

Evaluation of the effects of cattle hide treatment with aqueous shellac solutions on microbial status of beef meat

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Introduction: Cattle hides are very significant source of microbial contamination of beef carcasses during dehiding. A novel, alternative approach to improve the effectiveness of hide treatments in reducing microbial transfer from hides on carcasses has been developed: **microbial immobilisation on cattle hides of hides with shellac**, natural, food-grade resin. The basis of this treatment is immobilisation of microorganisms on cattle hide's hair and subsequent reduction of their transferability from the hair onto carcass meat during dressing of slaughtered cattle. This study evaluated the effectiveness of different aqueous shellac solutions (ASL) applied to hides in reducing the transferability of microbiota from hide to meat under laboratory and commercial abattoir conditions.



Material and methods

➤ **Lab model:** Paired, symmetrical pieces of clean and dry hides were placed one over another, hair-to-hair and left for 30 mins to allow for transmission of microbiota between them, to achieve as similar microbial characteristics as possible; For each experiment, six shellac treated and six corresponding control hide pieces were used treated with eight aqueous and ethanol shellac solutions with different adhesive properties.

➤ Large beef joints were sterilised by submerging them in boiling water and meat slices cut and placed into stainless steel template. Using direct hide-to-meat contact model, pieces of untreated or treated hides were placed onto meat slices for a few seconds, then separated, and meat slices examined for aerobic (ACC) and *Enterobacteriaceae* counts (EBC) naturally occurring on cattle hides, using ISO methods.

➤ **Abattoir trials:** Twenty clean and dry cattle were spray treated (after bleeding, before dehiding), over hide area where skin-opening cuts are made. The effects of hide coating with shellac was evaluated by swab-sampling four carcass meat sites after dehiding and examining for ACC and EBC.

Results

Table 1. Efficacy of aqueous shellac solutions in reducing the transfer of microbiota naturally occurring on cattle hides in lab model

Shellac type and amount of coating*	ACC control (log ₁₀ CFU/cm ²)	ACC treatment (log ₁₀ CFU/cm ²)	ACC reduction (log ₁₀ CFU/cm ²)	p (Ho=0)	EBC control (log ₁₀ CFU/cm ²)	EBC treatment (log ₁₀ CFU/cm ²)	EBC reduction (log ₁₀ CFU/cm ²)	p (Ho=0)
A (saturated)	6.16	4.85	1.31	<0.001	3.30	0.93	2.37	<0.01
B (saturated)	7.05	5.22	1.83	<0.01	3.96	1.55	2.41	<0.01
C (saturated)	6.56	5.76	0.80	<0.001	3.36	1.57	1.79	<0.05
D (saturated)	7.13	4.71	2.43	<0.001	4.13	2.49	1.64	<0.001
D (light coating)	7.24	4.83	2.41	<0.001	2.57	1.60	0.97	=0.07
E (saturated)	6.88	3.98	2.90	<0.001	3.76	0.81	2.95	<0.001
F (saturated)	7.71	4.66	3.05	<0.001	4.10	2.16	1.93	<0.005
G (light coating)	4.79	2.78	2.01	<0.001	2.56	0.83	1.73	<0.005
H (saturated)	5.43	3.39	2.04	<0.001	2.94	1.23	1.71	<0.001

*Shellac A - Ethanol solution based on a waxed shellac (solid content 25%); Shellac B - Aqueous solution Wabelac (25%); Shellac C - Aqueous with 10% glycerol (30%); Shellac D - Aqueous with 20% glycerol (39%); Shellac E - Ethanol solution based on a dewaxed shellac (25%); Shellac F - Aqueous solution Norelac (25%); Shellac G - Aqueous with propylene glycol (35%); Shellac H - Aqueous with 15% glycerol (28%)

Table 2. Efficacy of aqueous/modified shellac solution in preventing microbial transfer from hide to carcass meat in abattoir conditions

Sample	Mean control (log ₁₀ CFU/cm ²)	Mean treatment (log ₁₀ CFU/cm ²)	Microbial reduction (log ₁₀ CFU/cm ²)	p H ₀ =0
Carcass ACC	4.22	3.44	0.78	<0.001
Side flank ACC	2.29	1.97	0.31	= 0.22
Belly ACC	4.68	3.55	1.14	<0.0001
Brisket ACC	4.98	3.83	1.15	<0.0001
Front leg ACC	4.92	4.41	0.52	<0.0001
Carcass EBC	0.58	0.34	0.23	<0.05
Side flank EBC	-0.24	-0.29	0.04	= 0.47
Belly EBC	0.52	0.30	0.22	= 0.23
Brisket EBC	0.92	0.19	0.74	< 0.0005
Front leg EBC	1.10	1.17	-0.07	= 0.79

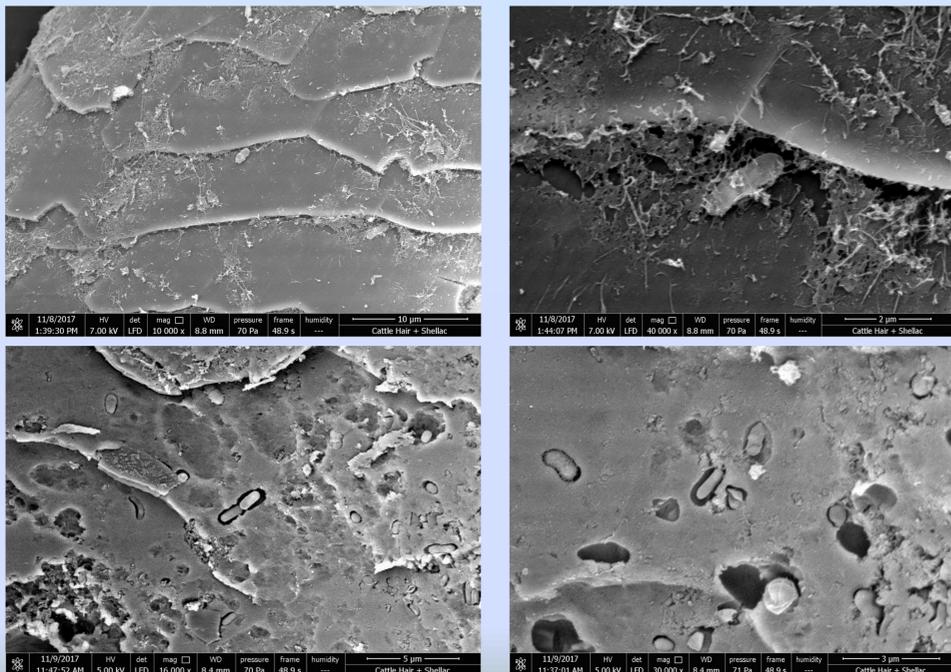


Figure. Scanning Electron Micrographs of hair treated with aqueous shellac solution: the cells of inoculated *E. coli* O157 entrapped and covered with thin and thick shellac coating

Conclusions

- The reduction effects for ASL in preventing transfer of bacteria from hides onto meat in lab trials were up to 3 logs of ACC and 2.4 logs of EBC (average reduction of **2 logs**).
- The reduction effect on microbial transfer from cattle hides onto resulting carcass meat in abattoir comparing to untreated animals was on different carcass sites 0.3-1.1 log for ACC and 0-0.7 log for EBC.
- The efficacy of ASL in abattoir was comparable and better than reported in some other hide decontamination studies.
- The study has provided a scientific basis for the further development of this hide treatment, for wide-scale use in a commercial abattoir setting.

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