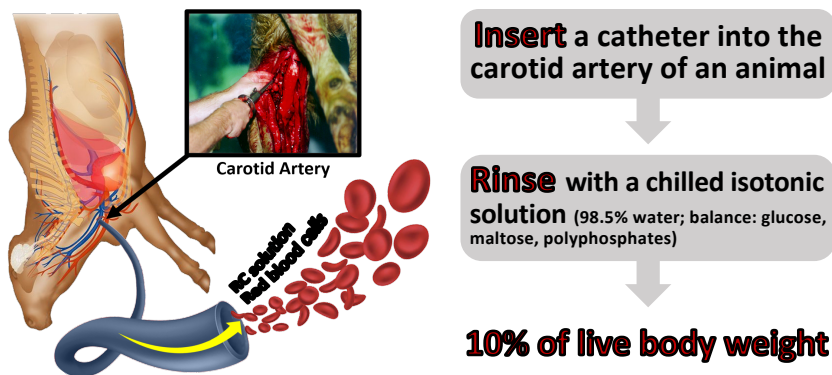


## Objective

This review summarized highlights how Rinse & Chill® technology (RC) works on a variety of animal types (beef, bison, pork, and lamb).

## Methods



- Immediately upon exsanguination, the RC system (MPSC Inc.) involves inserting a specially designed catheter into the carotid artery of an animal followed by rinsing with a chilled isotonic solution through the cardiovascular system.
- The vascular system is rinsed at a rate up to 10% of the carcass weight and as a result improves residual blood removal from the carcass.

**Keywords:** blood removal, carcass chilling method, color, food safety, tenderness

## Major Advancements

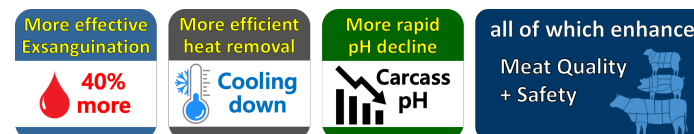


Figure 1. Primary purposes of Rinse & Chill® Technology.

- Effectively remove about 40% more residual blood from the carcass.
- Lower internal temperature rapidly due to the large internal surface of the vascular system and the reduced distance between the muscle and the chilling medium.
- Optimize pH decline that could be explained by the ingredients in the isotonic solution and their effect of glycolytic enzymes.
- A common result is the color of the meat is lighter (Figure 2a, 2b).
- Beef from RC is easier to debone, increasing yield by as much as 2% and improves worker safety and ergonomics (Figure 2c).



Figure 2. Non-rinsed (left) and RC-processed meat (right). (a) beef, (b) lamb; (c) RC beef paddle bone.

## Conclusions

A novel postmortem process referred to as Rinse & Chill® technology being adapted by the meat industry to improve product safety and meat quality while improving economic performance.

### Blood Removal

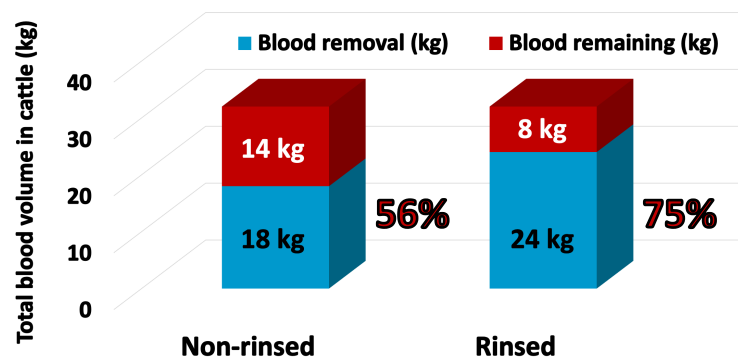
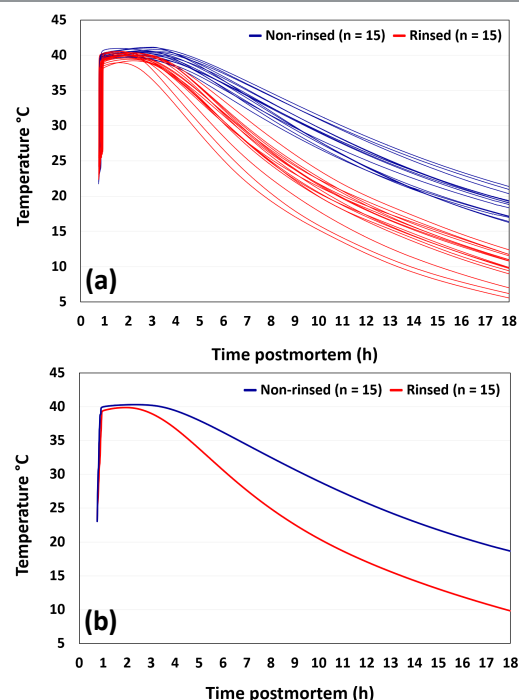


Figure 3. How well RC contributes to the effectiveness of exsanguination in cattle.

- Using a 454 kg (1,000 lb) cattle as an example, there is a total of 32 kg (70 lb) of blood in the animal, which is 7 % of live weight.
- Average blood yields are; **non-rinsed = 56% (18 kg or 40 lb); RC-processed = 75% (24 kg or 51 lb).**
- RC results in **5.6 kg (12 lb) additional blood removed** in comparison to the non-rinsed animal, while 8 kg (30 lb) of blood remains.
- RC **removes about 40% more residual blood** from the carcass.

### Temperature Decline



RC treated beef carcasses **chilled significantly faster** in the deep round muscle.

RC carcasses were **8.8°C colder in the deep round muscle** at 18 hours of chill than non-rinsed carcasses.

Figure 4. RC effect on temperature decline (a) individual and (b) average cooling curves in semimembranosus of beef carcasses.

### pH Decline

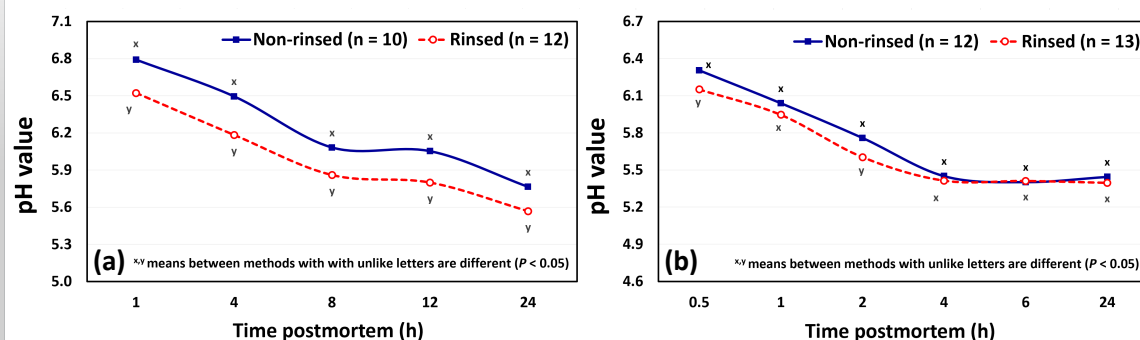


Figure 5. Rate of pH decline in (a) cull dairy cows and (b) market hogs.

- RC carcasses exhibited lower pH values during 24 h postmortem on cull dairy cows.
- In market hogs, RC had lower pH values prior to 4 h postmortem.
- RC had no difference in cooler shrink but less lipid oxidation and improved color.
- RC appears the **more rapid pH decline is capable of preventing cold-induced shortening.**
- Interestingly, despite the more rapid pH decline in pork, **use of the chilled RC solution and its effect on efficiently removing heat out of the carcass helps protect the meat pigments** from being denatured and improves the red color stability.

### Antimicrobial Effect

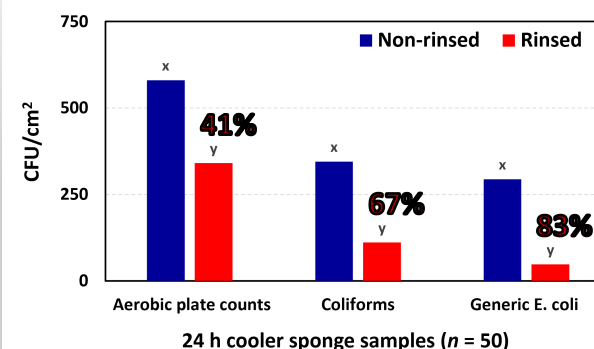


Figure 6. Microbial status of beef carcasses after 24 hours in the cooler.

- Aerobic plate counts, a general measurement of microbial cleanliness of carcasses after 24 hours in the cooler, were reduced by more than 41%. Coliform bacteria and *E. coli* were reduced by more than 67% and 83%, respectively by RC.
- RC solution in itself has antibacterial properties against *Escherichia coli*, *Salmonella typhimurium*, and *Pseudomonas fragi*.

### Metabolite Residues

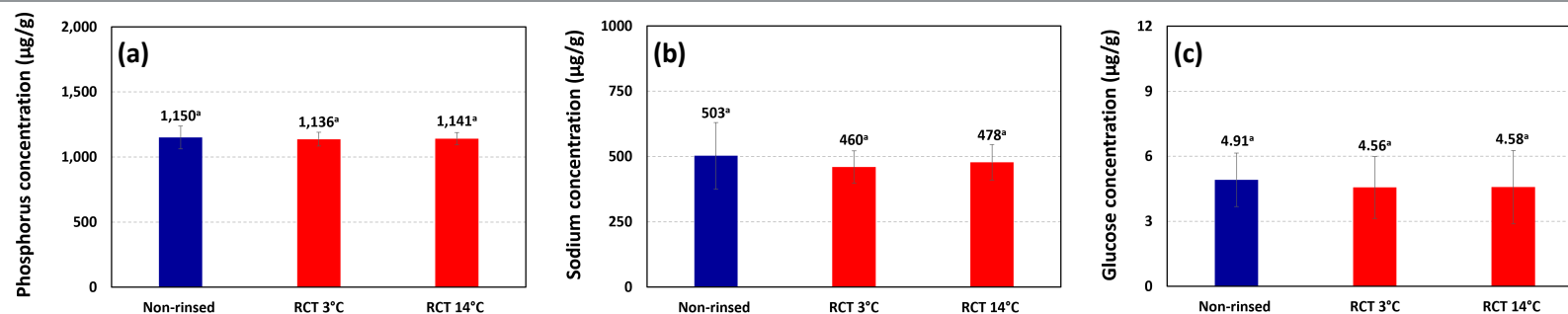
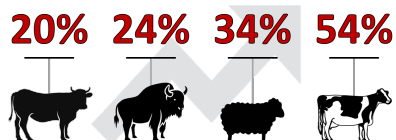


Figure 7. Assessment of residual (a) phosphorus, (b) sodium and (c) glucose content (mean  $\pm$  std. dev., wet basis) in beef longissimus muscle from non-rinsed (n=12) compared to RC carcasses (RC3, 3°C rinse solution; n=13; RC14: 14°C rinse solution; n=15). <sup>a</sup>Means no differences ( $P>0.05$ , S.E.: phosphorous, 19.81; sodium, 27.14; glucose, 0.39) were found between the non-rinsed controls and either of the rinse temperature beef samples.

- When assessed for potential rinse solution residues (glucose, phosphate, sodium) in meat associated with the application of this technology, **there were no differences in residuals between the non-rinsed carcasses and the RC carcasses.**
- These results support the conclusion that the **RC solution leaves no detectable residues** in meat.

### Tenderness



Based on a reduction in mechanical shear, tenderness was improved by 20% in cow striploin steaks, 24% in bison steaks, 34% in lamb chops, and 54% in steaks from cull dairy cows.

### Labelling for Meat Product

Meat from this process does not require any labeling requirements for moisture as based on moisture fat free analysis there is less than 0.5% of a difference compared to non-rinsed carcasses in the loin muscle.