

Carbon Dioxide

| INTERVENTION SUMMARY | |
|-------------------------------------|--|
| Status | Currently available |
| Location | Packaging |
| Intervention type | Gas flush of packaged product |
| Treatment time | During storage |
| Regulations | Approved |
| Effectiveness | Fair to good |
| Likely cost | CO ₂ is cheap. The high pressure CO ₂ equipment is still under development but will most probably be expensive due to the product and the associated risks |
| Value for money | Good |
| Plant or process changes | Many plants already use CO ₂ in MAP retail packs to improve storage life High pressure processing system may require space |
| Environmental impact | CO ₂ is naturally present in air, so little impact |
| OH&S | High CO ₂ levels can cause suffocation, the area would need to be well ventilated |
| Advantages | CO ₂ is cheap and safe |
| Disadvantages or limitations | The high pressure equipment is still under development Works well in modified atmosphere packaging but would be much harder to control in larger pack sizes (such as sides or quarters) If used in large quantities would have OH&S implications |

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Carbon Dioxide

Carbon dioxide (CO₂) is a colourless, odourless, tasteless and non-flammable gas. The inhibitory effect of CO₂ on spoilage microorganisms and pathogens has been well documented. At the meat surface, CO₂ penetrates the cells, inhibits bacterial enzymes and also disrupts the cell membrane. The inhibitory effect of CO₂ increases as temperature decreases, as the gas becomes more soluble, and the use of increased pressure will improve the penetration of CO₂ into the cells.

Modified atmosphere packaging (MAP) with CO₂ has been shown to be an effective storage technology, but using CO₂ as a means to inactivate microorganisms in foods still requires much research to understand the inactivation mechanisms and the critical parameters (Guan and Hoover, 2005). Some authors advocate the use of a small amount of carbon monoxide, CO, in conjunction with the CO₂ which has the added benefit of preserving the red colouration. CO₂ use is permitted around the world. Use of MAP in conjunction with anti-microbial agents, in active packaging systems, has been shown to further increase the shelf life of the chilled stored meat (La Storia *et al.*, 2012).

As an intervention strategy, CO₂ combined with other non-thermal processing technologies, such as high pressure and pulsed electric fields, has shown some promise (Guan and Hoover, 2005). In contrast, Kudra *et al.* (2013) found that the addition of a high-carbon dioxide MAP system during storage of irradiated products did not greatly improve the control of pathogens when compared to irradiation alone. High pressure carbon dioxide (up to 15 MPa) has been evaluated, and found to have some success in reducing *Salmonella* numbers in liquids and semi-solid foods (Wei *et al.*, 1991). The treatment, however, was applied for 2 hours, and the outcomes were very variable between different foods. High pressure carbon dioxide also showed synergistic anti-microbial effect with increasing temperature and decreasing pH (Haas *et al.*, 1989).

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References

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