Food Safety and Pasteurisation of Cashews

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Food Safety Perspective for Cashews

Microbiological hazards from pathogens such a Salmonella, Listeria and E.coli are associated with the consumption of nuts have been documented through product recalls and food borne illness outbreaks. Cashews have been implicated in food borne illness outbreaks in 2010, 2013, and 2015.

A risk assessment was initiated in 2014 by the FDA which includes an intensive sampling program of consumer packs of tree nuts in US retail shops. The FDA published a prevalence study in 2017 indicating that Salmonella was found in 0.5 percent of Cashew samples, 1.2 percent of Walnut samples and 4.3 percent of Macadamia samples. The prevalence was lower in Hazelnuts and Pecans.

To date, the means to mitigate this microbiological risk has been to control for the presence of contamination through a sampling program. However, such a method is unlikely to reduce the risk, because the contamination level is low and the risk is high of not finding the contamination in a load. The FAO (Food and Agriculture Organization) of the UN has shown that a very low level of contamination can result in disease, particularly in at risk population, making the presence of salmonella in any part of the load dangerous.

There is an obligation of food operators to ensure that food put on the market is unadulterated. In the context of the US Food Safety Modernisation Act (FSMA), the US and foreign food facilities are obligated to comply with risk based preventative controls. The only preventative control for Salmonella is a validated pasteurisation microbial reduction process. In the US, for almonds, a mandatory pasteurization program is in place since 2007. For other tree nuts, the industry has been gearing up to meet the preventative control obligation with investments in pasteurisation equipment.

Thermal Pasteurisation

Exposure to heat in a thermal pasteurisation process will kill bacteria. However dry heat, as used in roasting for example is relatively inefficient and requires high temperatures to obtain the desired microbial reduction performance. As a

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consequence, dry heat processes are difficult to validate and not suitable for pasteurising raw nuts since the product will lose its raw characteristics.

Steam treatments on the other hand are effective at much lower temperatures. Processes using saturated steam are particularly performant because the stored latent heat kills the bacteria when the steam condenses on the product surface. In addition to its efficiency, saturated steam, when properly controlled, is dry and contains no water droplets, thus minimizing the impact of the process on the raw nuts.

Creating saturated steam conditions involves a batch process because control of pressure can only be achieved in a closed pressure vessel (autoclave). When the product is treated in such a vessel, pressure is uniform everywhere in the vessel and inside the treated load, and as a consequence the product temperature is also uniform.

A validation is necessary to demonstrate the effectiveness and reliability of the pasteurisation process. This consists in testing and documenting the efficacy of the process through a microbiological challenge test. Usually, product samples that have been artificially inoculated with a high concentration of bacteria are placed in several locations inside the load, the load is then pasteurised and the inoculated samples are retrieved and sent back to the laboratory for analysis. A microbial reduction performance of >100'000 times (5log) is expected for a successful pasteurisation. This procedure needs to be repeated for three different pasteurisation runs.

The Napasol Pasteurisation Technology

Napasol has developed a pasteurisation process specifically designed for the nut industry. The pasteurisation process consists in moving the product through the process line in bulk bins from a pre-heater to the pasteuriser and then to a cooling platform. Because the product itself does not move during the process (the bin moves the product which remains immobile inside the bin) there is no mechanical damage inflicted on the product. Because the product is never in contact with the pre-heater or pasteuriser, there is no down time for cleaning the process line. Switching from one product to another is as simple as selecting the appropriate recipe and moving the bins with the new product onto the processing line.

In the pasteuriser, saturated steam conditions are maintained by controlling pressure and nuts can be treated in a partial vacuum at temperatures <100°C. Because the pressure is uniform in the pasteuriser, the treatment temperature is uniform inside the load, and the microbiological reduction performance is demonstrably uniform as well. The efficiency of the saturated steam process allows for a very high microbial reduction (>100'000 fold reduction or >5log) even at temperatures as low as 80°C with short exposure times.The combination of vacuum and heat is very effective in eliminating infestations and killing all stages of development of insects from the egg to the larvae and the adult.

There is no moisture pickup, so the product does not need to go through a drying step and the pasteurised nuts maintain their raw qualities. After pasteurisation, the product has been cooled down and is ready for packaging.

Napasol Pasteurisation Lines for the Nut Industry

Napasol AG is a Swiss Company with worldwide distribution of its pasteurisation technology. The technology is suitable for all low moisture products from nuts to seeds, herbs, spices, botanicals, and dry fruit.

Napasol offers a range of equipment sizes tailored to the through put needs of its customers and each line is custom built to fit into their processing facility. Sizes range from 1 bin units with a 700kg/h capacity and a small foot print of 5 meters in length, up to 6 bin units with throughputs of 7000kg/h and 40 meters in length.

Pasteuriser Model	Number of bins	Pasteuriser throughput kg/h
Statisol 300	1	750
Statisol 600	2	2'400
Statisol 1200	4	4'800
Statisol 1800	6	7'200

Napasol Pasteurisation line of 6 bins showing full bins from the top (left) and bins lined up on the loading platform ready to enter the pasteuriser. Photos courtesy of Poindexter Nut Company. CA, USA

References

Harris, L.J., M. Palumbo, L.R. Beuchat, and M.D. Danyluk. 2017. Out breaks of food borne illness associated with the consumption of tree nuts, peanuts, and sesame seeds: Table and References. (http://ucfoodsafety.ucdavis.edu/files/169530.pdf)

Guodong Zhang et al. Prevalence of Salmonella in Cashews, Hazelnuts, Macadamia Nuts, Pecans, Pine Nuts and Walnuts in the United States. Journal of Food Protection. Vol 80, Nov 3, 2017. (http://jfoodprotection.org/doi/pdf/10.4315/0362-028X.JFP-16-396)

Joint FAO/ WHO Expert Consultation on Risk Assessment of Microbiological Hazards in Foods. July 17-21 2000, FAO headquarters, Rome Italy. (http://www.fao.org/fileadmin/templates/agns/pdf/jemra/SL00_en.pdf)

FSMA (Food Safety Modernization Act) Final Rule for Preventive Controls for Human Food. Current Good Manufacturing Practice, Hazard Analysis, and Risk-Based Preventive Controls for Human Food. September 2015. (https://www.fda.gov/Food/GuidanceRegulation/FSMA/ucm334115.htm)

Author Profile

Dr Cameon Ivarsson, Co-founder and CEO of Napasol North America, has been involved in developing at and commercialising the pasteurisation technology, the company offers. Cameon holds a PhD from the University of Lausanne, Switzerland is a frequent contributor to scientific publications, and is member of technical and scientific committees of major industry associations.