Zhiguo Li et al., J Food Process Technol 2015, 6:8
http://dx.doi.org/10.4172/2157-7110.S1.023

OMICS International
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4th International Conference and Exhibition on
Food Processing & Technology
August 10-12, 2015 London, UK

Multiscale geometrical modelling of tomato fruit, why and how?

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It would be scientifically and commercially valuable to understand how external mechanical damage to fruit causes internal cellular damage and other changes that lead to bruising. This requires multi-scale geometrical modelling and FEA simulations linking the macroscopic (whole fruit) scale through the mesoscopic (tissue) scale to the microscopic (cellular) scale. As a first step in such modelling, the anatomical characteristics of a commercial tomato variety were reviewed. Subsequently, some key technologies to simplify an anatomical model of a real tomato fruit for geometrical modelling are discussed in detail. It mainly includes: 1. What components should be included in a multiscale geometrical model of whole fruit? 2. How to create the asymmetric and irregular structure and curved contour line of fruit at different scales, 3. How to connect the boundaries between different tissues in a whole fruit models, 4. How best to represent the cells in specific tissues, this relates to the vibration in tissue thickness, cell size, shape and arrangement, cell wall thickness and protoplast and 5. How to handle the effect of locular cavity and some spaces between the cells on the simulation results in FEA. In summary, it is important to simplify an anatomical model of a real tomato fruit for geometrical modelling. A more complex model might be more accurate but take a long time to compute using FEA. Using these new simplifications a potential improvement in model accuracy would be achieved within existing computing power. Those simplified methods might also be suitable for geometrical modelling of other fruits.

Biography

Zhiguo Li has completed his PhD from Jiangsu University and is carrying out Postdoctoral studies of Marie Curie Research Fellow from School of Chemical Engineering, University of Birmingham. His research interest focuses on the evaluation and prevention of mechanical handling damage of fruits and vegetables. He has published 26 papers in reputed journals (cited 141 times) and been authorized 4 national invention patents. He was invited to be reviewer of 14 international journals in food engineering and Editorial Board Member of 2 open access journals.

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