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# From the printer to the lungs: Inkjet-printed aerogel particles for pulmonary delivery

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## Abstract

Inkjet printing is as an emerging technique in the biomedical field offering cost-effective solutions for flexible production and the engineering of personalized medicine solutions. Thermal inkjet printing technology in the “drop-on-demand” mode allows the design of fully automated deposition patterns with high spatial resolution for applications ranging from microparticles in drug formulations to cell deposition in regenerative medicine. In particular, novel formulations in the form of porous particles are sought for the treatment of respiratory disorders and the systemic administration of bioactive compounds using the pulmonary route. Aerogel particles, i.e. highly porous and light-weight nanoporous powders, are particularly promising as carriers for the pulmonary route. In this work, the preparation of aerogel microspheres by thermal inkjet printing followed by supercritical drying is presented for the first time to overcome the current processing limitations. Alginate aerogel particles were loaded with salbutamol sulphate, a bronchodilator used for the treatment of asthma attacks and chronic obstructive pulmonary disease, as a model drug for sustained pulmonary delivery. The optimized processing method allowed the preparation of reproducible nanostructured

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