Production of polystyrene foam (Styropor foam)

(Item No.: P7182000)

Curricular Relevance

Area of Expertise: Chemie
Education Level: Klasse 10-13
Topic: Organische Chemie
Subtopic: Polymerchemie
Experiment: Herstellung von Styroporschaum

Difficulty	Preparation Time	Execution Time	Recommended Group Size
Intermediate	10 Minutes	20 Minutes	2 Students

Additional Requirements:

Experiment Variations:

Keywords:

polymers, polystyrene foam

Task and equipment

Information for teachers

Learning objectives

- Suitable plastics are pre-polymerized in granular form, which can be further processed to basic material or similar products later.
- A foamed plastic can be easily produced by addition of highly volatile substances during the polymerization.

Notes on set-up and procedure

Tea-balls (tea-eggs) are particularly suitable as metal form, which should be greased carefully with silicone grease or silicone oil (fluid). The resulting foam is then relatively easy to remove, so that the tea-eggs can be reused for further experiments. With a bit aged styrofoam P it might be necessary to boil the granulate material directly in water, since the sole heating up of it in water vapour is not enough to achieve optimal results.

Hazards

- When heating water splashes can occur. Wear protective glasses!

Remarks on the students' experiments

Make sure that the produced foam has cooled down sufficiently before you begin with its examination.

Notes

The processing technology shown in this experiment is often applied industrially. The propellant agent containing polystyrene beads (diameter 0.5 - 2 mm) must be prefoamed by stirring it in steam at 105 °C and 0.2 bar, and afterwards postsintered at 100 °C to form a foamed plastic with close cell structure. The volume of the starting substance increases hereby between 20 and 80 times of the initial volume. The foamed plastic has a density between 13 and 30 kg/m^3.

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Remarks on the method

The experiment leads to a well-known product, whose applications can be treated in more detail. Here, the economic, but also the ecological importance of packaging materials can be picked out as a central theme. In this context is recommended to pick out the difference between the "physical" propellants used for this experiment and the blowing gases formed during a polymer reaction as a central theme.

Waste disposal

Put the shaped foam in the normal waste.

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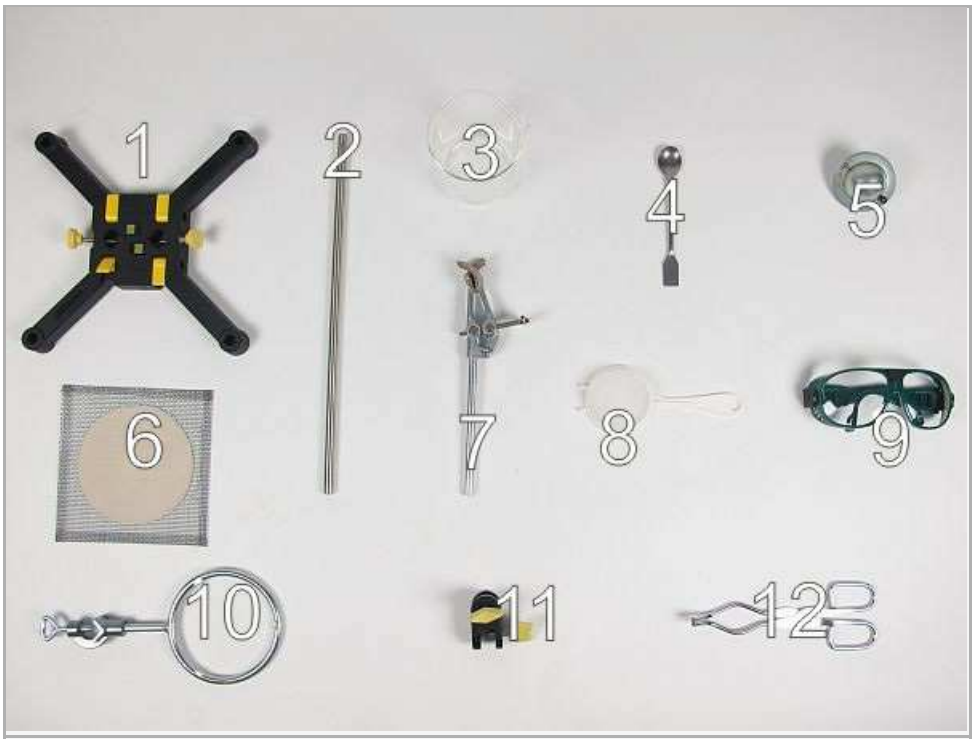
Task and equipment

Task

How can polymers be further processed? (3)

Produce polystyrene foam from polystyrene beads.

Equipment



Position No.	Material	Order No.	Quantity
1	Support base, variable	02001-00	1
2	Support rod, stainless steel, l=370 mm, d=10 mm	02059-00	1
3	Glass beaker DURAN®, short, 400 ml	36014-00	1
4	Spoon, special steel	33398-00	1
5	Mold, spherical, diameter 40mm	35033-00	1
6	Wire gauze with ceramic, 160 x 160 mm	33287-01	1
7	Universal clamp	37715-00	1
8	Sieve, fine mesh, d=60 mm	40968-00	1
9	Protecting glasses, clear glass	39316-00	1
10	Ring with boss head, i. d. = 10 cm	37701-01	1
11	Boss head	02043-00	1
12	Crucible tongs,200mm,stainl.steel	33600-00	1
	Butane burner f.cartridge 270+470	47536-00	1
	Butane catridge CV 300 Plus, 240 g	47538-01	1
	Silicone oil 500 ml	31849-50	1
	Boiling beads, 200 g	36937-20	
	Styropor P, 250 g	48492-25	
Additional material			
	Tap water		

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Set-up and procedure

Set-up

Hazards

- When heated water splashes can occur. Wear protective glasses!

Set-up

Set up a stand with the support base and the support rod as you can see in Fig. 1 to 4.

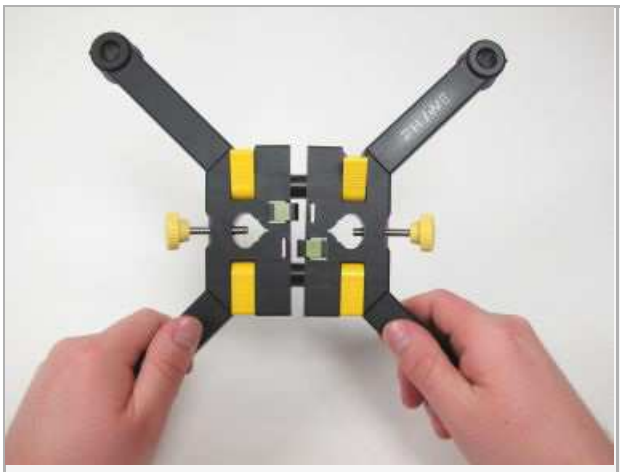

Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fill two thirds of the beaker with water. Fix the sieve in the universal clamp (Fig. 5) and add some boiling stones (Fig. 6).


Fig. 5


Fig. 6

Bring the water to boiling, then adjust the burner so that the water continues to boil gently (Fig. 7).


Fig. 7

Procedure

Procedure

Put three spoons of styrofoam P and leave it steaming for approximately 15 min (Fig. 8).

Fig. 8

Grease the spherical mold with silicone oil (Fig. 11), add the pretreated styrofoam P (Fig. 12) and close the spherical mold (Fig. 13). Take the spherical mold by means of the crucible tongs and introduce it into the hot water in the beaker (Fig. 14), heat it up for another 10 min so that it boils gently.

Fig. 9

Fig. 10

Fig. 11

Fig. 12

Hold the spherical mold with the crucible tongs and rinse it under cold water until it has cooled down. Take the resulted shape out from the spherical mold. Grease the spherical mold anew, and add three spoons of untreated styrofoam P and heat it up once more for 10 min as above.

Cool the spherical mold under cold water, take out the resulting styrofoam shape, and compare both styrofoam shapes with each other.

Waste disposal

Put the shaped foam in the normal waste.

Report: Production of polystyrene foam (Styropor foam)

Result - Observations

Write down your observations in general form.

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Evaluation - Question 1

Draw the conclusions from your observations.

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Evaluation - Table 1

Mention the differences between the two resulting foamed shapes in tabular form.

	Pre-foamed polystyrene	Untreated polystyrene
Appearance	1	1
Structure	1	1
Density	1	1

Evaluation - Question 2

Styrofoam P is a pre-polymerized polystyrene, which contains small quantities of pentane. Determine the boiling point of pentane, and explain the process which has taken place.

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Evaluation - Question 3

Mention possible applications for the produced foam material.

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