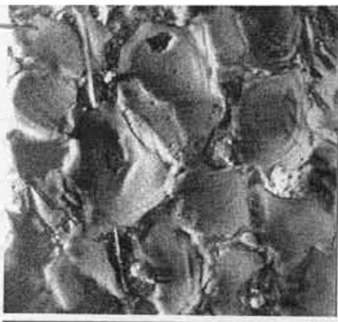

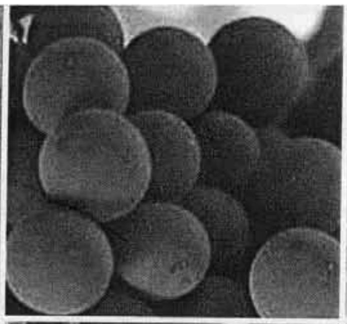

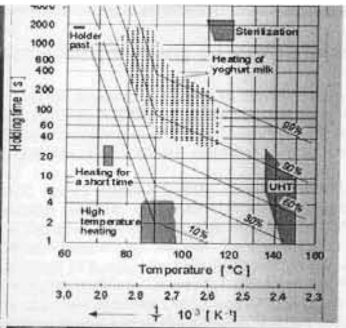

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P01

MOISTURE TRANSPORT AND PREDICTION OF AIR RELATIVE HUMIDITY IN REFRIGERATED FACILITIES

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Air relative humidity (RH) affects the rates of product evaporative weight loss and condensation/frosting on air cooling coils and other surfaces in refrigerated facilities. Product weight loss is an economic cost, condensation and frosting on surfaces such as floors lead to safety and productivity problems, while frosting on coils reduce their performance and necessitate regular defrost.
The objectives of this paper are to present a methodology to predict air RH in refrigerated facilities and to show the use of this methodology to optimise RH via a case study.
Air RH is determined by the balance of moisture entry into and removal from the air in a coolstore. Existing quantitative methods to predict the latent (moisture-based) heat loads due door air infiltration, sorption by packaging, dehumidification by the air cooling coils, product weight loss and miscellaneous mechanisms were combined into an integrated moisture transport model. The methodology was implemented and solved iteratively using standard Excel™ spreadsheets.
A coolstore for horticultural products with a loading dock was analysed as a case study. It was found that to increase RH, sensible heat loads (such as conduction through insulation and fan power) and the air to refrigerant temperature difference should be minimised and latent heat loads maximised, and vice versa to reduce RH. Active humidification (e.g. steam injection) or dehumidification (e.g. desiccants) should only be used as a last resort.
Refrigeration of food remains one of the best food preservation methods in terms of cost-effectively retaining "as fresh" quality attributes. While temperature control in the cold chain is paramount, increasingly control of RH is being considered important for the design and operation of cold chain facilities. This paper shows that structured, fundamental engineering approaches can be applied to this issue in order to optimise the cost-benefit of coolstore design and operational options.

N02

ESTIMATION OF THE ACTIVATION ENERGY BY DMTA: AN ORIGINAL APPROACH FOR CONSIDERING BIOLOGICAL HETEROGENEITY

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Among parameters used for process modelling, the activation energy (E_a) is an important thermo-physical criterion. If the differential scanning calorimetry (DSC) is generally considered as a reference to gauge E_a during both reversible and irreversible reactions, it induces a systematic misjudgement due to the local sampling, on the evidence of the biological heterogeneity
The aim of this work consists in applying an original nonisothermal dynamic approach to globally estimate Ea during the irreversible gelatinisation process. The method implies cooking samples of banana plantain using the dynamic mechanical thermoanalysis (DMTA).
Weatherproofed 17mm cylinders of 'Harton' plantain (*Musa* spp. AAB group) between parallel plates are submitted to a uniaxial sinusoidal stress (500 and 450 mN as static and dynamic forces, respectively) at constant 1 Hz frequency. The corresponding strain responses are recorded at different heating rates β (7.5 to 20°C min^{-1}). The loss tangent damping factor is normalised by analogy with DSC computation procedure and stated under the Arrhenius form. Prior to the resolution using the extent of reaction α, data are smoothed using a cubic spline. For comparison, a DSC dynamic approach is applied by performing multiple micro-samplings into two distinct areas corresponding to DMTA pulp specimens. Data are similarly numerically computed. Both apparatus lag temperatures at different β rates are corrected with a pure indium standard.
At α=0.05, the DSC results showed a 13% maximum variation in E_a depending on sampling area. No significant differences were observed above α= 0.4. The plantain water gradient may explain such differences in regard to well-known relationship between Ea and water content. In addition, the dependence of E_a on α for both DSC and DMTA suggested the evidence of a complex multi-step process. A maximum 5% difference in E_a estimate was observed between DMTA and DSC in the 0.15-0.7 α range. Higher variations at the end of the complex reaction (ΔE_a <30 KJ mol^{-1}) were probably due to some undesirable shrinkage and to the difference between temperatures of DMTA thermocouple and samples.
The original DMTA approach was suitable to globally estimate E_a at a given conversion extent, independently of the reaction model.

N03

MODELLING THE TEMPERATURE DEPENDENCE OF COLOUR CHANGE IN TOMATOES

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The prediction of quality changes in horticultural products can be used in the design and evaluation of postharvest handling, grading and supply chains to optimise the value of the product passing form the grower to the consumer. As temperature is a key variable determining quality, an important component of quality change models is the accurate description of the influence of temperature on a given quality parameter.
The objective of this work was to develop and compare mathematical models to describe literature data relating to colour change of tomatoes. Tomatoes were selected given their value as a major horticultural crop and the range of experimental data available reporting the influence of temperature on colour and other quality parameters. An extensive literature review was conducted and rates of colour change based on *LCH* or *Lab* colour systems were collated or determined using logistic models over the temperature range of 10 – 35°C. Relative rates were calculated using 20°C data as a reference and the temperature dependence was described using either Arrhenius or square root models. Rates of colour change increased with increasing temperature at low temperatures but declined at the higher end of the range. Up to 20°C, the relative rates were adequately fitted by an Arrhenius relationship with an activation energy of ~94 kJ.mol-1. Different approaches were considered to describe the rate of colour change over the whole temperature range. For example, a square root model described the data well for Tmin and Tmax values of 0.6 and 37.8°C, respectively. The relative advantages of different modelling approaches are discussed.
The development of generic models of quality change provides the opportunity for the optimisation and economic evaluation of alternative supply chain systems. Such models may also serve a useful role in postharvest education and training.

N04

MODELLING VOLATILE RELEASE IN ACTIVE PACKAGING POST HARVEST SYSTEMS IN RESPONSE TO CHANGING AMBIENT TEMPERATURE CONDITIONS

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