

Supporting Information

Raman spectroscopic detection of carotenoids in cattle skin

*Correspondence to Megha Mehta: (Email: megha.mehta@lasra.co.nz)

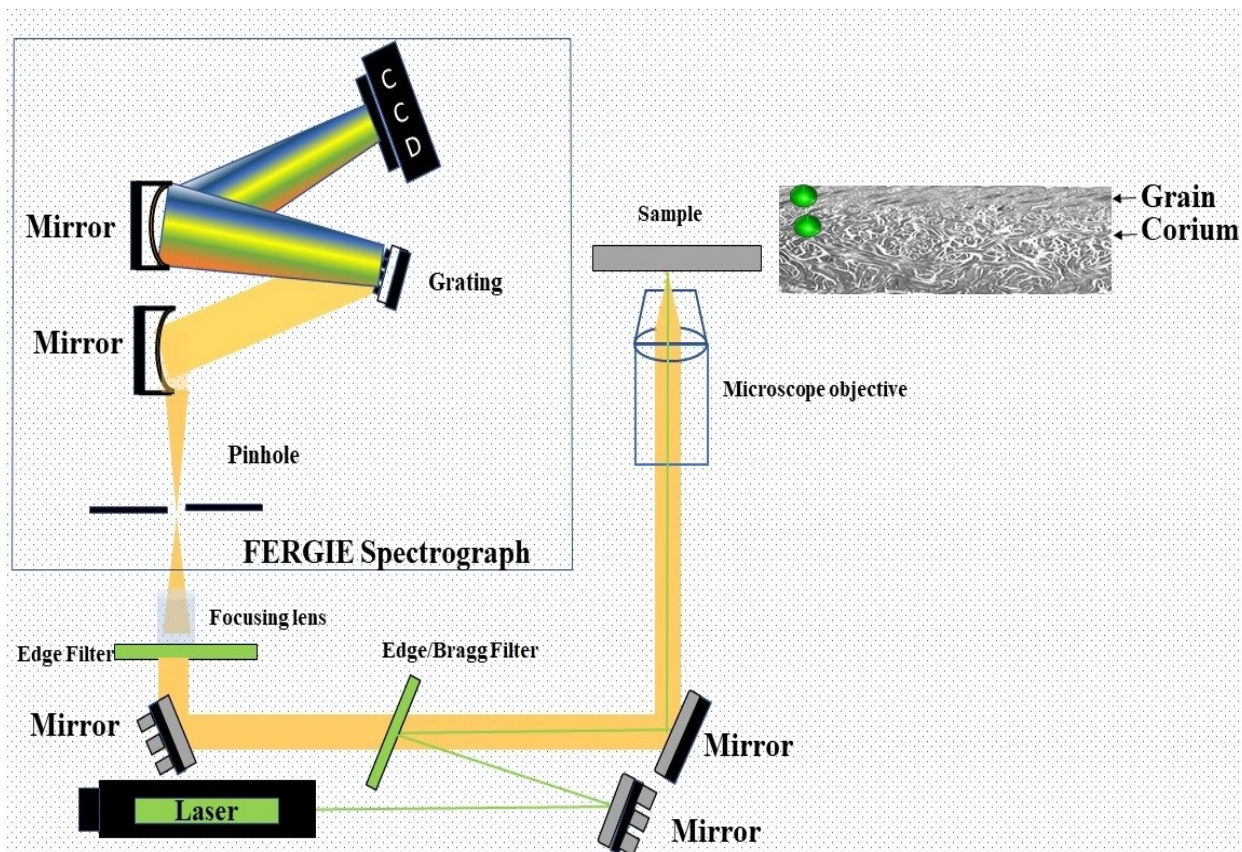


Fig. S1 Illustration of Raman spectroscopy hardware and setup with hide sample.

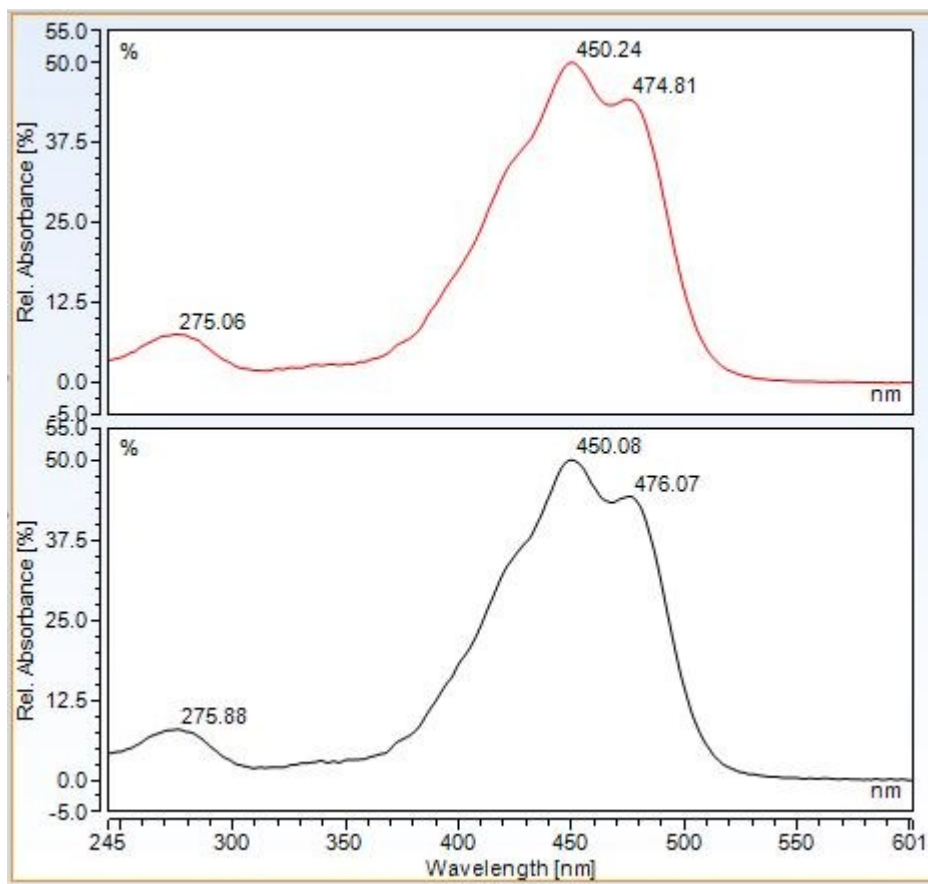


Fig. S2 UV scan of carotenoid external standard (top) and carotenoid extracted from the sample (bottom).

Table S1. Tentative assignments of Raman bands (grain and corium layer of cattle hide)

Position of character peak (cm⁻¹)	Biochemical Assignments	Biomolecular Assignments	Skin layer
515	S-S stretch	Keratin	GRAIN
567	N-H stretch	Cytosine or Guanine	CORIUM
872-873	ν C-C Hydroxyproline	Protein (collagen)	GRAIN, CORIUM
938	ν C-C Proline and valine (α -helix)	Protein (collagen)	CORIUM
956	δ CH ₃ (deformed)	Lipid, protein	GRAIN
1001-1004	ν C-CH ₃ ring breathing	Phenylalanine, Carotenoids	GRAIN
1084-1095	ν -O-P-O-, ν C-C phospholipid	Nucleic acid (DNA, RNA)	CORIUM
1151.00	ν C-C	Carotenoids	GRAIN

1243	Amino compound III (β fold)		CORIUM
1267	Amino compound III (α -helix)		GRAIN
1288–1304	Lipid CH_2 bending vibration and bending vibration CH_2CH_3		CORIUM
1351	Carbon particle		GRAIN
1388	CH_3 band		GRAIN
1441-1449	δCH_2 (bending) proteins and lipids	Protein, Lipid	GRAIN, CORIUM
1518-1522	$\nu \text{C}=\text{C}$	Carotenoids	GRAIN, CORIUM
1588	$\nu \text{C}-\text{C}$ aromatic ring	Melanin	GRAIN
1654,1657	Amino compounds I, α helix	Protein	CORIUM
1744	$\text{C}=\text{O}$ stretch	Carbonyl feature of lipid spectra, Ester group	CORIUM

2154	ν C \equiv N		GRAIN
2305-3100	ν C-H	CH ₃ symmetric stretch of lipids	GRAIN, CORIUM

ν : stretching vibration, ν_{as} : asymmetric stretching vibration, ν_s : symmetric stretching vibration, δ : bending, deformed, swing (relative peak intensity = the peak intensity/average intensity of the full spectrum).

Table S2: Distribution of biochemical components in Grain and Corium Layers of hide.

Number	Normalised Intensity					
	Lipids		Proteins		Carotenoids	
	Grain	Corium	Grain	Corium	Grain	Corium
1	0.042	0.049	0.06	0.029	0.23	0.008
2	0.047	0.041	0.06	0.040	0.22	0.01
3	0.035	0.046	0.07	0.042	0.26	0.007
4	0.027	0.043	0.08	0.048	0.26	0.010
Average	0.0380	0.045	0.07	0.040	0.24	0.009
SD	0.0085	0.0035	0.00	0.0079	0.019	0.0019

Table S3: HPLC results for correlation with Raman results.

Sample	Grain layer β -carotene concentration ($\mu\text{g}/\text{mg}$)
37	0.04957
59	0.04513
42	0.04042
55	0.02982
57	0.03962
66	0.01317
31	0.02451
26	0.03579
44	0.01710
40	0.02013
43	0.03690
54	0.03276
27	0.0501
28	0.1075
29	0.0534
30	0.082
32	0.0917
33	0.1217
34	0.0265
35	0.1156
36	0.0681
52	0.1808
39	0.0546
41	0.0585
46	0.0259
50	0.0307
51	0.0326
53	0.0605
56	0.0546
58	0.0451
48	0.039
61	0.2257
62	0.0607
63	0.0916
64	0.0418
67	0.0217