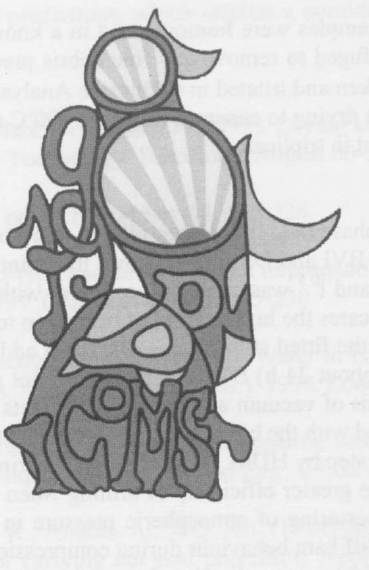
Posters C.73-C.97.1

PS 13

Poster session and workshop 13

Dry-cured products



Thursday, September 3rd
17:15h-18:45h

FEASIBILITY OF BRINING OF HAM FOR CURING

Barat, J.M.; Grau, R.; Montero, A.; Chiralt, A. and Fito, P.
Food Technology Department, Polytechnic University of Valencia (Spain). Camino de Vera, 14. 46022- Valencia.

BACKGROUND

In ham manufacture, the salting process step using solid salt is a long one because of the slowness of the diffusion mechanism. To achieve a mean NaCl concentration of 3% (w/w) in a 10 kg ham, the salting time ranges from about 10 to 12 days.

Salting processes can be carried out more quickly in porous products (such as cheese, meat,...) introducing brine into the pores by means of vacuum impregnation processes (Fito et al., 1994; Chiralt and Fito, 1997). VBI consists of two steps: first a vacuum pressure was applied and maintained in the brine tank during a time t_1 and afterwards the atmospheric pressure was restored while the ham remains immersed for a time t_2. During the vacuum period the gas occluded in the porous structure of the ham expands and partially flows out allowing a more intense capillary penetration. In the second period, the restoring of the atmospheric pressure promotes the residual gas compression and the external brine penetration by a hydrodynamic mechanism (HDM) (Fito et al., 1996), thus allowing a faster salting process.

OBJECTIVE

The aim of this work is to analyse the feasibility of VBI in the salting of ham for curing and to quantify kinetics of salt uptake and water loss as compared with the traditional salting process (in dry salt: DS) and simple brine immersion (BI).

METHODS

Salting procedure

Hams were salted with a 24% (w/w) brine in a tank with temperature and pressure control. The equipment was designed and built by the DTA-UPV and METALQUIMIA, S.A. Salting temperature was 3ºC and 50 mbar of pressure was applied during the vacuum period. BVI treatments with different lengths of t_1 (1-216 h) and t_2 (4-48 h) periods were carried out. Three BI treatments for 24, 96 and 360 h were also performed as well as two DS treatments for 216 and 240 h. Each treatment was carried out at least in duplicate. Three ham batches (1 to 3) were used for the different experiments.

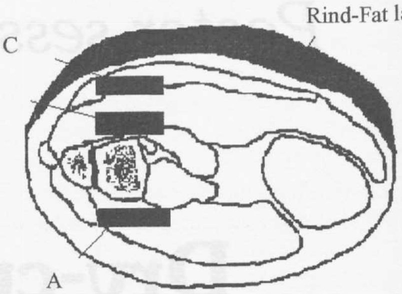


Figure 1. Samples analysed from the widest ham section.

At the different salting times the whole hams were taken out and placed for 24h in a chamber where the temperature and relative humidity were controlled at 3ºC and 85% to avoid drying and to allow the porous matrix to absorb the penetrated brine. Afterwards, in order to analyse salt and moisture concentrations, four samples were analysed; three of them were taken at different depths in the widest section of ham (A, B and C; Fig. 1) and the fourth the homogenised remainder (R). Each sample was thoroughly homogenised before the analysis of the concentration of water and sodium chloride.

Analytical controls

For the sodium chloride determination, samples were homogenised in a known amount of distilled water at 9000 rpm in an ULTRATURRAX T25 for 5 minutes and centrifuged to remove any fine debris present in the sample. Afterwards the solution was filtered and exactly 500 µl aliquot sample was taken and tritated in a Chloride Analyser equipment (CIBA Corning Mod. 926).

Moisture content was determined by oven drying to constant weight at 100ºC (UNE 34 552 h2).

Analytical determinations were carried out in triplicate.

RESULTS AND DISCUSSION

The salt mass fraction in the ham liquid phase (z_{NaCl}) has been plotted as a function of the square root of total salting time for all samples salted by the different procedure BI, BVI and DS. Fig. 2 shows the point distribution of each experimental series. For BI experiments a linear relationship between z_{NaCl} and $t^{0.5}$ was observed, coherent with the diffusion control of the salt uptake. Points obtained by DS lie below the BI line, which indicates the higher yield of brining in terms of time. BVI also leads to a linear z_{NaCl} vs. $t^{0.5}$ relationship, but results in a greater slope of the fitted straight line due to an additional brine flow by hydrodynamic mechanism (HDM) promoted by vacuum. However, short (about 24 h) BVI treatments did not suppose significant differences in salt uptake as compared with BI treatments. From 48 h onwards of vacuum application the effects of the HDM appeared notable in salt gain. The need for a lengthy vacuum period could be related with the big size of the pieces and the subsequent delay of the internal gas out flow and brine capillary entry throughout the vacuum step by HDM. Nevertheless, experiments of BVI for 10 days (t_1=9 d and t_2=1 d) and 5.5 days (t_1=1 d and t_2=4.5 d) put in evidence the greater efficiency of brining when vacuum was applied throughout the greater part of the process. This could be explained if the restoring of atmospheric pressure in the second step did not promote brine in-flow through pores but their collapse due to the non-stiff ham behaviour during compression.

Salt distribution inside the wider part of ham immediately after salting (Fig.3) reflects notable differences for BI and BVI treatments. A deeper salt penetration occurs in BVI, principally in the bone joint neighbouring zone, which is an important aspect concerning safety of product during curing.

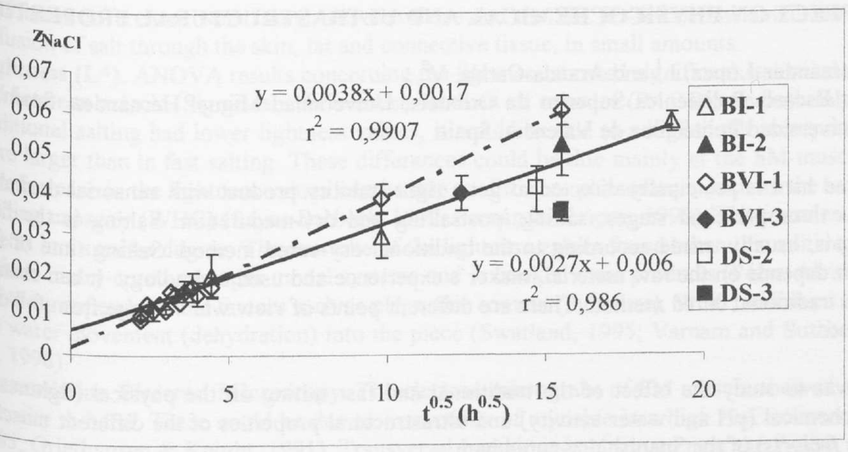


Figure 2. Salt concentration in ham liquid phase (z_{NaCl}) obtained in the different treatments (BI, BVI and DS) and ham batches (1, 2 and 3) for differnt salting time (t_1+t_2).

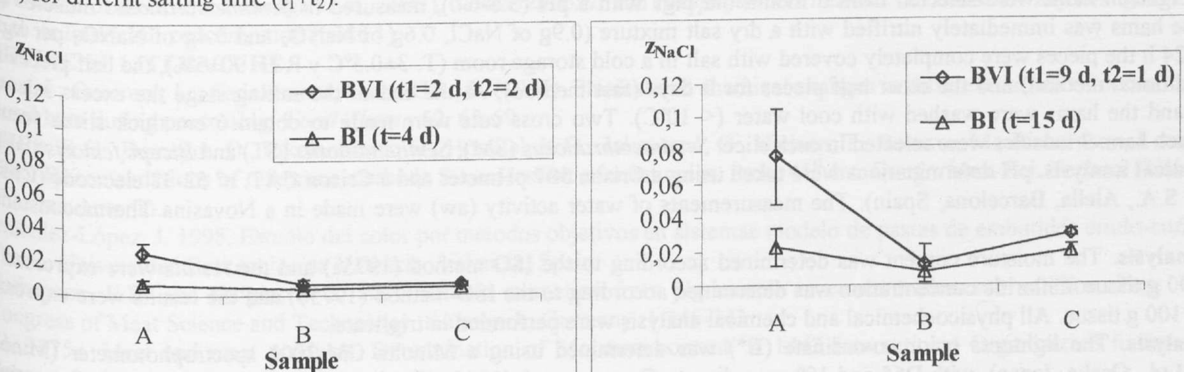


Figure 3. Salt distribution in the internal parts (A, B and C) of ham (batch 1) immediately after salting at different times for BVI and BI treatments.

CONCLUSIONS

Brining of ham implies a reduction in salting time as compared with the use of dry salt, especially when working at vacuum pressure. The effect of vacuum pulse for a short time at the beginning of the process seems to be less effective than the continuous vacuum action throughout the brining. Therefore, capillary action promoted at low pressure seems to be the mechanism responsible for the faster salt gain. To obtain the usual salt content reached after industrial salting (z_{NaCl}~0.42), the required time in BI and BVI would be 4.7 and 7.4 d, according to the linear predictions, which implies a considerable reduction in salting time (of 59 and 36%, respectively).

PERTINENT LITERATURE

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Métodos de ensayo de carnes y productos cárnicos. Determinación de la humedad. Norma UNE 34 552 h2 (ISO R-1442).