Quasi energetically costless shelf-life extension of raw watermelon juice by hyperbaric storage compared to refrigeration

Carlos Pinto[1], Álvaro T. Lemos[1], Ana C. Ribeiro[1], Sílvia A. Moreira[1], Liliana G. Fidalgo[1], Mauro D. Santos[1], Ivonne Delgadillo[1], Jorge A. Saraiva[1]

1 — Department of Chemistry & QOPNA, University of Aveiro

Currently, the preservation of many food products is highly dependent of refrigeration (RF), which is energetically expensive and environmentally harmful. In fact, it was estimated that more than 380 megatons of CO_2 were released into the atmosphere in 2008 due to RF processes, being the food industry the third major source of CO_2. Thus, environmentally-friendlier food preservation methodologies are needed to reduce the carbon footprint while ensuring food quality and safety.

Hyperbaric storage (HS) at room temperature (RT), a concept that arose by chance after the recovery of the Research Submarine Alvin (that sunk and remained at 1540 m in deep sea (≈15 MPa) over 10 months), is currently being studied as a possible alternative to RF. The main advantages of HS/RT over RF are the reduction of energy consumption, since energy is only needed during the compression and decompression phases of the pressure vessel, and no additional energy is required to maintain foods under pressure along storage, as well the needless of temperature control, potentiates a lower carbon footprint.

Recent data from our research group hinted, as an additional advantage, the possibility to achieve higher shelf-lives by HS/RT compared with RF. A first trial showed that HS/RT of raw watermelon juice (a highly perishable food) at 100 MPa reduced the microbial load and maintained the fresh-like juice characteristics for up to at least 7 days, while by RF the juice was unacceptable for consumption after 3 days. Further experiments at a slightly lower temperature (15 ºC) and pressure (62.5 MPa) resulted in a higher shelf-life extension (up to at least 58 days), reducing the microbial load and maintaining the juice fresh-like characteristics (Figure 1).

So far, HS/RT showed to be a new promising quasi energetically costless food preservation process, allowing a considerable shelf-life extension compared to RF, being necessary further broader and deeper research in HS/RT.

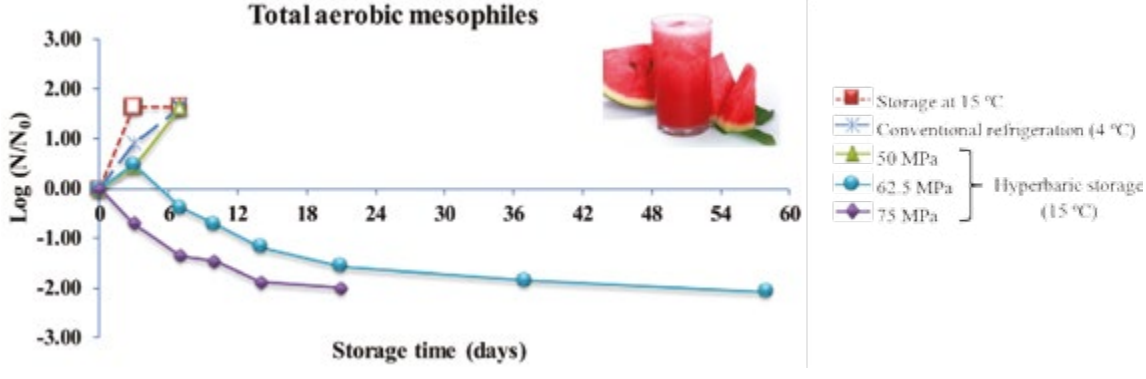

FIGURE 1
Total aerobic mesophiles load evolution (N), compared to the initial value (No), stored under different conditions. Unfilled symbols represent juice spoilage.