For statistic characterising we use Tukey-B test. It shows that origin of variety of potatoes can be defined for $P<0,05$ on base of measurement of a* dates (red colour area).

This dates can not be use like conclusive. We have to confirm our first results in few harvest and take into account other factors like different growing plans, area, weather, stocking etc.

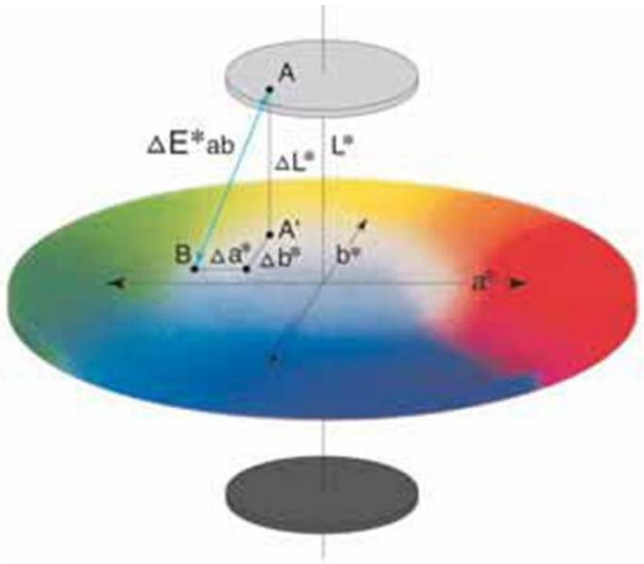

Figure 2
L*a*b* colour system

ACOUSTICS METHOD OF THE CHEESE RIPENING EVALUATION

J.Buchar[1], Š.Nedomová[1], J.Trnka[2], P.Dvořáková[2], L.Severa[1]
[1] Mendel University of Agriculture and Forestry, Zemedelska 1, 613 00 Brno, Czech Republic,buchar@mendelu.cz
[2] Institute of Thermomechanics, Czech Academy of Science, Dolejškova 5, 182 00, Praha 8,trnka@it.cas.cz

ABSTRACT

The paper is focused on the study of the feasibility of using the acoustic impulse-response technique to evaluate Edam cheese texture and maturity. Cheese blocks were hit with an impact bar and the acoustic response at the eight points on the cheese surface was recorded. The response signals (impact force, surface displacement and surface velocities) were detected by the laser-vibrometers. In connection with the results of the classical compression tests performed on the tested cheeses the constitutive equation of the cheese behaviour has been designed. This equation has been used in the numerical simulation of the cheese block response. This simulation has been performed using of the LS DYNA 3D finite element code. The numerical results show reasonable agreement with experimental ones.

INTRODUCTION

The texture of the cheese are traditionally determined by destructive sensory and instrumental measurements. Texture Profile Analysis (TPA), uniaxial compression and puncture tests have been widely used to assess cheese texture, providing information on both the deformation and fracture properties of food products. At present, new non-destructive techniques such as small displacement probes, vibrating rheometers, near infrared spectroscopy (NIR), computer vision, biosensors, ultrasonic analysis and sonic measurements are more and more used. One of these non destructive methods is the acoustic impulse–response technique where the food is excited by being struck with a probe and the response functions are obtained. This technique was used to detect surface cracks in eggshells or voids in watermelons (Cho,2000). Furthermore, this methodology has been applied on fruits such as peaches, apples and pears, in order to quantify changes in firmness during ripening.

These ultrasonic techniques were also used to assess the degree of Manchego cheese maturity (Benedito et al., 2006). The texture of some other cheeses like Mahon or Cheddar cheese has been also studied. The acoustic impulse –response technique used for the study of the cheeses has used response function in form of sound waves detected by the microphones. In the given paper the modified technique has been used where the response of the cheese is described by the time histories of the surface displacement and surface velocity.

MATERIALS AND METHODS

The experiments were carried out on blocks of Certified Origin EDAM cheese (Content of the fat 30%), manufactured by a company located in South Moravia.

The pieces were matured in chambers where relative humidity and temperature were maintained according to the company procedures. The blocks of cheese have been tested at 16,39,60,79 and 107 days after the production.
Two types of the experiments have been realized. First of all the simple compression and stress relaxation tests have been performed using of the TIRA testing device. The crosshead velocities have been chosen to be 1,10,100 and 400 mm/min. Results of these tests have been used to obtain the constitutive parameters of the non-linear viscoelastic materials like cheeses etc. The details of this procedure are described in (Goh et al.,2004).
The impact tests were carried out using an impact device specially designed and built for cheese measurements. The impact set-up consisted of a free-falling cylindrical bar(6 mm in diameter, 200 mm in height – made from aluminium alloy). The bar is instrumented by strain gauges . This instrumentation enables to record the time history of the force at the interface between cheese and bar. At the distances 30, 45, 60,75, 90, 105, 120 and 135 mm from the point of the bar impact the surface displacement as well as the surface velocity are measured using of the laser-vibrometer.
The cheese response was picked up through an amplifier and a commercial A/D PC board to the PC, which simultaneously served as the data acquisition system. An optical sensor was used to trigger the acquisition. The signal was sampled at a rate of 200,000 samples/s for a period of 15 ms. Instead of the time dependent response functions, the MATLAB computer program transformed the response from time to frequency domain by means of Fast Fourier Transform (FFT). The impact velocity of the bar has been kept to be constant (1.2 m/s).

RESULTS AND DISCUSSION

In the Fig.1 the experimental records of the surface displacement - time are displayed. This displacement is connected with the propagation of the surface wave from the point of the impact. The results show that the surface wave exhibits the significant attenuation in the direction of the stress wave propagation. This attenuation also increases with the time of the cheese ripening – see Fig.1. This phenomenon indicates that the behaviour of the cheese is more or less viscoelastic. The damping of the stress wave in the direction of its propagation can be also described in the frequency domain .If we substitute the displacement $p(t)$ by its Fourier transform $P(\omega)$, where ω is the angular frequency we can define the transfer function $T(\omega)$:

$$T(\omega) = \frac{dP(\omega)}{dx}$$

Where x is the distance in the direction of the wave propagation

The transfer function amplitude is also studied. The analysis of the experimental data found that this dependence was typical for the different stages of the cheese ripening. One can see that the description of the wave attenuation in the frequency domain is more simple than that in the time domain.

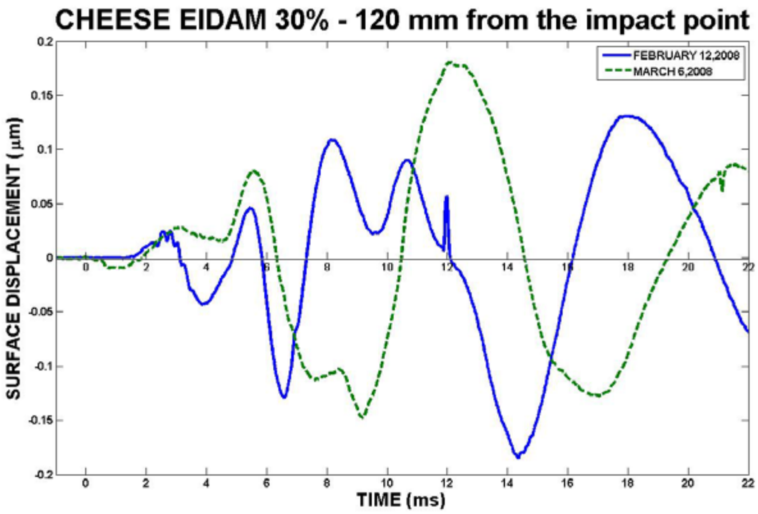

Figure 1.
Surface displaement vs.
Time at the point x=90 mm from the point of the bar impact.

In the next step the displacement at the different points has been evaluated using of the constitutive equation obtained from the simple compression and relaxation tests. According to the procedure outlined in (Goh et al.,2004) the parameters of the non-linear viscoelastic model have been evaluated. The detail description of this work will be subject of the forthcoming papers. The obtained model of the cheese mechanical behaviour has been used for the numerical simulation of the experiments

Generally one can see that the proposed method of the cheese properties evaluation seems be a promising tool for the next research. There is only one critical limitation of this procedure which follows from the role of the stress wave propagation. The origin of some voids or some holes in the cheese can effects the wave propagation much more significantly than some changes of the cheese texture, e.g. during its ripening. The presence of the holes in the cheese on the stress wave propagation should be a subject of some next research.

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DETERMINATION OF SOME PHYSICAL AND SENSORY PROPERTIES OF MILK, DARK AND WHITE CHOCOLATES ENRICHMENT WITH SUNFLOWER SEED, FLAX SEED, OAT AND DRIED DAMSON PLUM

Özlem ÇAĞINDI, Semih ÖTLEŞ
Ege University, Department of Food Engineering, 35100 Bornova Izmir Turkey
ozlem.cagindi@ege.edu.tr, semih.otles@ege.edu.tr

Table 1
Melting point and texture properties of enrichment chocolate samples[1]

Enrichment chocolate samples	**Melting point (^{0}C)**	**Hardness (kg force)**
White chocolate	29.13±0.12[a]	1.91±0.09[b]
White chocolate with flaxseed	22.67±0.42[d]	2.00±0.09[a]
White chocolate with sunflower seed	21.93±0.21[e]	1.75±0.03[c]
White chocolate with oat and rice	27.07±0.06[c]	1.88±0.01[b]
White chocolate with damson plum	27.20±0.17[b]	1.63±0.01[d]
Milk chocolate	29.97±0.06[a]	2.90±0.05[a]
Milk chocolate with flaxseed	27.03±0.06[d]	2.39±0.07[c]
Milk chocolate with sunflower seed	26.00±0.10[e]	2.39±0.00[c]
Milk chocolate with oat and rice	28.27±0.06[c]	2.68±0.00[b]
Milk chocolate with damson plum	29.10±0.10[b]	2.41±0.13[c]
Dark chocolate	30.57±0.06[a]	3.51±0.01[a]
Dark chocolate with flaxseed	27.03±0.06[d]	3.25±0.03[c]
Dark chocolate with sunflower seed	26.77±0.25[e]	2.79±0.05[e]
Dark chocolate with oat and rice	29.57±0.06[c]	3.45±0.01[b]
Dark chocolate with damson plum	29.93±0.06[b]	2.88±0.18[d]