problem by showing them part of a video introducing table salt production in the Netherlands (see JOZO video until 1:00). The video is stopped when the brine arrives at the salt production company and students are faced with the problem of reproducing the processes. They are told the whole video will be shown at the end of the lesson in order to motivate them.

JOZO video: <http://www.youtube.com/watch?v=VM7HeserH0U>

### Student task:



You are an engineer at the salt production company and get the instruction to develop a process that will purify your impure salt brine.

You will get a sample of the brine and a selection of equipment. Your task is to develop a process to come up with salt that might be used in the kitchen.

### Sample brine:

The impurities in the brine can be adapted to student competence in the classroom. Depending on the competence the following substances can be part of the sample brine:

- sodium chloride (= table salt)
- sand
- stones
- calcium sulfate (solubility very low)

The choice of substances should be closely related to the students' level of competence. For elementary students, physical processes would suffice to develop an experimental set-up and discuss results. For more advanced students calcium sulfate as an impurity can be included in order to discuss how it can be chemically removed from the brine. Here, the different processes of salt production (see literature) come into play and can be compared and evaluated to the one the students conducted.

### Equipment:

Depending on the students' experimental skills, the providing of equipment to conduct experiments can be more or less scaffolded. Good groups can get the instruction to select equipment of their choice while weaker groups should get a list of material they are allowed to use (but do not necessarily have to).

A possible list can be:

For your salt production process, you are allowed to use the following equipment:

- Beakers
- Erlenmeyer flask
- Bunsen burner
- tripod
- wire gauze
- funnel
- filter paper
- ...



*Wear your eye protection!*

If you think a different device would be useful, discuss your idea with the teacher!

Depending on student skills, the list can also be filled with superfluous equipment so that students have to choose the most appropriate set-up.

### Sample lesson plan (120 min)

Time	Activity	Social mode
10 minutes	Introduce the problem and show the first part of the video (until 1:00); students are allowed to ask questions and discuss their impression	Whole class
5 minutes	Students get their task and are introduced to the equipment they can use Safety issues are mentioned (e.g., goggles while using burner)	Teacher
15 minutes	Students plan the investigation	Student groups
15 minutes	Group discussion on the different experimental set-ups; is the set-up ideal and do all groups know how to go on?	Whole group
20 minutes	Students conduct their experiment	Student groups
20 minutes	Presenting process and findings Follow-up questions	Whole group
5 minutes	Watching the rest of the video	Whole group
15 minutes	Students discuss and evaluate their process to the one that was presented in the video	Student groups
15 minutes	Evaluation of processes What else can be done?	Whole group
HW	Students are supposed to read a text on different production processes (solar salt etc.)	

## Alternatives: Production of table salt from rock salt

### Abstract

The students get ground rock salt (with selected impurities) and have to develop an experimental set-up to separate the different substances from each

other. The experiment should result in a clean substance (table salt) which might be used for cooking.

### **WoW introduction:**

Students are introduced to the question by making them – as scientists - responsible for helping a small village producing table salt. The way salt is industrially purified is only given as an application at the end (see chocolate chip cookie).

### **Literature:**

Westphal, G. et al. (2010). Sodium Chloride. In: *Ullmann's Encyclopedia of Industrial Chemistry*. Wiley-online.

Sedivy, V. M. (1996). Purification of salt for chemical and human consumption. Received from <http://krebs-swiss.com/salex.pdf> (16 January 2014).

### **Other sources:**

JOZO image on student task retrieved from <http://www.ah.nl/appie/producten/soepen-conserven-sauzen-smaakmakers/kruiden-en-specerijen/merk=Jozo/zout>