Vaporex

INTERVENTION SUMMARY	
Status	Patents listed but no longer supported. Final treatment parameters, microbiological and sensory shelf life studies completed satisfactorily for frankfurts and sliced processed meats. Other perishables such as processed red meat portions, whole carcass red meats, chicken, cheese etc have been satisfactorily investigated at laboratory level.
Location	Post-processing, packaging
Intervention type	Surface
Treatment time	Varies with food type, typically 0.06 min. or less, with similar post treatment contact times. Both dependent more on consumable cost reductions than process lethality.
Regulations	2001 initial assessment report application A429 FSANZ for hydrogen peroxide, pe racetic acid and carbonic acid. No restriction on acetic acid. 2016 clarification by NSW Department of Primary Industries, Food Authority indicates application now only required for carbonic acid.
Effectiveness	Initial reduction (approximately 1.5 $\log_{10}$ cfu/g) in *Listeria* on frankfurts using only 0.26%w/w transferred acetic acid. Typical decline in microbial counts with time observed as a result of acetic acid compromised cells.
Likely cost	Initial equipment cost plus 0.5 to 5 c/kg of treated product
Value for money	unknown
Plant or process changes	Medium - installation of equipment that can produce the mixture required, engineering to allow contact of product with gas biocide/s
Environmental impact	Unknown, may depend on choice volatile biocide/s
OH&S	Handling of volatile biocides, monitoring of atmospheric CO2 and biocide levels may be required

Advantages	Increase in shelf life and reduction of pathogen numbers.
Disadvantages or limitations	Not yet commercialized. Confirmation of or Establishment of treatment parameters will be required for each food type to avoid a flavour impact. Only suitable for treatment of whole carcass and manufactured meats. Exposed, raw muscle fibers will have the myoglobin converted to metmyoglobin proportional to the severity of the treatment. Possibly suitable for the latter where the end application e.g. cooking will result in the formation of metmyoglobin. Entire surface of the food must be exposed to the biocide vapour.

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Vaporex is a patented system (currently lapsed) to extend the shelf life of food by treating it with a volatile biocidal substance/s within a gaseous system. The volatile substance is usually acetic acid and the carrier gas is carbon dioxide. The biocide is more soluble in the small amount of water on the surface of the perishable food than in the carrier gas (2^{nd} law of thermodynamics) and therefore partitions extremely rapidly into the surface moisture. This results in very high surface concentrations of the transferred biocide/s, which are transient due to the reaction, diffusion and equilibrium of the biocide/s through to the continuous water phase of the treated food. A clear advantage is that during this transient phase a degree of post process protection is afforded to the treated food. Additionally all product wetted surfaces that are exposed to Vaporex biocide/s will also benefit from a degree of microbiological control. A processing line engineered and validated to realize the full advantage of the latter benefits could be maintained at a very high level of sanitation.

The treatment equipment does not require evacuation before the process commences allowing food to be treated in batches or continuous mode. The volatile biocide/s and the carrier gas can be recycled through the system with the addition of further biocide/s or carrier gas. The system is designed for solid products which have an exposed surface with a water activity ≥ 0.85. The process time can be reduced with the use of a heated biocide. The short length of treatment does not increase the temperature of the product significantly. Biocide temperatures have been successfully used over the range of 11^{o}C to 50^{o}C. Treatable food may include red meat whole carcass, whole chicken and possibly drumsticks, cheese, smallgoods such as roast beef portions, cured meats, frankfurts, sausages, ham, bacon, chicken, turkey, and fruits and berries.

The concentration of acetic acid in the carbon dioxide carrier gas is proportional to the temperature of the biocide/s gas mix and the pressure applied to the gas mix by the treatment equipment. In the case of acetic acid a concentration of several g/l can be achieved.. The effectiveness of the treatment is dependent on product type, volatile biocide/s and their relative proportions and concentrations, and treatment time. All of the latter variables can be manipulated to achieve a similar technological goal for a given food thus permitting substantial process flexibility. Frankfurters treated by the vaporex process had an immediate decrease in *Listeria* numbers of at least 1.5 $\log_{10}$ cfu/g and after 15 days a decrease in count compared to untreated controls that ranged from approximately 1.5 $\log_{10}$ cfu/g to 5 $\log_{10}$ cfu/g dependent on treatment parameters Frankfurts treated in a similar manner, at industry level research, had lower surface and core counts at 74 days than the control sample on the day of manufacture. Preliminary investigations indicate that the addition of Vaporex hydrogen peroxide to a Vaporex acetic acid only process should increase the process lethality by at least two logs at any given sampling time. The flavour profile of sliced meats that were treated with a blend of hydrogen peroxide and acetic acid and other smallgoods that were treated with acetic acid only had negligible sensory changes after the successful conclusion of standard and extended shelf life studies.

Commercialisation of this technology will require further engineering of dedicated equipment, balancing of flavour profiles and appropriate validation studies.
With a recent clarification from NSW Department of Primary Industries, Food Authority the use of gas phase per acetic acid and hydrogen peroxide now has a high confidence level of being compliant with the act. Processors wishing to use Vaporex per acetic acid or hydrogen peroxide are advised to seek specific clarification for their intended use with the appropriate process validation data. A copy of the clarification is available on request.

Approval is required from FSANZ for the use of Vaporex carbonic acid with a draft assessment completed in 2001.

Proponent/Supplier Information

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References

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