



STUDY OF THE EFFECT OF FREEZING ON THE VISCO-ELASTIC PROPERTIES OF STRAWBERRIES



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Consumers demand:

Attractive food products

Easy to prepare

Nutrition balanced

Industry response:

New processes/products

Optimisation of existing processes

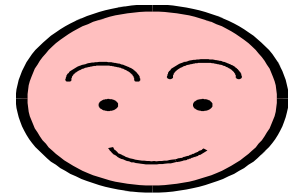
Extended shelf-life



INTRODUCTION

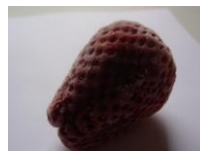
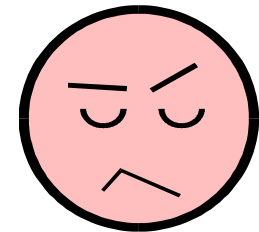
Freezing is a common and simple method of food preservation:

Maintaining some of its original characteristics



Delays food deterioration and growth of microorganisms

Affects texture due to cellular damage caused by
ice crystals growth



INTRODUCTION

Texture is a very complex property:

Food characteristic associated with fracture and particle size

Plays a basic role in food appreciation and perceived characteristics

Consumers perceive products' texture attributes during consumption using

mechanical

tactile

visual

and auditory receptors



INTRODUCTION

It is not possible to quantify consumers perception with rheological studies

Results from rheological experiments can be used to explain structure changes occurring when a food product is submitted to different processing conditions



INTRODUCTION

Dynamic mechanical testing may provide some clues of analogies between food physical properties and human sensory evaluation

Viscoelastic behaviour is usually assessed

Linear Viscoelastic Region

Storage modulus

Loss modulus



Characterise the visco-elastic properties of strawberries and study the effect of freezing in such properties



Materials and Methods

Sample preparation

Fragaria ananassa strawberries, acquired in a local market

Frozen in a blast and fluid bed freezer at -30°C for 1 hour

Stored at -30°C in freezing chambers

(Storage temperature was selected based on previous studies)

Samples were cut in small cylinders (1.5cm x 1.5cm)

Left to relax for 1 hour at room temperature



Rheological measurements

Fresh strawberries

after freezing (day 0)

during storage time (days 7, 14, 21, 29, 35 and 49)

Three replicates analysed for each condition

Equipment: Dynamic Mechanical Analyser

Testing Temperature: 20°C

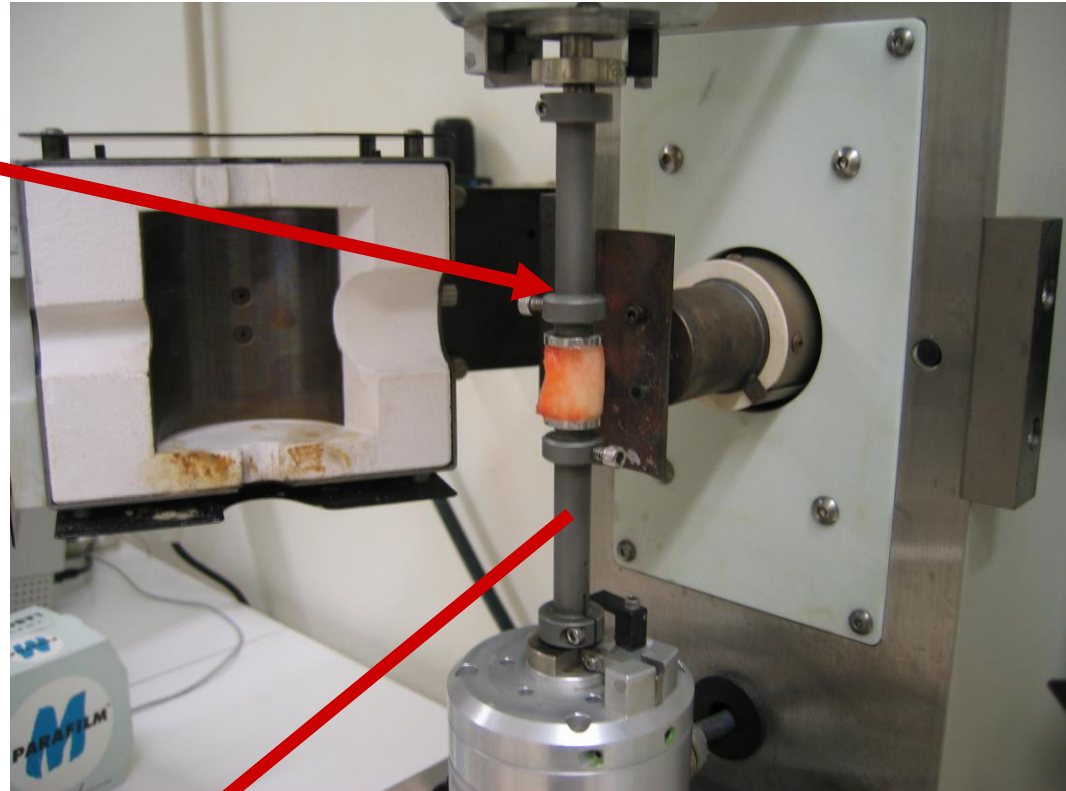
Geometry: parallel plates (ϕ 1.5 cm)



Rheological measurements

Rheometrics® Solid Analyser II

Oscillatory strain applied to the sample.



Resulting sinusoidal stress of the sample measured



Rheological measurements

Evaluation of the linear visco-elastic region

Determination of the strain



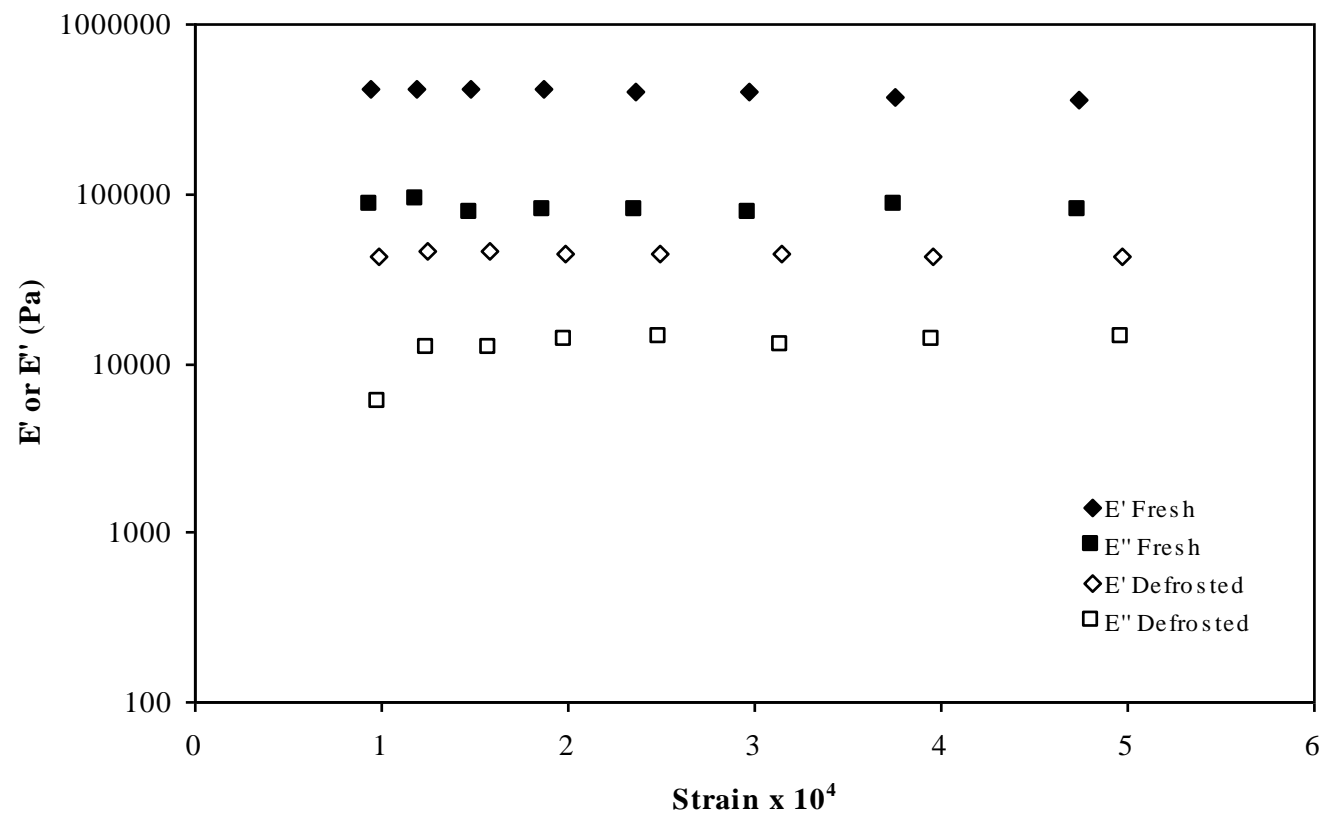
Evaluation of frequency dependence behaviour

Dynamic strain sweep test
(frequency: 1 Hz)

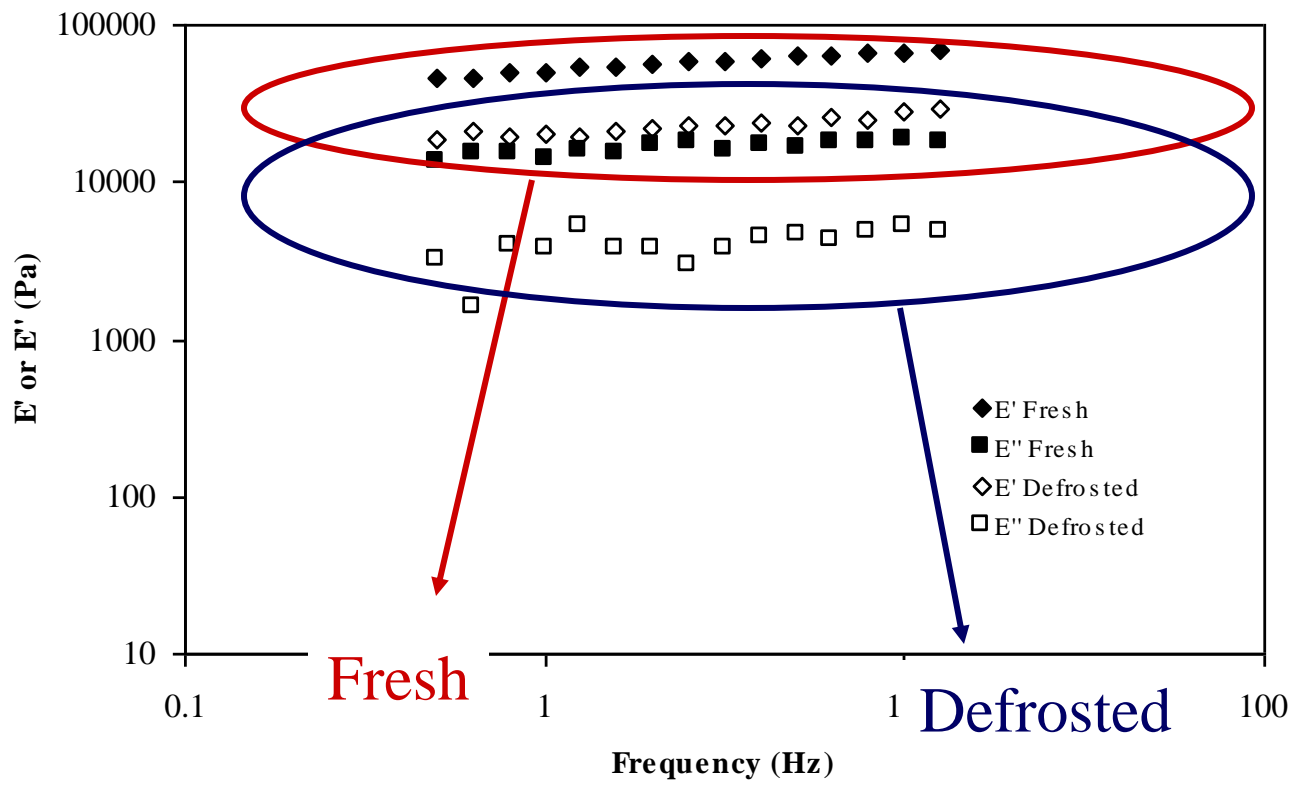
Dynamic frequency sweep test
(strain: 2.5×10^{-4})



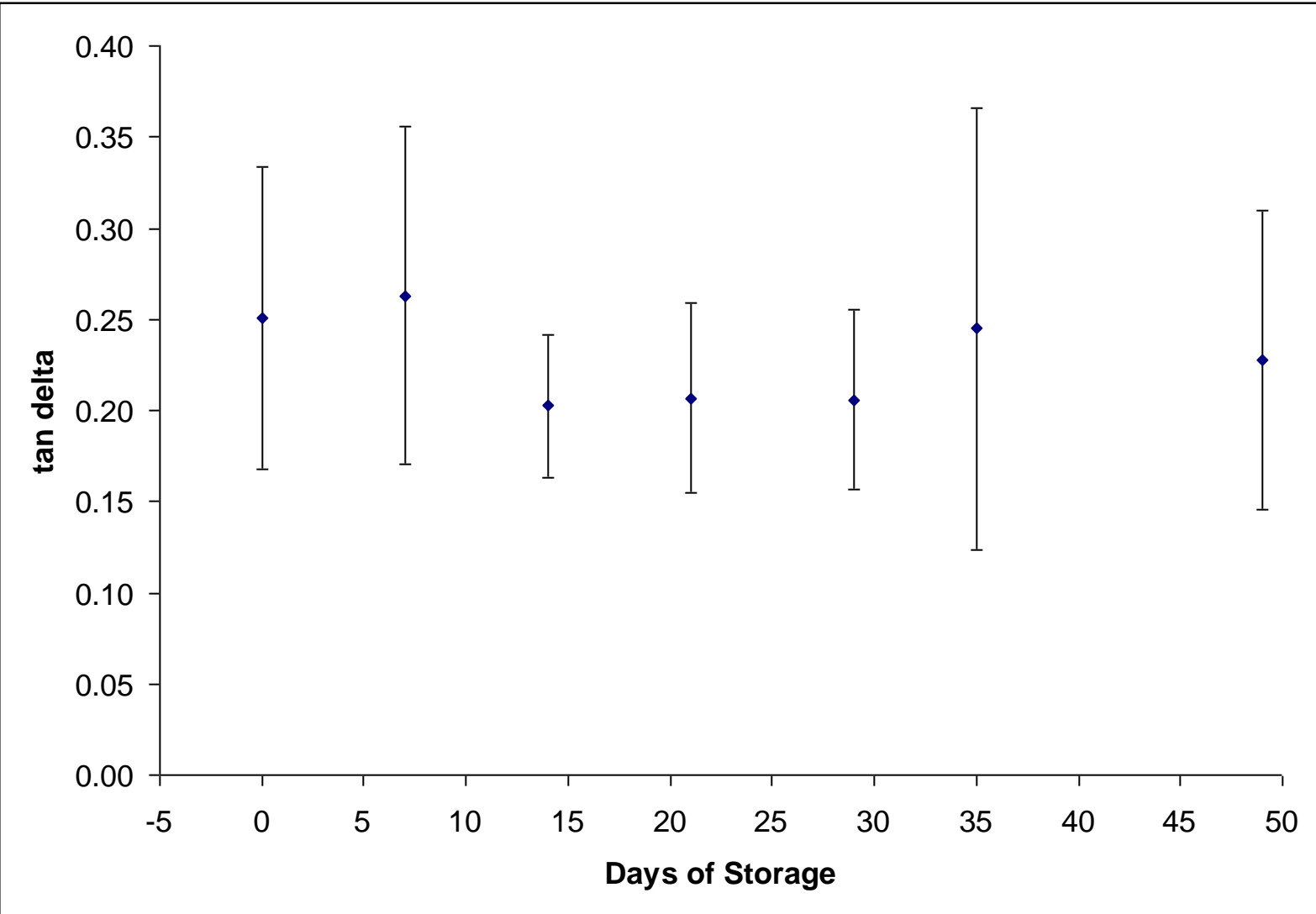
Results and Discussion



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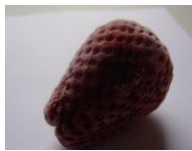
Conclusions

Strawberries' characteristics resemble behaviour closer to a solid material.

Although, the “solid like” characteristic is maintained, the freezing process greatly affects the visco-elastic properties of strawberries.

After freezing, a decrease in E' and E'' was observed, which can be related with the visual observation of softening and lost of firmness.

During frozen storage at $-30\text{ }^{\circ}\text{C}$ no significant changes occurred in the samples visco-elastic behaviour.





Thank you for your attention!