

Uniform and dry SiO₂ beads

Encapsulator B-390 / B-395 Pro: Manufacturing of dry spherical monodisperse SiO₂ beads with a size of 430 μm

Spherical and uniform beads were produced by encapsulation of nano SiO₂ within a Ca-alginate matrix in this application note the Encapsulator and the Rotavapor® were used for obtaining the dried beads.

Table 2: Rotavapor® R-300 settings for drying the beads.

Mode	Dry
Solvent	Ethanol absolute
Water bath temperature	60 °C
Condensation temperature	5 °C
Vacuum	50 mbar
Rotation speed	200 rpm
Rotation interval	10 s
Drying time	30 ~ 40 min

1. Introduction

SiO₂ among other oxides such as Al₂O₃, TiO₂ and ZrO₂, are common raw materials used in materials field [1]. In the manufacturing process, granulation is one of the important steps.

Using this encapsulated technique, the particle size of the final beads can be varied in the range between 300 and 1000 μm.

2. Equipment and chemicals

Equipment:

Encapsulator B-390 or B-395 Pro
Hand blender
BUCHI Rotavapor® R-300

Chemicals:

SiO₂ powder, Low viscosity sodium alginate, Calcium chloride dihydrate, Ethanol absolute

3. Procedure

3.1 Production of SiO₂ beads

A 2 % (w/w) sodium alginate and a 0.25 M CaCl₂ aqueous solution were prepared. Sodium alginate was dissolved using a hand blender.

Subsequently, 10 g SiO₂ powder was carefully added to 290 g of 2 % alginate solution and dispersed using a hand blender again. Bubbles in the prepared soultuions are removed by sonication in an ultrasonic bath. The mixture was processed quickly on the Encapsulator B-390 or B-395 Pro (Table 1). The wet microbeads were hardened during 30 min.

Table 1: Encapsulator process settings.

Nozzle set	Single-flow nozzle: 300 μm
Feeding rate	12.5 mL / min
Vibration frequency	350 Hz
Electrode tension	0 V
Amplitude	3
Hardening bath	0.25 M CaCl ₂ solution, gently stirred

3.2 Drying of SiO₂ beads

The wet beads were dried using a Rotavapor® (Table 2). The beads were collected, rinsed with distilled water and resuspended in some ethanol. Ethanol was used to decrease the drying time.

4. Results

Dry and spherical beads with a diameter of 430 ± 35 μm, as shown in Figure 1, were produced. In the final particles, a low alginate content of only 36 % by weight is reported and might be completely removed, for instance in a calcination process.

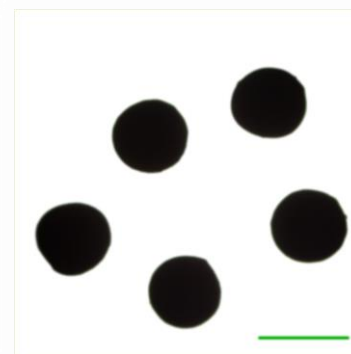


Figure 1: Light microscope image at 40× displaying dried SiO₂ beads with a green 500 μm green scale bar. The beads size were 430 ± 35 μm

5. Conclusion

This Short Note highlights the production of SiO₂ beads having an average diameter 430 μm. A novel granulating technology using the BUCHI Encapsulator B-390 or B-395 pro was successfully applied.

6. Reference

[1] BUCHI Labortechnik, best@buchi no.69, Advanced Materials.

For more detailed information and safety considerations please refer to the Application Note No. 247/2016.