WEIGHT LOSS OF MEAT PRODUCTS IN COLD-STORAGE PLANTS AND ITS TREATMENT

José Mª Nacenta, Catalina Cánovas
Universidad Politécnica de Cataluña
E-Mail: niking@eic.ictnet.es

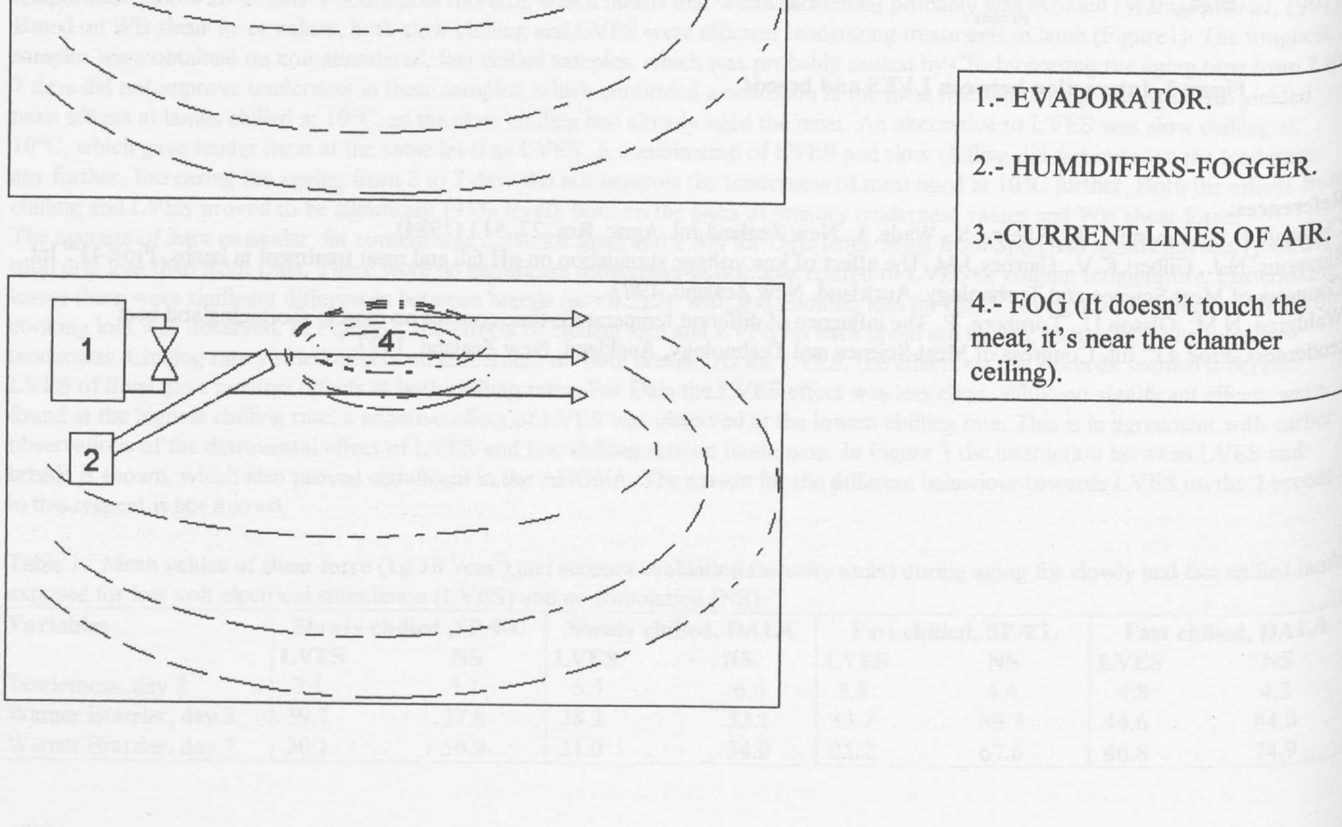
Key Words: meat, weight loss, equilibrium relative humidity.

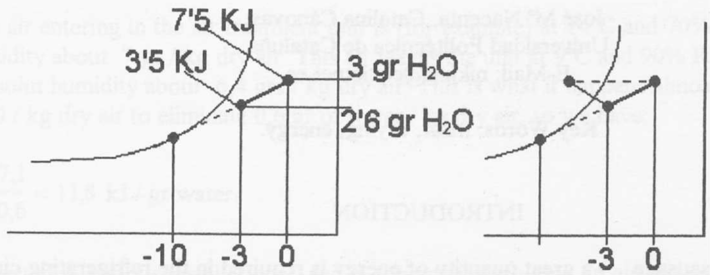
INTRODUCTION

In meat conservation at 0ºC in cold-storage chambers, the relative humidity recomended is 90%, but nowadays installations with mechanical draught evaporators reach values near 75% or 80%, with the consequent evaporation of the meat constitutive water through its surface. Here is purposed a method tested in various refrigerating chambers to get a weight loss about 0,05% (daily) instead of the actual 0,2% . Due to the high quantity of meat stored, this is a great saving in weight and in quality (because the original colour of the meat is manteined for a longer time).

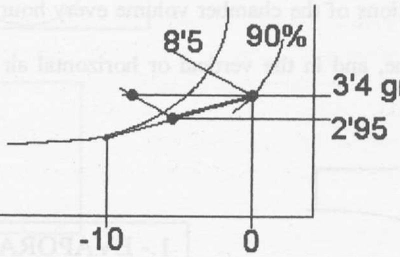
METHODOLOGY

The actual technology used in refrigerating circuits (even in the ones using HFC or NH_3), in chambers at 0ºC, the evaporation takes place at -10ºC, so when the evaporator is turned on the humidity reaches values between 75% and 80% when cold is not required, for the refrigerating circuit, and also for the evaporator ventilators. In this moment, the humidity increases until values near 96%, which is the meat equilibrium humidity. When the refrigerating circuit restarts, the air passing through the evaporator makes the humidity decrease until 75% or 80%, and it stays between these values until the system is turned on.
Depending on the season, the weight loss oscillates around 0,2% daily. This value is not very significative at first sight, but for example in a 20 x 10 x 6 m. chamber storing 360.000 inside, it represents a daily loss of 720 kg., and 262.800 every year. But also the quality has become worse, and the meat gets a dark red colour.
Air treated at 0ºC and 80% RH leaves the evaporator at -3ºC and 88% HR. If we evaporate at -10ºC, the respective absolut humidities are 3 and 2 grs/Kg of dry air. So, for every kg. of air passing through the meat and, after this, through the evaporator, it leaves in the evaporator 0,4 grs. of water.

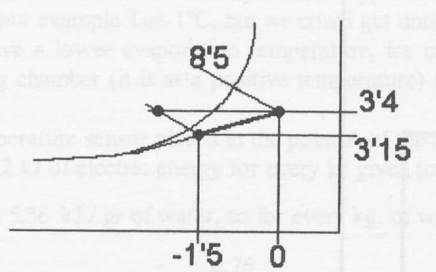




The first solution used to solve this problem was the incorporation of humidifiers (but not steam ones, because of their cost), fog humidifiers (fog producers, foggers). The fogger discharge must be done in the evaporator air discharge, so we are forcing the air to leave at -3,5ºC and 105% RH (supersaturated , with water drops in it). When this air circulates near the chamber ceiling, receives the heat coming in through the chamber walls, and the one in the top of the chamber. It gets to the opposite wall at -1ºC and 95% RH, passing through the meat with more humidity, and eliminating less water from the meat. But then the air relative humidity in the chamber increases until 90%, and the same evaporator reacts now on the next way:



Air treated at 0ºC and 90% RH, and with an absolut humidity of 3,4 grs/Kg dry air leaves at -2,8ºC and 97% RH and an absolut humidity of 2,95 grs/Kg dry air. When it is humidified with foggers, it's like it was at -3ºC and 110% RH, and when it receives the heat from the top of the chamber, and the one coming in through the ceiling and the walls, it gets to the opposite wall at -1ºC and 96% RH, having already evaporated all the drops, and not letting them being in touch with the meat. Passing through the meat, it gets 0ºC and 90%, and this is very dangerous, because if anywhere inside the chamber existed air contacting the meat at more than 96& RH, then the meat would get water from trhe air, and the meat would experiment a very fast bacterial growing, becoming absolutely unuseful. The next solution tested was duplicating the number of evaporatos, getting so double air flowing and a new evaporation temperature (-5ºC) at which one the evaporators eliminate less water, but with the incorporation of the foggers, the air diagram changes on the next ways: air gets in at 0ºC , 90% RH and 3,4 grs/Kg dry air; gets out at -1,5ºC, 93% RH and 3,15 grs/Kg dry air; and after the fogger it is at -1,6ºC, 102% and 3,32 grs/Kg dry air. With this, we get a weight loss around 0,05% which represents that in the anterior example with the 20 x 10 x 6 m. chamber , the daily water loss of the meat is around 180 kg / day (= 65.700 kg / year), and the meat keeps its colour of the recently dead.



Note[1]: What is not possible is to eliminate the weight loss, because the bacterial growing would be really great, due to the humidity unbalance in the chamber (and anywhere in the chamber, the value of the meat equilibrium humidity, 96% RH, would be trespassed).. Note[2]: The humidity regulation system cannot be done by an hygrostate, because of its slowness respect the rythm at the one the evaporators dry and the foggers generate humidity. The only way is that the foggers work at the same time with the "humidity stealers": the evaporators.

CONCLUSIONS

To decrease the weight losses in meat stored products, we must evaporate at a higher temperature, installing more evaporators, and then apport humidity using foggers in which the foggy particles generated mustn't exceed the size of 2 µm.