Large Amplitude Oscillatory Shear: Analysis of Puff Pastry Margarine Fat Crystal Network

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Puff pastry margarines necessitate a careful balance of elasticity and viscosity to ensure optimal lamination and baking results. Traditional quality control techniques—including Solid Fat Content (SFC) measurement, hardness evaluation, and the 'thumb test'—frequently fall short, as they do not account for subtle structural variations that significantly affect product performance. This study utilizes Large Amplitude Oscillatory Shear (LAOS) as an advanced and comprehensive means of characterizing the complex rheological properties intrinsic to puff pastry margarines. Margarines were subjected to controlled processing and tempering adjustments to introduce minor but significant changes in their internal structure. LAOS exhibited enhanced sensitivity in identifying these differences, particularly by revealing critical nonlinear viscoelastic behaviors at higher harmonic frequencies that conventional methods cannot detect. The application of refined LAOS data analysis provided detailed insights into the microstructure of the fat network.

Comparative analysis confirms the effectiveness of LAOS in distinguishing nuanced structural differences in margarine (fat crystal network), establishing it as a robust for advanced quality control within the fat and oil industry. This research presents the methodology, findings, and development of LAOS data analysis, advocating for the inclusion of advanced rheological approaches in routine assessments of complex food systems such as puff pastry margarine.