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ACTIA

Optimization of water activity calculation in different food products and comparison with average results from an inter-laboratory trial

Piaudel G.[1], Beaufort A[2], Beraha P.[1], Carlier M.[1], Christieans S.[3], Cornu M[2], Denis C.[4], Jamet E.[5], Michel V.[5], Pinon A.[6], Servais J.P.[7], Stahl V.[8], Thuault D.[9], V. Zuliani[1], Garry P.[1]

1 IFIP- Institut du porc 7 avenue du Général de Gaulle F 94704 Maisons-Alfort. 2 AFSSA 23, avenue du Général De Gaulle F 94706 Maisons – Alfort. 3 ADIV 10, rue Jacqueline-Auriol ZAC du parc industriel des Gavranches F 63039 Clermont-Ferrand. 4 ADRIA NORMANDIE Bd 13 juin 1944 F 14 310 Villers Bocage. 5 ACTILAIT Technopole ALIMENTEC, Rue Henri de Boissieu F 01060 Bourg en Bresse. 6 Institut Pasteur de Lille 1 rue du professeur Calmette F BP 245 F 59019 Lille Cédex. 7 EPLEFPA - ENIL Saint Lô Hall technologique 383, rue Popielujko F 50000 Saint Lô. 8 Aérial Parc d'Innovation Rue Laurent Fries BP 40443 F 67412 Illkirch Cédex. 9 ADRIA Développement Z.A De Creac'h Gwen F 29196 Quimper

Context

Micro-organisms, food characteristics and processes are major components involved in the quality and safety of food products. Physico-chemical properties of food (*ie.* water activity, pH, temperature …) influence micro-organisms behaviour and are key factors to estimate consequences of changes in food products formulations using predictive microbiology programs such as Sym'Previus (www.symprevius.org). To improve models results, knowledge based on different parameters must be provided.

Objectives

An inter-laboratory trial (ILT) was conducted during summer 2009 on water activity determination in some standard food products. Results obtained were confronted with results obtained using two models of calculation of water activity and a new software design for calculation of water activity.

Objectives of this work are to compare different mathematical models for calculation of water activity and confront them using average data obtained during inter-laboratory trial.

Material & Methods

Inter-laboratory trial was realized in 25 French laboratories. Products analysed were cheese, salami, chorizo and four different jellies.

Measures obtained were analysed and provided "real" data for comparison with results issued from mathematical models.

Mathematical models used were :

a_w=1- (0,0052471 * NaCl / Moisture * 100) - (0,00012206 * (NaCl / Moisture * 100)^2) developed by Cornu *et al.*, 2006 (Afssa)

a_w =0,99-(0,63*Nacl / (Nacl + Moisture))-(Lipids *0.0004) developed at Ifip (unpublished data)

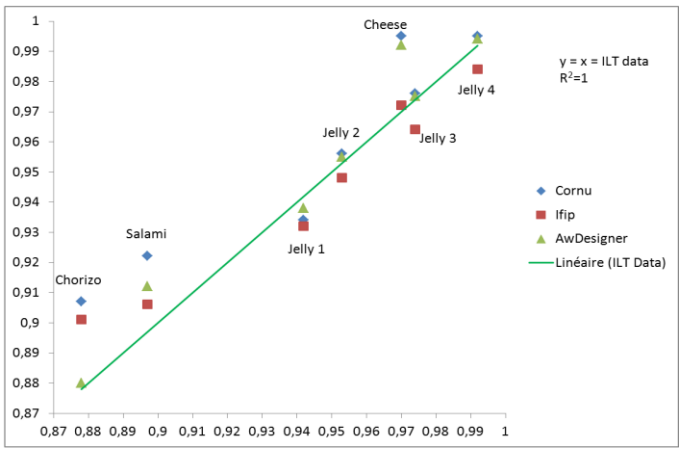
A new software, AwDesigner (ADRIA Développement), was developed for water activity calculation based on a database containing water activity of 230 ingredients and additives, using algorithms with integration of solubility of all components for analysis.

Results

Table 1 : Comparison of results of ILT and results obtained using the two mathematical models and AwDesigner

	Cheese	Jelly 1	Jelly 2	Jelly 3	Jelly 4	Salami	Chorizo
ILT data	0,970	0,942	0,953	0,974	0,992	0,897	0,878
Afssa model	0,995	0,934	0,956	0,976	0,995	0,922	0,907
IFIP model	0,972	0,932	0,948	0,964	0,984	0,906	0,901
AwDesigner	0,992	0,938	0,955	0,975	0,994	0,912	0,880

Figure 1 : Graphic representation of result's variations compared with ILT data



Conclusions

This study demonstrated the feasibility of mathematical models for the determination of water activity in food products based on physicochemical characteristics of the products. With these tools, changes in food products formulations can be translated into changes in physical parameters and therefore used to model the bacterial behaviour.

Mathematical models or softwares as AwDesigner could provided water activity results near than data obtained during an interlaboratory trial. However, using these tools needs a perfect knowledge of composition of products to obtain a good estimation of a_w.

Reference:

Cornu M., Beaufort A., Rudelle S., Laloux L., Bergis H., Miconnet N., Serot T., Delignette-Muller M.L. (2006). Effect of temperature, water-phase salt and phenolic contents on Listeria monocytogenes growth rates on cold-smoked salmon and evaluation of secondary models. International Journal of Food Microbiology. 106: 159-168.

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