“Drying of aerogel particles and beads in lab and pilot scale”

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Supercritical drying of gels allows to preserve their structural properties and to convert them in an aerogel form. This process is well established for aerogel monoliths and gel-textile composites, being however often a time-limiting step during their production. In the last decades interest has grown in the production of aerogels in form of particles of a given size. Therefore, supercritical drying should be extended for particulated aerogels. Since the diffusion and mass transfer depend on the size and the shape of the particles as well as on the position of the particles in the apparatus, optimal process conditions for supercritical drying of particles are significantly different as those for monoliths. At the same time, not only organogels (pore solvent is an organic solution) but also hydrogels (pore solvent is water) are considered to be potentially interesting for aerogel production. In case of hydrogels an additional step, a solvent exchange is needed, since the water is not a suitable solvent for supercritical drying. Thus, in this work different strategies for the solvent extraction from hydrogel particles of different origins are investigated on bench and pilot scales (50L; >500 Liter). Thereby both the processes of the solvent exchange (water to ethanol) and the drying itself (ethanol to CO_2) are discussed. Thereby the focus lies on the scalability of the process and the influence of the particle size and flow conditions on the overall processing time of aerogels. In particular, practical aspects of the solvent exchange and supercritical drying at larger scale are discussed.

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