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**FUNDAMENTAL RHEOLOGICAL PROPERTIES  
OF PROCESSED CHEESE SLICES**

144  
6037

**A THESIS PRESENTED IN PARTIAL FULFILMENT OF  
THE REQUIREMENTS FOR THE DEGREE OF MASTER  
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To my wife, Rebecca, and  
my daughter, Dorothy

## **ABSTRACT**

Fundamental rheological properties of two types of processed cheese slices, Individually Wrapped Slices (IWS) and Slice On Slice (SOS), produced under different process conditions, were determined. Shear creep, shear stress relaxation, dynamic impulse measurements and confocal laser scanning microscopy were used to determine the rheological properties and the texture of processed cheese slices. The shear creep, the shear stress relaxation and the dynamic impulse halfsquare measurements were carried out using an Instron Universal Testing Machine. A Texture Analyser TA.HD was used for the shear stress relaxation measurements. Comparison of shear stress relaxation results between the two instruments showed agreement.

The shear creep compliance of IWS cheese show higher values than that of SOS cheese at 21°C. On the other hand, the shear stress relaxation moduli indicated lower values for IWS cheese than SOS cheese at 21°C. This indicated that IWS cheese was more liquid-like than SOS cheese though there are no significant compositional differences. Higher shear creep compliance is related to less resistance of the cheese to deformation while lower shear stress relaxation modulus indicates less resistance to deformation. These results are also in agreement.

The melting properties of the two types of slices were studied with dynamic impulse measurements. IWS cheese melted at a lower temperature (50°C) than SOS cheese (60°C). Microscopic structure indicates more protein-protein interaction in SOS cheese than IWS cheese, which had smaller fat globules evenly distributed within the protein network, thereby reducing the protein-protein interaction and making the network integrity weak, thus confirming the shear creep and shear stress relaxation findings.

The rheological and textural differences between the two cheeses were attributed to different process conditions used during the cheese manufacture. These different process conditions are the heating temperature and time combination and the cooling rate. The comparison of static measurements, the dynamic measurements using small deformations

and the microstructure to determine the properties of processed cheese is a useful tool to determine the effects of different process conditions. It might enable the choice of those desired process parameters such as temperature-time combination and cooling rate for various processed cheese types.

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