

Summary of Interventions that may be used during red meat production

Technology	Documented applications	Treatment time	Approx. microbial reduction	Advantages	Disadvantages, limitations	Regulatory status	Tradename, distributor or proponent
Organic acids (eg, acetic, lactic)	Carcasses, primals, livers, lips, cheekmeat, tongues	10-30 s, depending on T°C	1-3 logs	Applied by spray or immersion. Much literature on effectiveness. Can be used with other interventions	If used on primals, they may be wet for packaging; possible discolouration of lean, organoleptic problems; concerns about acid-resistant pathogens, corrosion of equipment.	USDA approved – 21CFR101.100 Not EU approved	Ecolab-CHAD FPE
Trisodium phosphate	Carcasses, livers, lips, cheekmeat, tongues	10 s	0.7-1.5 logs		May have issues with phosphate removal from effluent and expensive disposal.	USDA approved – 21CFR182.1778 Not EU approved	
Peroxyacetic acid	Carcasses, primals	10 – 30 s	1.4 log	Low concentration	If used on primals they may be wet for packaging; possible discolouration of lean	USDA approved 21CFR173.370; FSANZ – Std 1.3.3 Not EU approved	Ecolab-CHAD (Inspexx®)
Ozonated water	Carcasses, primals	15 – 60 s	1-2 logs	Ozone dissipates quickly	If used on primals they may be wet for packaging; possible discolouration of lean at high concentrations, potential oxidation of fat	USDA approved – 21CFR173.368; FSANZ – Std 1.3.3	Ozone Safe Food Pacific Ozone
Irradiation (gamma rays)	Primals, ground beef	Several mins	2-6 logs	Able to treat packaged food	Expensive to install - central treatment facility only; consumer acceptance issues.	USDA approved – 21CFR179.26 Not EU approved EU consumer rejection	Steritech
Irradiation (electron beam)	Primals, ground beef	Seconds	Up to 4 logs	Able to treat packaged food	Expensive to install - central treatment facility only; consumer acceptance issues.	USDA approved – 21CFR179.26 Not EU approved EU consumer rejection	SureBeam (no longer trading)
Rinse and Chill	Carcasses	10-15 s	0.2-2 logs	Meat quality improvements	Capital outlay	AQIS approved, US, Japan, Korean approvals	MPSC Inc.

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High pressure	Primals, ground beef, processed meats	0.5 – 5 min	Up to 4 logs	Increase shelf life by reducing initial microbial count, treat in-pack	Expensive; systems not yet large enough; possible meat colour/texture changes	No particular legislation in US. Required to demonstrate equivalence in EU	Avure Technologies
Pulsed electric fields (PEF)	Ground beef, steaks	<1 s	1 log		Works best for liquids so limited meat applications at present. Commercial development incomplete		PurePulse Technologies (no longer trading)
Pulsed light	Primals	<1 – 10 s	1-3 log	Can be used on packaged product	Probably not suitable for opaque foods; not yet commercially viable for foods		PurePulse Technologies – suspended operations
Ultraviolet light	Meat marinades and brine	10 s- 10 min	Up to 2 logs	Can be used on packaged product	Limited to surface sterilisation or liquids		Safe Food Corporation
Ultrasound	Primals	0.25 – 3 min	0.5-2 logs	Possible to treat VP food.	High power equipment required. Commercial development incomplete		Dr Hielscher, Etrema
Natural antimicrobials (i.e. bacteriocins, nisin, reuterin etc)	Primals, processed meats, ground beef	Residual effect	1-2 logs	Spray application, then VP chilled storage, Used as a surface coating (in alginate).	Some only effective on gram positive microbes.	Not EU approved (Nisin is under consideration) Nisin approved in US	Danisco
Hot water/steam pasteurisation	Carcasses, primals	10-15s at 75-85°C.	1-3 logs	Can use in combination with chemicals for greater effect	If used on primals, they may be wet for packaging; possible discolouration of lean. Recirculation of water may be necessary.	No restrictions, discouraged in the EU Approval required for recirculation of water in Australia and US	FPE, APV (Invensys) CHAD company
Steam Vacuum	Carcasses	Seconds	1-3 logs	Directed at visible contamination	Labour costs, some bleaching of meat surface	No restrictions	Vac San – Kentmaster Australia CV-1 – Jarvis ANZ

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Acidified sodium chlorite	Carcasses. Has potential for vacuum packed primals, pork tongues, beef trim, ground meat	Up to 60s	Up to 4 logs.	Not affected by organic load. Possible continual effect on stored product	If using strong acids as the activator, may need to consider storage and operator safety	USDA approved – 21CFR173.325; permitted by FSANZ Not EU approved	Vibrex - Grayson Australia, Zydox - Zychem Technologies, Sanover - Alcide Corporation
Activated lactoferrin	Carcasses, primals, ground beef		0.7-2.5 logs	Can be used on VP beef; natural product. Possible continual effect on stored product	If used on primals, they may be wet for packaging	USDA approval – 21CFR170.36; no specific EU regulation; permitted in Japan and Korea	National Beef Company
Cetylpyridium chloride (CPC)	Carcasses, hide, trimmings	15-30 s at 1% CPC	1.5-2 logs on hides 2.1 logs on beef tissue	Effect on hide maintained up to 4 hrs (1 study); does not impact flavour, texture, appearance, or the odour of foods	Residual levels if used on meat at 1% CPC.	Currently undergoing USDA review Not EU approved	CHAD – wash cabinet Safe Foods Corp (Cecure)
Electrolysed water	Carcasses, poultry, surfaces	Spray or dip	1.5-3 log on inert surfaces 2-2.5 log on poultry	Salt is the only chemical used	Initial capital needed – but may be substantially cheaper than other methods.	FDA and USDA considered safe Awaiting full approval	Primacide - Electric Aquagenics Unlimited
Acidic calcium sulphate	Ground beef, ready-to-eat products			Makes pathogens (<i>Listeria</i>) more sensitive to heat eg. during temp abuse/cooking.	An additive not yet approved	Under consideration by USDA Not EU approved	Mionix