## Carbon Dioxide

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<th><strong>INTERVENTION SUMMARY</strong></th>
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| **Plant or process changes** | Many plants already use CO₂ in MAP retail packs to improve storage life  
High pressure processing system may require space |
| **Environmental impact** | CO₂ is naturally present in air, so little impact |
| **OH&S**                 | High CO₂ levels can cause suffocation, the area would need to be well ventilated |
| **Advantages**           | CO₂ 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 |

### Disclaimer

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Carbon Dioxide

Carbon dioxide (CO$_2$) is a colourless, odourless, tasteless and non-flammable gas. The inhibitory effect of CO$_2$ on spoilage microorganisms and pathogens has been well documented. At the meat surface, CO$_2$ penetrates the cells, inhibits bacterial enzymes and also disrupts the cell membrane. The inhibitory effect of CO$_2$ increases as temperature decreases, as the gas becomes more soluble, and the use of increased pressure will improve the penetration of CO$_2$ into the cells.

Modified atmosphere packaging (MAP) with CO$_2$ has been shown to be an effective storage technology, but using CO$_2$ 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 CO$_2$ which has the added benefit of preserving the red colouration. CO$_2$ 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, CO$_2$ 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


USDA/FSIS (2004), Safe and suitable ingredients used in the production of meat and poultry products. *FSIS Directive 7120.1 Amendment 6*, USDA-FSIS.