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ABSTRACT

A prime interest in 3D food printing consists of controlling the texture of food products by means of structure design. Analytical and finite element models were used to predict the texture properties of printed honeycomb structures. Structures with varying cell size were 3D printed using food-inks composed of three different pectin concentrations and characterized with micro-CT and compression analysis. Porosity and average wall thickness of the samples appeared independent of food-ink composition but structure deviations could be distinguished between actual printed structures and CAD designs. The comparison between the texture properties of printed structures and those predicted by analytical and FE modelling in function of porosity showed that both predicted and actual texture properties matched to the same decreasing trend with increasing porosity. Finally, a good fit of the analytical model to the measured Young's modulus was obtained by using the actual porosity of the printed structures, while the validated finite element model provides a means to design more complex structures. The results emphasize the importance of structure correspondence for reliable design of texture properties of printed food structures.

Keywords: additive manufacturing; cellular food; texture; 3D food printing; model-based design

1 INTRODUCTION

Food Layer Manufacturing, generally referred to as 3D food printing (3DFP), combines additive manufacturing (AM) with traditional food processing in order to create new food products with