Prediction models for shape and size of ca-alginate macrobeads produced through extrusion–dripping method

Abstract

The aim of this work was to develop prediction models for shape and size of ca-alginate macrobeads produced through extrusion–dripping method. The relationship between the process variables on the shape and size of the alginate drops before and after gelation was established with the aid of image analysis. The results show that a critical Ohnersorge number (Oh) > 0.24 was required to form spherical beads. The shape transition of ca-alginate beads could be typically distinguished into three phases along the collecting distance and it was affected by the combined influence of the solution properties, the collecting distance and the drop size. Mathematical equations and a master shape diagram were developed to reveal a clear operating region and the overall process limits within which spherical ca-alginate beads could be formed. In terms of bead size, the overall size correction factor (K) which accounted for the liquid loss factor (kLF) and the shrinkage factor (kSF), varied between 0.73 and 0.85 under the experimental conditions. The size prediction model correlated well with the experimental data. The approach and the outcome could be used as a model to develop prediction tools for similar bead production systems.