Cellulose aerogels shaping and properties for tailored applications

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Bio-aerogels are a new generation of porous materials made from polysaccharides. They show high porosity (> 90 %), high specific surface area (200 – 500 $m^2.g^{-1}$) and low density (around 0.1 $g.cm^{-3}$). All these properties place them as good candidates for multiple applications in diverse fields such as drug delivery systems for medical applications or thermal insulating materials in buildings. Thus far, most of the produced aerogels were shaped in form of monoliths of a few cubic centimetres of volume for easy handling in laboratory preparations. However, several applications have specific requirements in terms of shape and size and aerogels should more often be shaped as beads or particles. In addition, all steps of the process (solvent exchange, drying) are much quicker when samples are of sub-millimetre size.

The challenge of our work was to produce cellulose aerogel beads of different sizes, from few microns to few millimetres, and study their structure and properties. Hence, we have explored different techniques to make cellulose beads: from the simple "dropping" technique to the more advanced emulsion method as well as the larger scale Jet-Cutting. The limitations and advantages of each method will be discussed.

Cellulose solvent as well as preparation conditions were adapted for each shaping technique. Cellulose beads size varied from few microns to few millimetres and their properties were similar to those of monoliths': low density (from 0.04 to 0.1 $g.cm^{-3}$) and high specific surface area (up to 450 $m^2.g^{-1}$).

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