

Production of uniform and dry paramagnetic beads

Encapsulator B-390 / B-395 Pro: Manufacturing of dry spherical monodisperse paramagnetic beads having a size of around 300 μm at laboratory scale

Uniform paramagnetic microbeads were produced by encapsulation of iron oxide within a Ca-alginate matrix using the Encapsulator B-390 / B-395 Pro. The average size of the dry beads was 293 μm .

1. Introduction

Paramagnetic microbeads and microcapsules could be applied for example in catalysis or for medical use [see 1 and refs. therein].

Using the described technique, the particle diameter of the dry beads can be varied in the range between 200 and 1000 μm .

2. Experimental

Equipment: Encapsulator B-390 / B-395 Pro, single-flow nozzle set, magnet holder extension, hand blender, Laboratory fluidized bed dryer.

Chemicals and Materials: The aqueous sample contained 15 % (w/w) magnetite powder and 1.275 % (w/w) sodium alginate. Sodium alginate was dissolved using a hand blender before dispersing the magnetite. The hardening solution was an aqueous 0.1 M CaCl_2 .

Alginate microspheres were produced applying a single-step procedure using the Encapsulator.

Table 1: Encapsulator process settings.

Nozzle set	Single-flow nozzle with extension: 300 μm
Feeding	Pressure bottle
Pressure (for feeding)	1000 mbar
Vibration frequency	670 Hz
Electrode tension	2370 V
Amplitude	3
Hardening bath	0.1 M CaCl_2 solution, gently stirred

After connecting the sample feed line, the stirrer, vibration, electrode tension and pressure parameters were set and activated as listed in Table 1.

Subsequently, the beads were dripped into the stirred CaCl_2 solution and hardened during 30 min.

The beads were collected and rinsed three times with distilled water. In a second step, the freshly produced beads were dried. The drying process was performed using a GEA STREA-1 fluidized bed dryer.

3. Results

Spherical and monodispersed microbeads were obtained (Figure 1). The average volumetric diameter was determined to 293 μm (Figure 2) by a Horiba laser scattering particle size distribution analyzer LA 950.

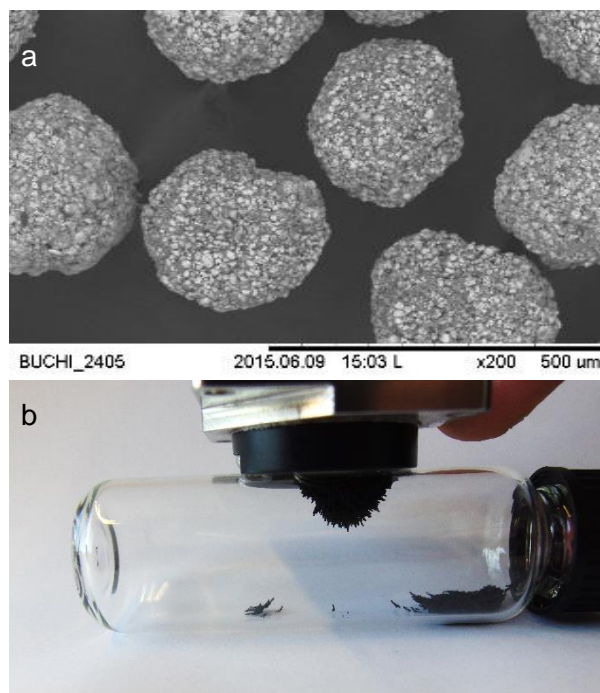


Figure 1: Final beads under a scanning electron microscope (a) and demonstration of paramagnetism (b).

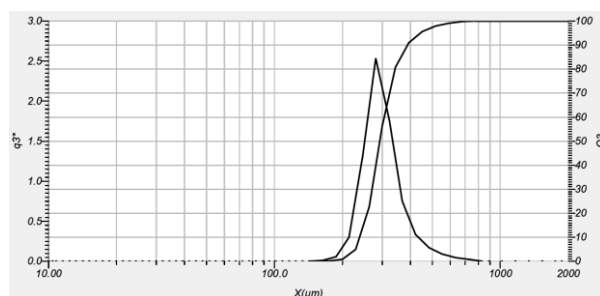


Figure 2: Relative ($q3^*$) and cumulative ($Q3$) volumetric distribution of final beads.

4. Conclusion

With the BUCHI Encapsulator B-390 / B-395 Pro, spherical, monodispersed and paramagnetic Ca-alginate microbeads in the size range of 300 μm were successfully produced.

5. References

[1] BUCHI Application Note: AN 207/2016

For more detailed information and safety considerations please refer to the Application Note No. 207 /2016.