coatings

Supplementary Materials

An SWIR-MIR Spectral Database of Organic Coatings Used on Historic Metals

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Table S1. Mastic resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	1371	Weakens	w, b	$2\nu(CH_3)+\delta(CH_3)$
	1426	Weakens	w, b	$2\nu(CH_2)+\delta(CH_2)$
	~1615		w, sh	º2ν(Ar. CH)
	1706-1738		s, b	$2\nu_{a+s}(CH_2)$
	~1940	Weakens	w, b	ν(OH)+δ(OH)
	2175	Shifts right to 2182	w	ν(CO)+$\nu(CH_2)$ and ºν(Ar. CH)+ν(Ar. C=C)
	2265		sh	Ar. shoulder
4412	2299		FTIR: w; FORS: s	$\nu_a(CH_2)+\delta(CH_2)$
4347	2401	Weakens and broadens	FTIR: w; FORS: m	$\nu_s(CH_2)+\delta(CH_2)$
	2463		m, b	º4δ(CC)
3473			m	ν(OH)
	3076	Disappears	w	º$\nu(CH_2)$
2949		Broadens	s	ν_a(CH)
2869			s, doublet with ^	ν_s(CH)
1707			s	ν(C=O)
1457, 1382			s	δ(CH)
1247–1033			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; $_a$: asymmetric; $_s$: symmetric

º = unique, characteristic feature of tree resins

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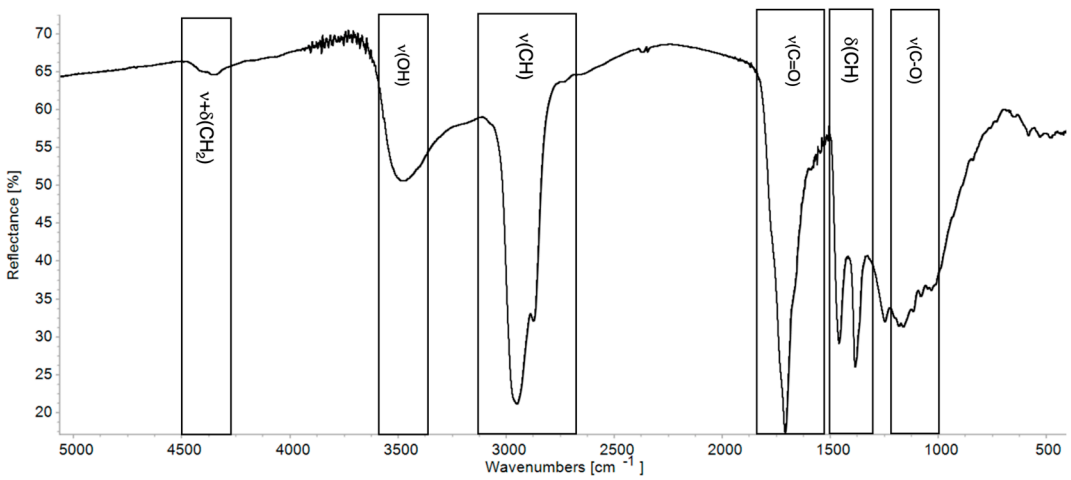

Figure S1. Mastic resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

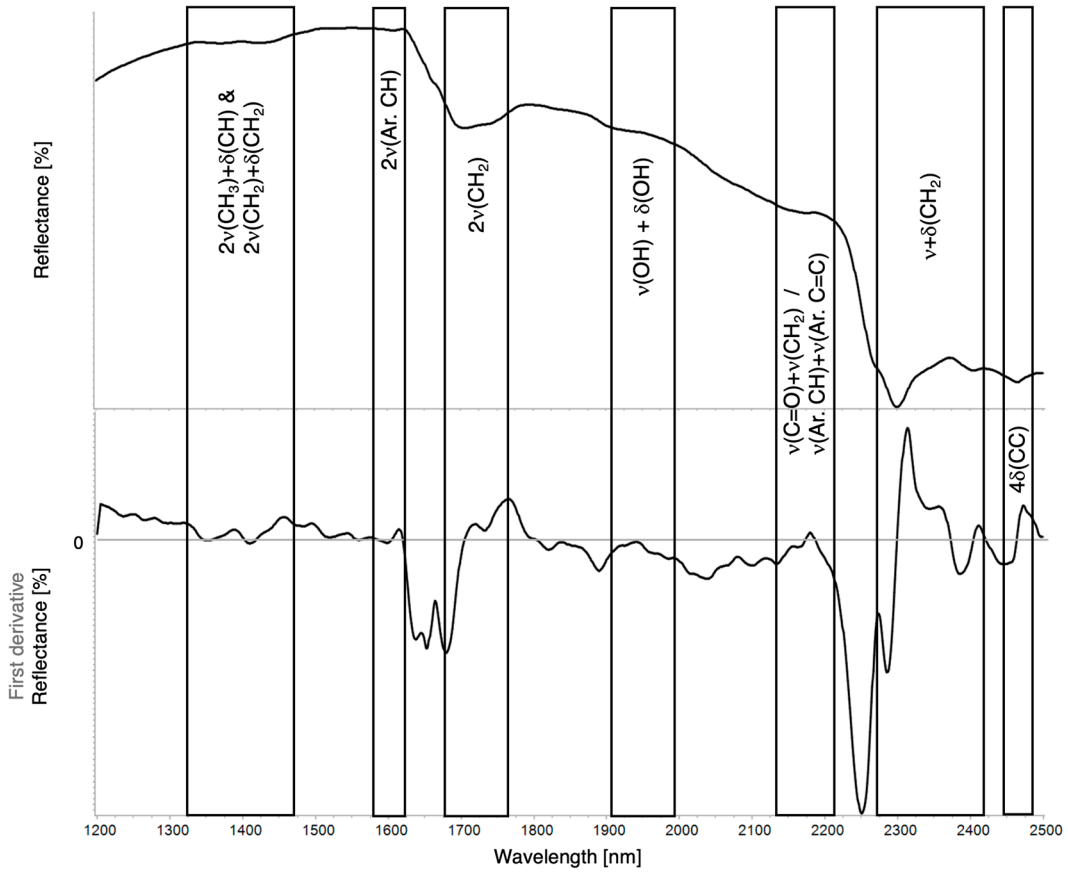

Figure S2. Mastic resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S2. Pine resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	1600-1623		m, sh	$^{o}2\nu$(Ar. CH)
	1717-1774	Shifts to 1708 and broadens	m, b	$2\nu_{a+s}(CH_2)$
	2180	Shifts to 2172 and broadens	w	$\nu(CO)+\nu(CH_2)$ and $^{o}\nu$(Ar. CH)+ν(Ar. C=C)

~4389	2305	Shifts to 2301	FTIR: w; FORS: s	$\nu_a(CH_2)+\delta(CH_2)$
	2354	Shifts to 2340	FORS: m	$\nu_s(CH_2)+\delta(CH_2)$
	2493	Shifts to 2386	m, b	$^{\varrho}4\delta(CC)$ and/or $\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{\text{aliphatic ester}}$
3434			m	$\nu(OH)$
3070			sh	$^{\varrho}\nu(CH)$
2943		Broadens	s	$\nu_a(CH)$
2870			s, doublet with ^	$\nu_s(CH)$
2638-2529, 1717-1696			sh, s	$\nu(C=O)$
1460-1387			s	$\delta(CH)$
1247–1032			s	$\nu(C\text{-}O)$

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; $_a$: asymmetric; $_s$: symmetric

$^{\varrho}$ = unique, characteristic feature of tree resins

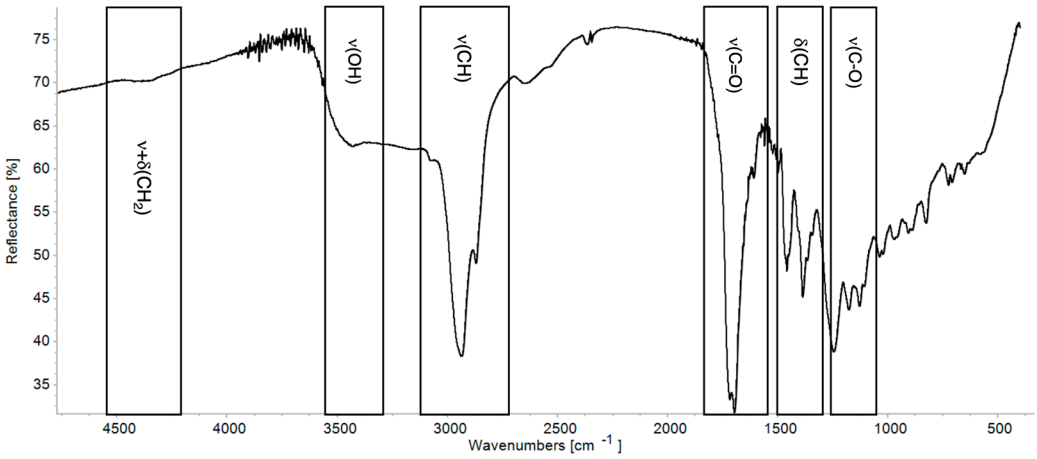

Figure S3. Pine resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

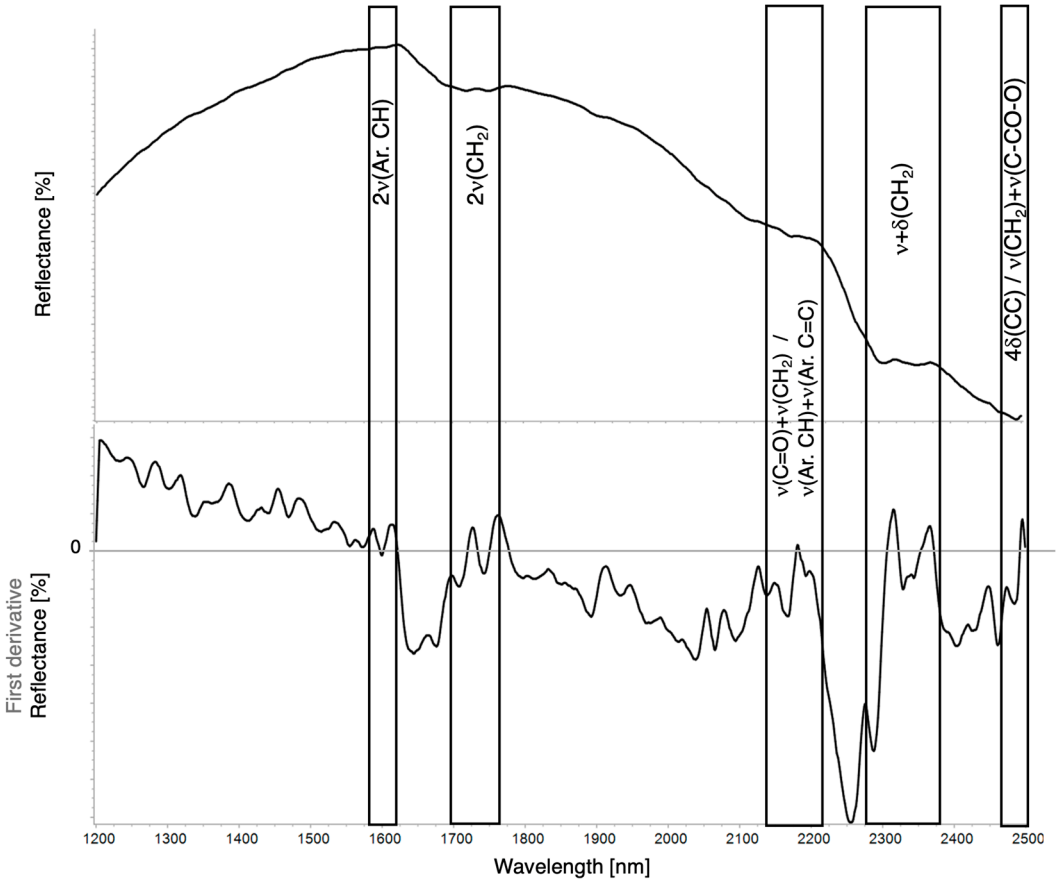

Figure S4. Pine resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S3. Bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	2007-2109	Shifts left	w, triplet	Unknown
	2311		m	$\nu_a(CH_2)+\delta(CH_2)$
	2359-2408		w	$\nu_s(CH_2)+\delta(CH_2)$
	2465-2486		w	Unknown
2952			m, sh	$\nu_a(CH)$
2925			s	$\nu_a(CH)$
2852			s, doublet with ^	$\nu_s(CH)$

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder
[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

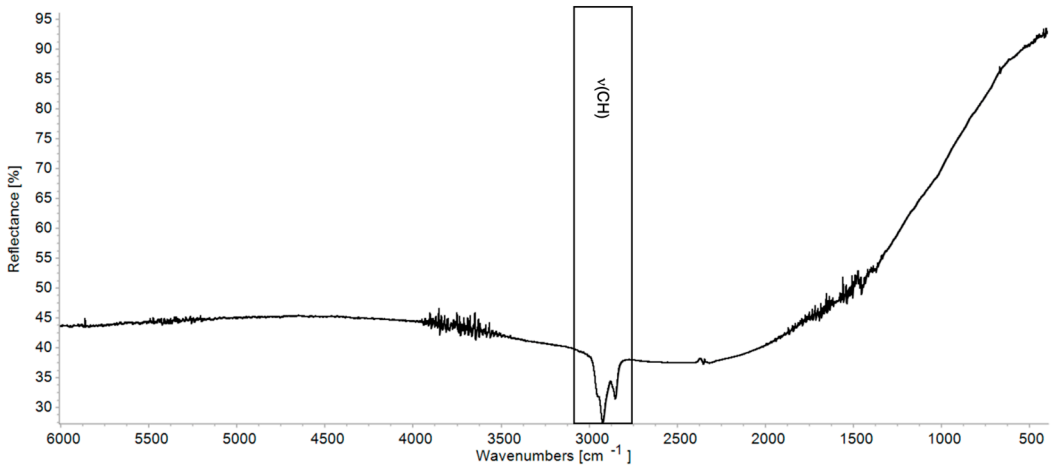

Figure S5. Bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

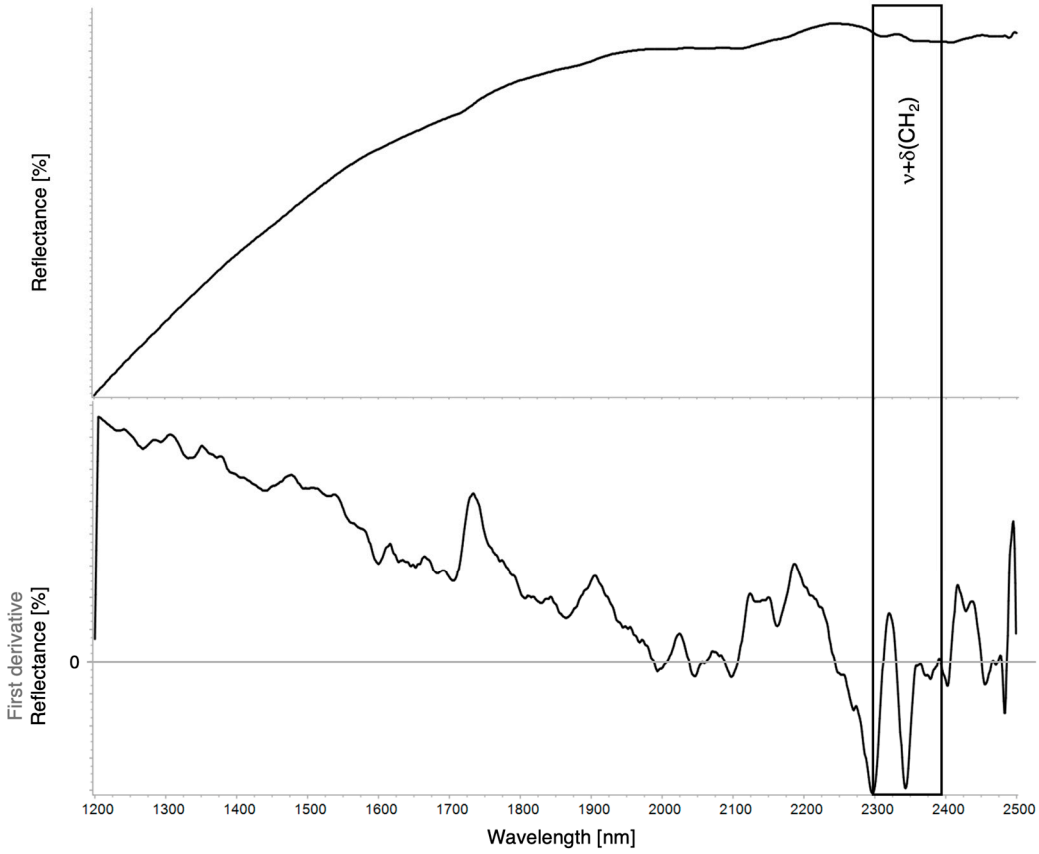

Figure S6. Bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S4. Linseed oil stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	1717		m	$2\nu_{a+s}(CH_2)$
	1929	Very weak and broad	w, b	*3ν(C=O)
	2120-2165	Slight shift to the left	w, b doublet	ν(C=O)+ν(CH_2)

4339	2306	Weakening in FTIR	FTIR: w; FORS: s	$\nu_a(CH_2)+\delta(CH_2)$
4259	2347	Weakening in FTIR	FTIR: w; FORS: s	$\nu_s(CH_2)+\delta(CH_2)$
	2460–2480		w, b	$*\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{\text{aliphatic ester}}$
3468			m	$\nu(OH)$
3011		Further degradation of left shoulder	sh	$\nu_a(CH)$
2926			s	$\nu_a(CH)$
2852			s	$\nu_s(CH)$
1743			s	$\nu(C=O)$
1532-1387			s	$\delta(CH)$
1166			s	$\nu(C\text{-}O)$

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

* = unique, characteristic feature of drying oils

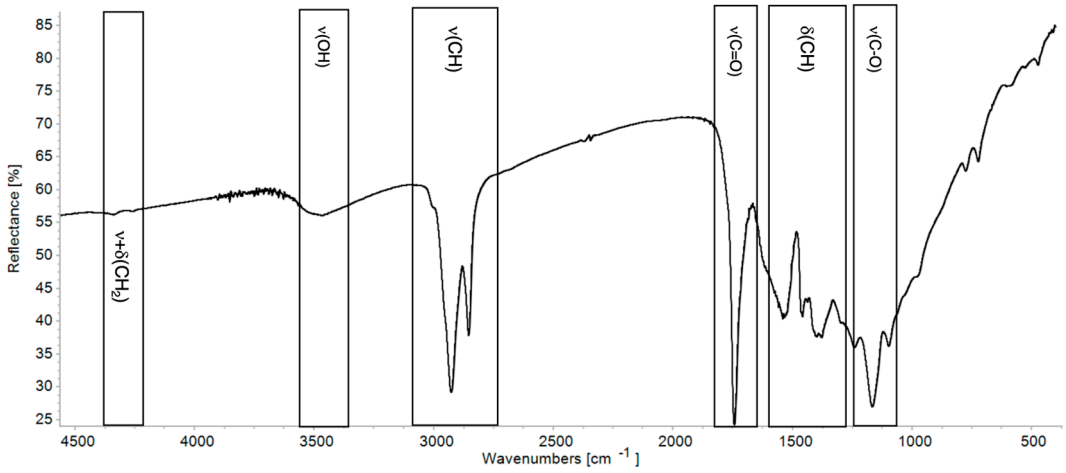

Figure S7. Linseed oil stoved on metal coupon ER-FTIR spectrum with assigned bands.

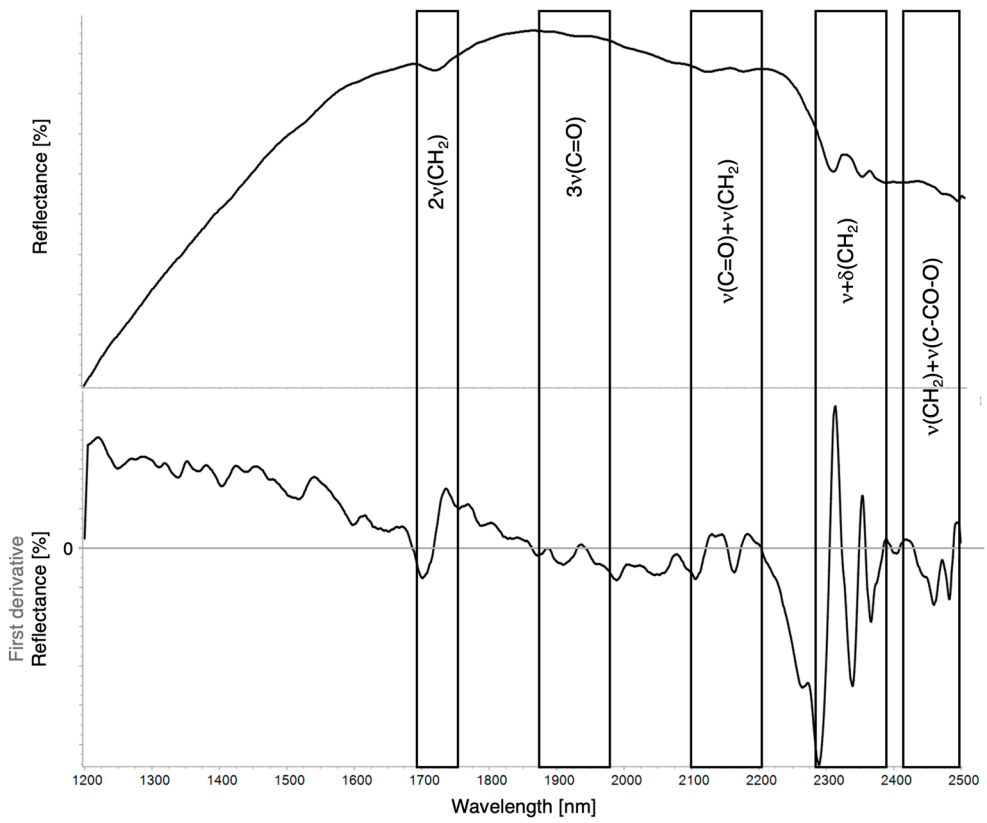

Figure S8. Linseed oil stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S5. Linseed oil–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity**[1]	**Assignment**[2]
FTIR (cm^{-1})	FORS (nm)			
	1707	Shift to 1714	m	$2\nu(CH_2)$
	2115-2104	Broadens	w, b Doublet	$\nu(C{=}O)+\nu(CH_2)$
4335	2309	Weakening in FTIR	FTIR: w; FORS: s	$\nu_a(CH_2)+\delta(CH_2)$
4266	2351	Weakening in FTIR	FTIR: w; FORS: m	$\nu_s(CH_2)+\delta(CH_2)$
	2385–2489	Less definition	w, b	$*\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{\text{aliphatic ester}}$
3407			m	ν(OH)
3011		Disappears	m, sh	$\nu_a(CH)$
2924			s	$\nu_a(CH)$
2852			s	$\nu_s(CH)$
1733			s	ν(C=O)
1460, 1396			s	δ(CH)
1168		Weakens	w	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; $_a$: asymmetric; $_s$: symmetric

* = unique, characteristic feature of drying oils

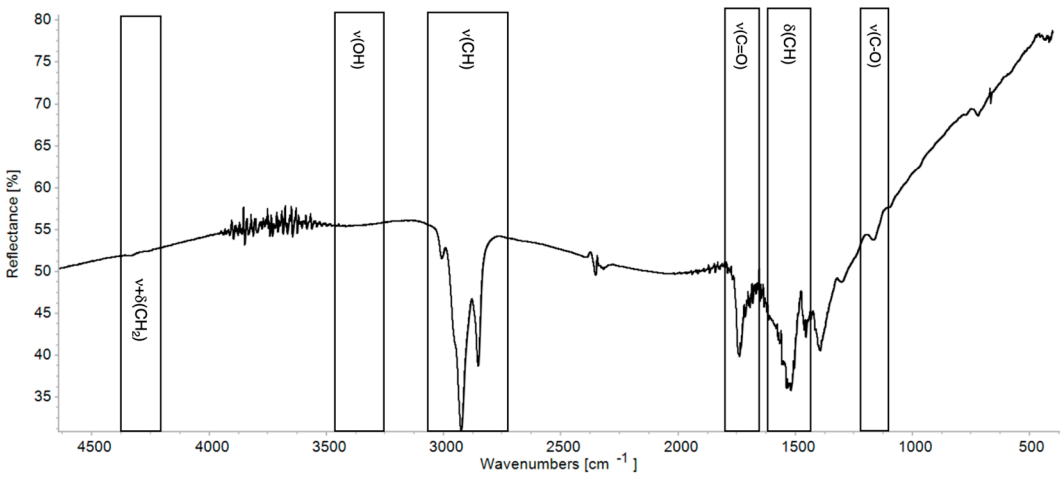

Figure S9. Linseed oil–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

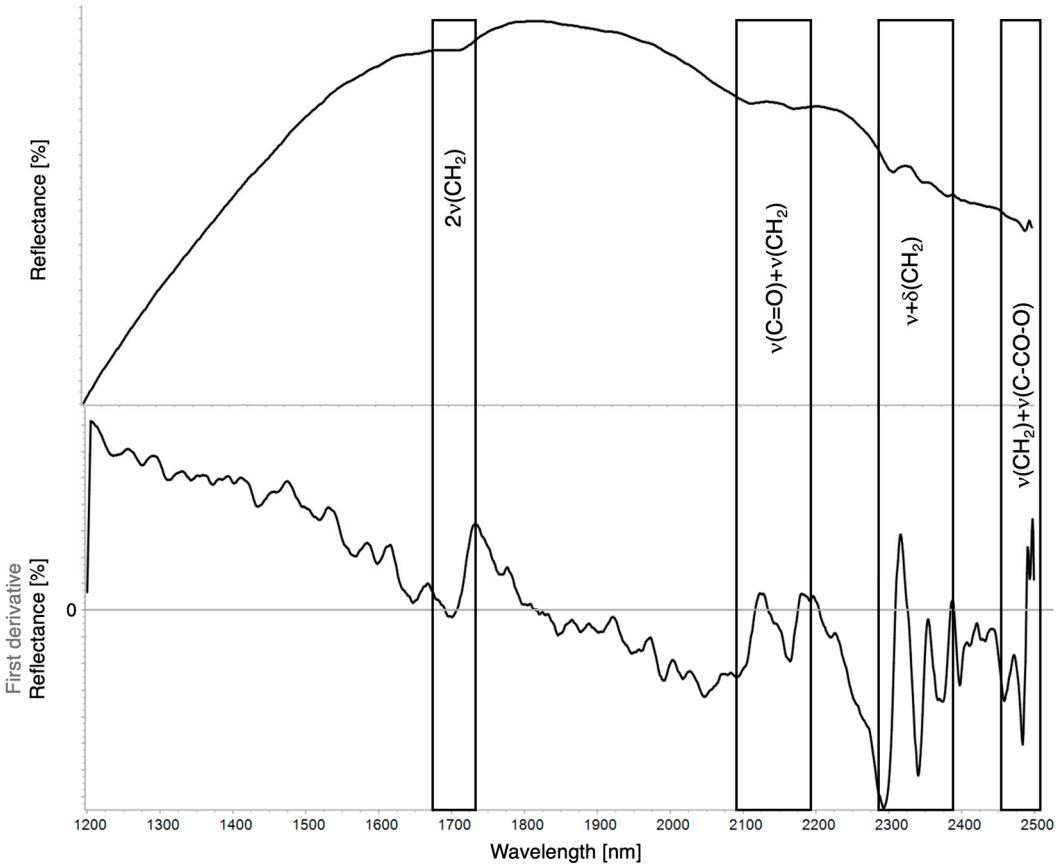

Figure S10. Linseed oil–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S6. Linseed oil–mastic resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity**[1]	**Assignment**[2]
FTIR (cm^{-1})	FORS (nm)			
	~1612		w, sh	$^{o}2\nu$(Ar. CH)
	1632-1712		w	$2\nu_{a+s}(CH_2)$
	1844-1916	Less resolved	w, b	ν(OH)+δ(OH) and/or *3ν(C=O)
	2115-2162		w	$\nu(C{=}O)+\nu(CH_2)$

	2265		sh	
4338	2300	Shift to 2303	FTIR: w; FORS: s	$\nu_a(CH_2)+\delta(CH_2)$
4251	2349	Shift to 2346	FTIR: w; FORS: m	$\nu_s(CH_2)+\delta(CH_2)$
	2376–2500		w, b Series of oscillating weak bands	º4δ(CC) and/or *$\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{aromatic/aliphatic}$
3500		Shift to 3464	m	ν(OH)
2928			s	$\nu_a(CH)$
2855			s	$\nu_s(CH)$
1739, 1711			s	ν(C=O)
1453, 1378		First abs shifts to 1457	m	δ(CH)
1162			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

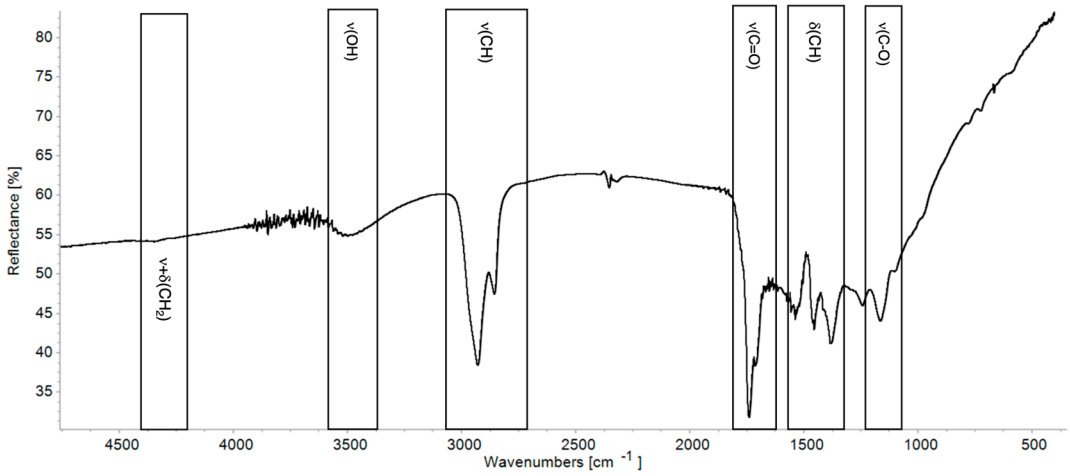

Figure S11. Linseed oil–mastic resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

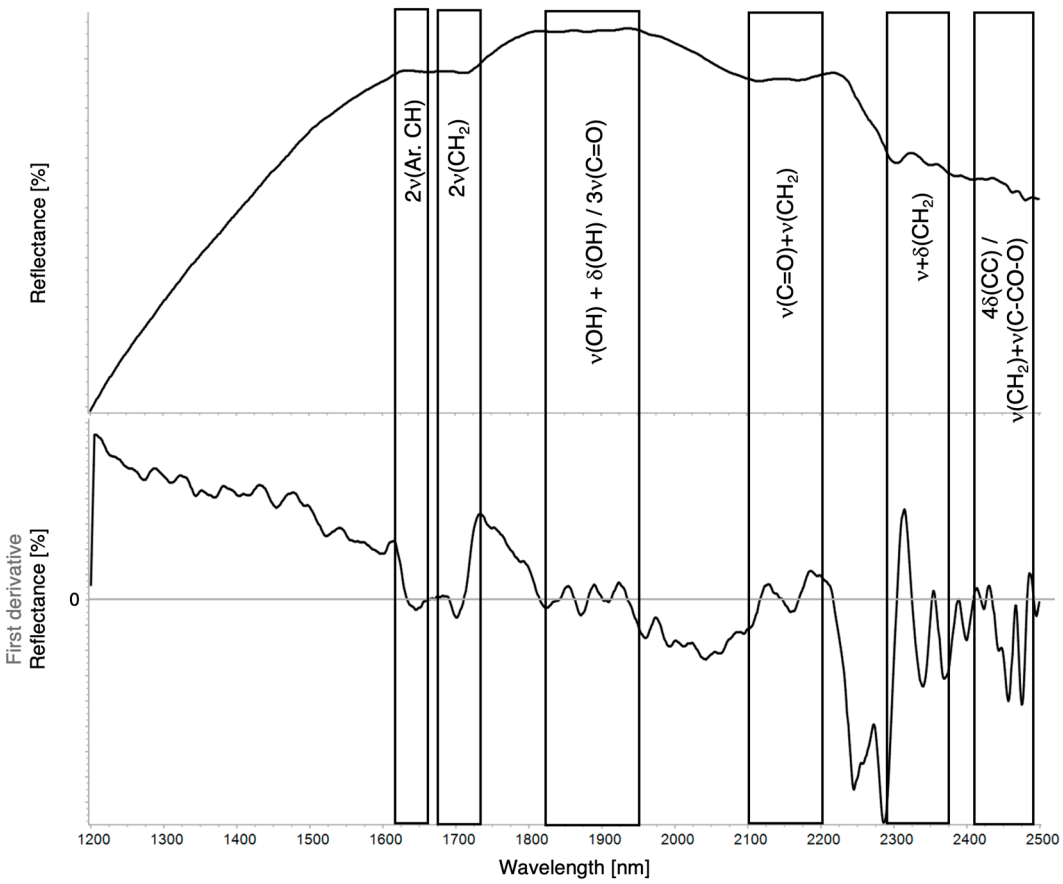

Figure S12. Linseed oil–mastic resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S7. Linseed oil–mastic resin–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	~1705	Less abs	w	$2\nu_{a+s}(CH_2)$
	1810-1882	Less resolved & shifts to the right	w, b	ν(OH)+δ(OH) and/or *3ν(C=O)
	2117-2172	Shifts to 2113-2168	w	ν(C=O)+ν(CH_2)
	2311		s	$\nu_a(CH_2)+\delta(CH_2)$
	~2354	Not well resolved in either	w	$\nu_s(CH_2)+\delta(CH_2)$
	2404–2481		w, b	º4δ(CC) and/or
			S	*ν(CH_2)+ν(C-CO-O)$_{aromatic/aliphatic}$
3434			m	ν(OH)
2924			s	ν_a(CH)
2852			s	ν_s(CH)
1742			s	ν(C=O)
1451, 1373			m	δ(CH)
1164			m	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; $_a$: asymmetric; $_s$: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

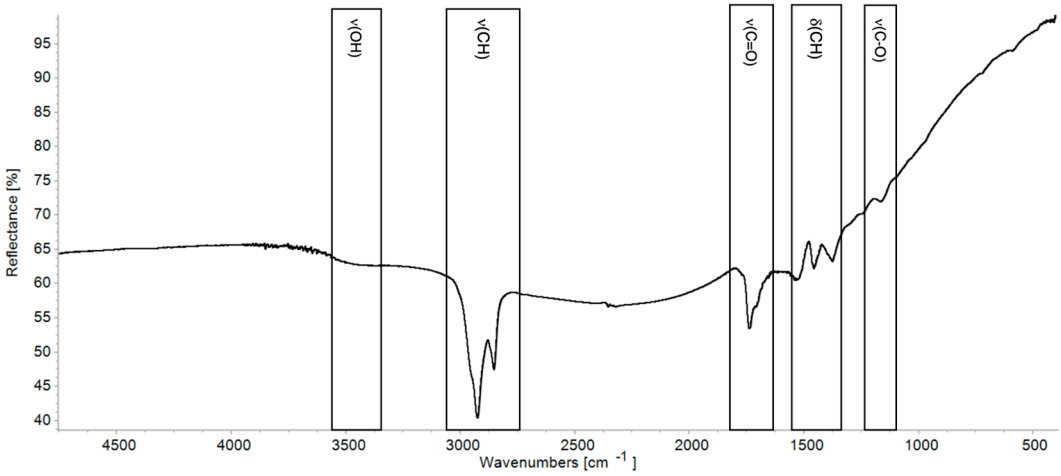

Figure S13. Linseed oil–mastic resin–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

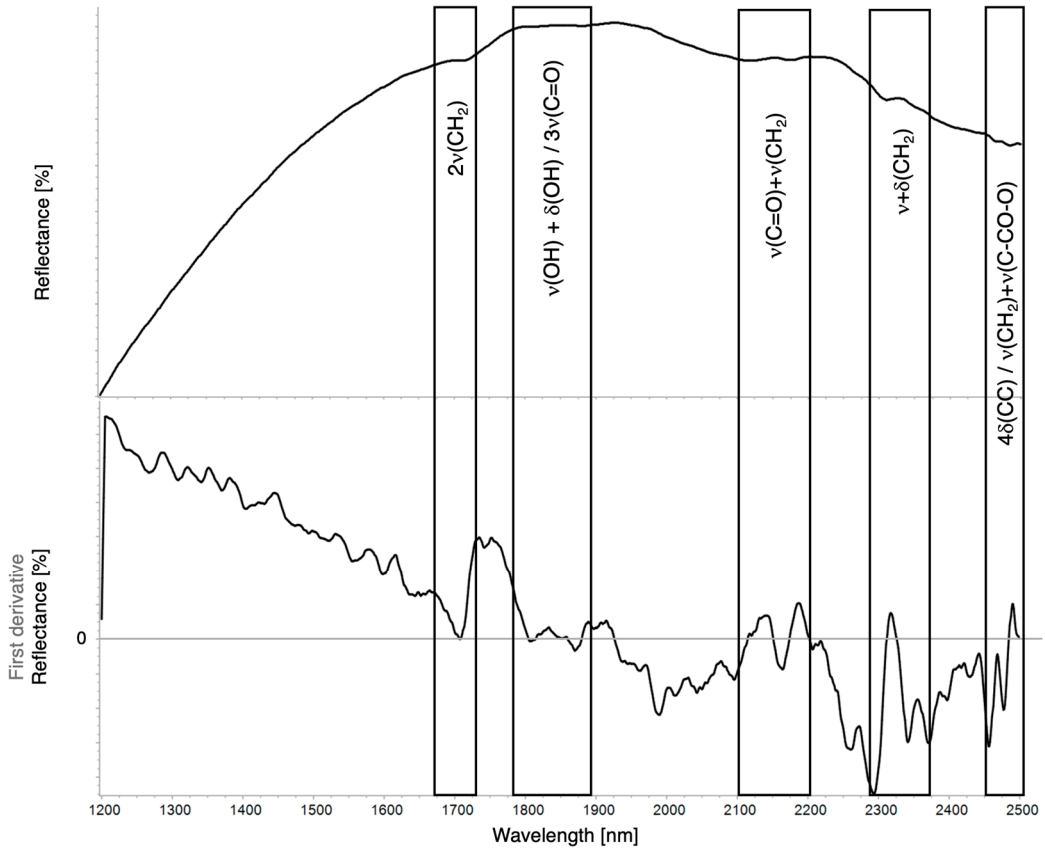

Figure S14. Linseed oil–mastic resin–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S8. Linseed oil–pine resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	1605-1615		w, sh	ºν(Ar. CH)
	1715		s	$2\nu_{a+s}(CH_2)$

	2123-2180		w, b doublet	ν(C=O)+ν(CH_2)
4336	2303	Weakening in FTIR	FTIR: w; FORS: s	ν_a(CH_2)+δ(CH_2)
4262	2344	Weakening in FTIR	FTIR: w; FORS: s	ν_s(CH_2)+δ(CH_2)
	2471–2483		w/m, b	*ν(CH_2)+ν(C-CO-O)$_{aromatic/aliphatic}$ and/or º4δ(CC)
3461			m	ν(OH)
2930		Further degradation of left shoulder	s	ν_a(CH)
2866			s, doublet with ^	ν_s(CH)
1736			s	ν(C=O)
1528-1389			m	δ(CH)
1164			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; $_a$: asymmetric; $_s$: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

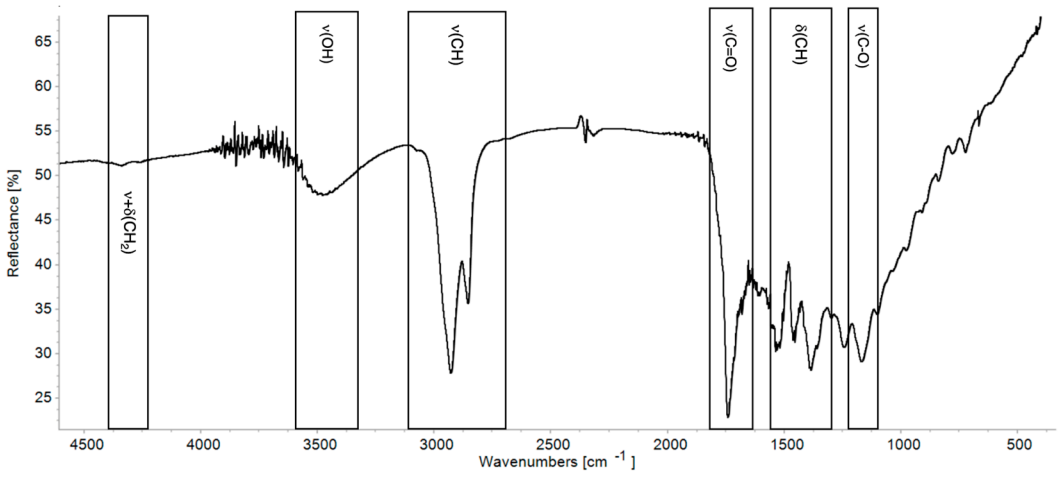

Figure S15. Linseed oil–pine resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

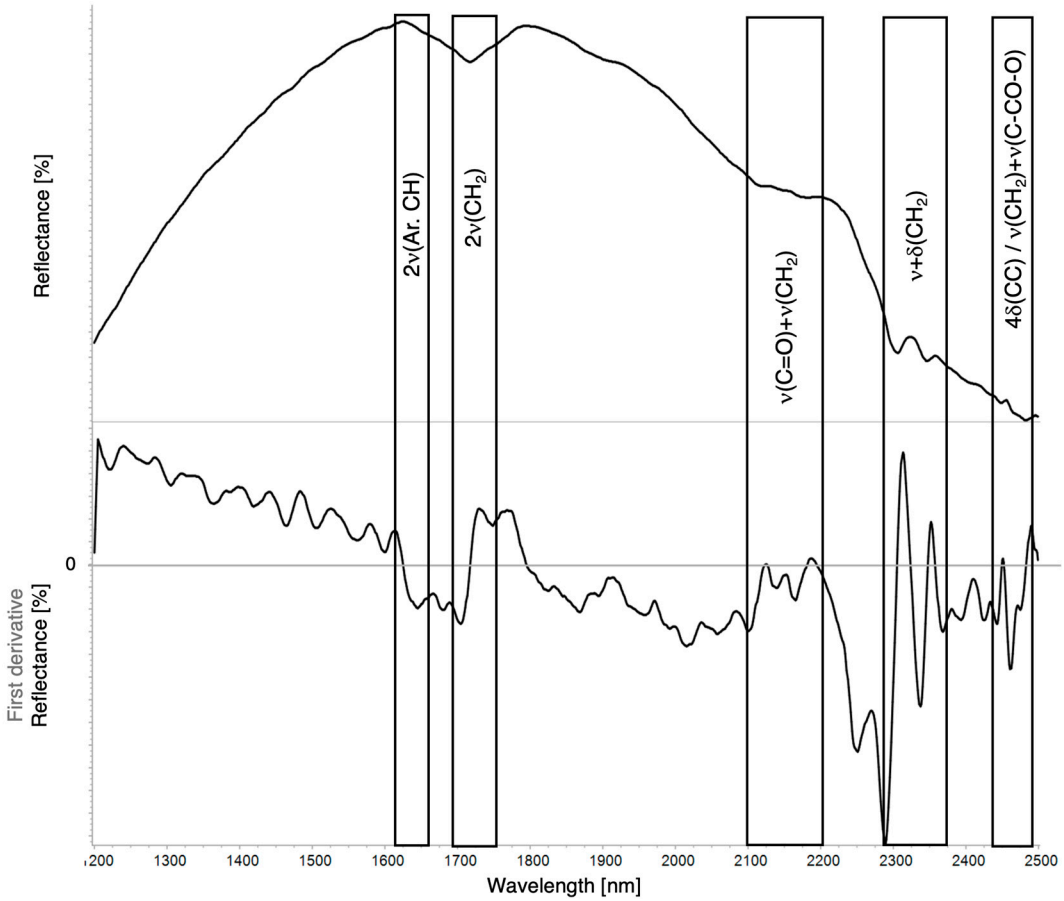

Figure S16. Linseed oil–pine resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S9. Linseed oil–pine resin–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity**[1]	**Assignment**[2]
FTIR (cm^{-1})	FORS (nm)			
	1643-1715	No clear abs	w, doublet	$2\nu_{a+s}(CH_2)$ and/or º2ν(Ar. CH)
	1832-1898	Narrows		Maybe *3ν(C=O)
	2116-2176		m, b doublet	ν(C=O)+$\nu(CH_2)$
4325	2311	Weakening in FTIR	FTIR: w; FORS: s	$\nu_a(CH_2)+\delta(CH_2)$
4257	~2354	Weakening in FTIR	FTIR: w; FORS: w	$\nu_s(CH_2)+\delta(CH_2)$
	2379-2483	Shift right	w, b	*$\nu(CH_2)+\nu$(C-CO-O)$_{aromatic/aliphatic}$ and/or º4δ(CC)
3425			m	ν(OH)
2925		Further degradation of left shoulder	s	ν_a(CH)
2852			s, doublet with ^	ν_s(CH)
1737			s	ν(C=O)
1451, 1387			m	δ(CH)
1159			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder
[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric
º = unique, characteristic feature of tree resins
* = unique, characteristic feature of drying oils

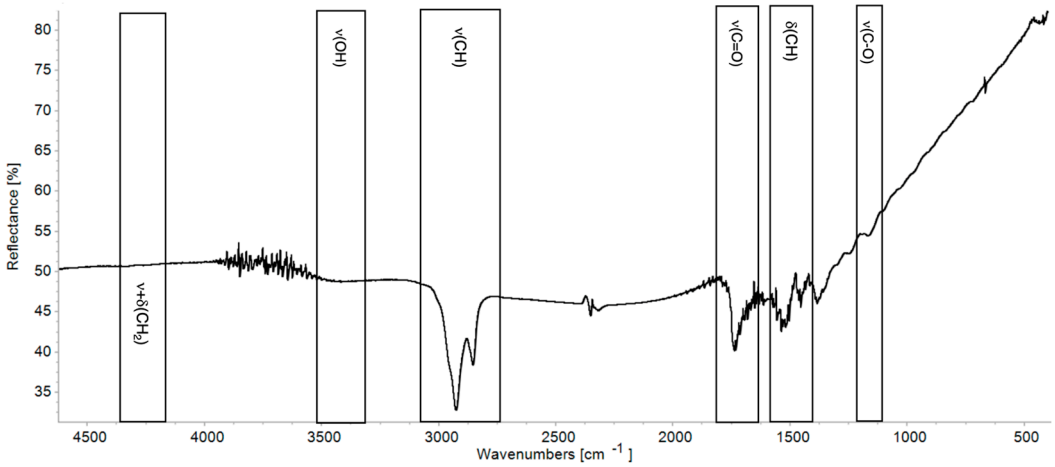

Figure S17. Linseed oil–pine resin–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

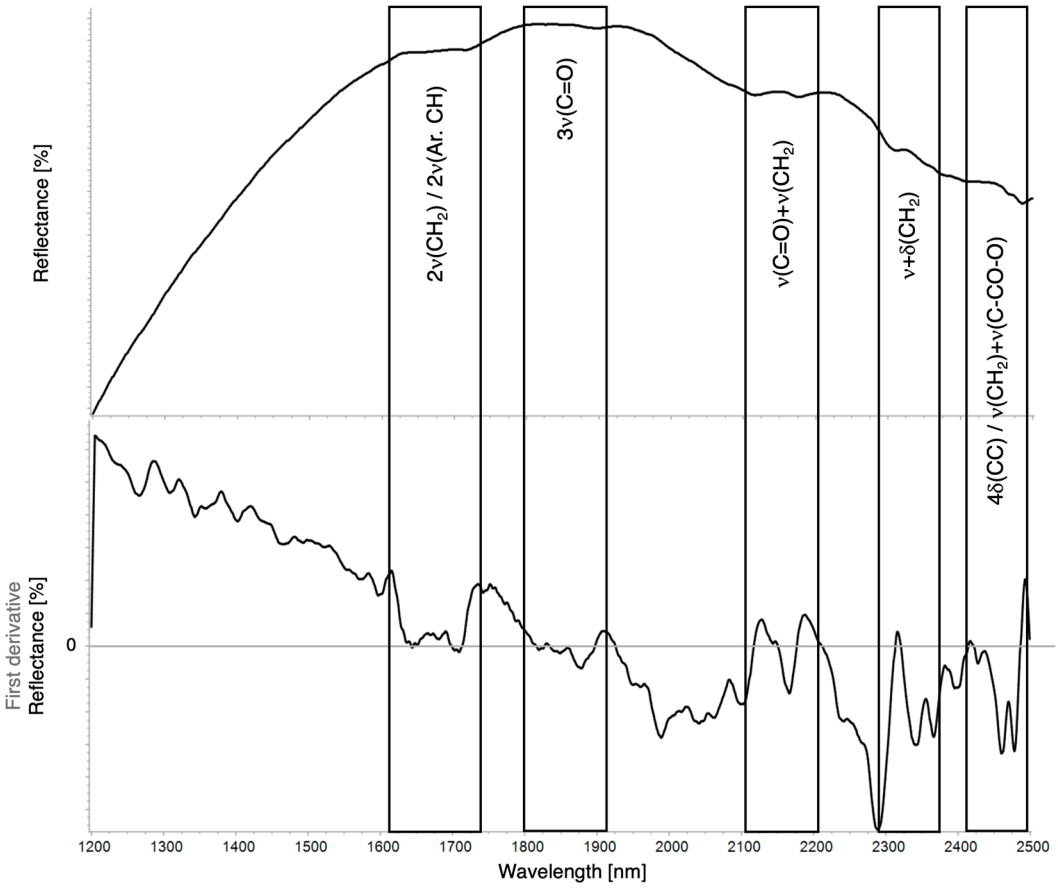

Figure S18. Linseed oil–pine resin–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S10. Linseed oil–mastic resin–pine resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position	Intensity[1]	Assignment[2]

FTIR (cm^{-1})	FORS (nm)	**Observed shift after artificial ageing**		
	~1612		w, sh	º2ν(Ar. CH)
	1719	Shift to 1715	s	$2\nu_{a+s}(CH_2)$
	~1914	Less resolved	w, b	ν(OH)+δ(OH) and/or *3ν(C=O)
	2139-2175	Shift to 2148-2177	w, doublet	ν(C=O)+ν(CH_2)
4339	2303		FTIR: w; FORS: s	$\nu_a(CH_2)+\delta(CH_2)$
4257	2347		FTIR: w; FORS: m	$\nu_s(CH_2)+\delta(CH_2)$
	2465-2480		w, b	º4δ(CC) and/or *ν(CH_2)+ν(C-CO-O)$_{aromatic/aliphatic}$
3466		Shift to 3464	m	ν(OH)
2929			s	$\nu_{as}(CH)$
2856			s	$\nu_s(CH)$
1737			s	ν(C=O)
1460, 1382			m	δ(CH)
1169			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

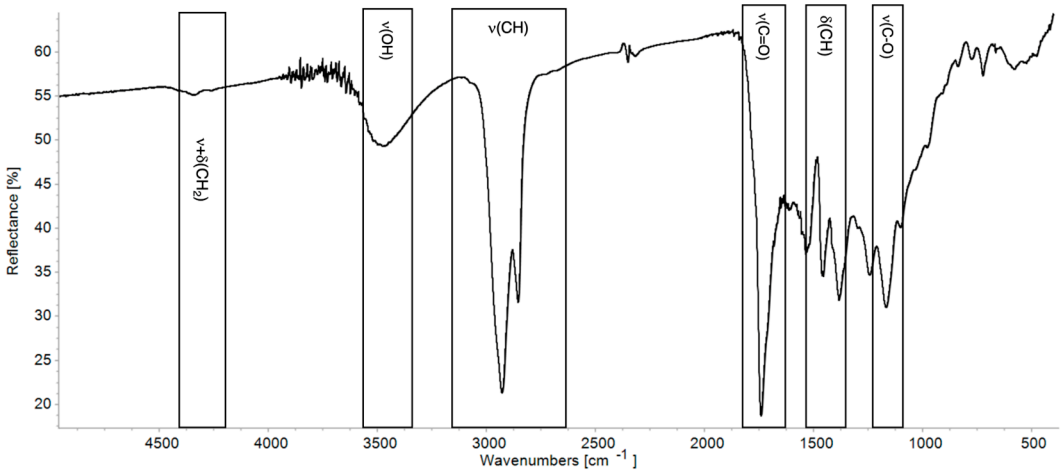

Figure S19. Linseed oil–mastic resin–pine resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

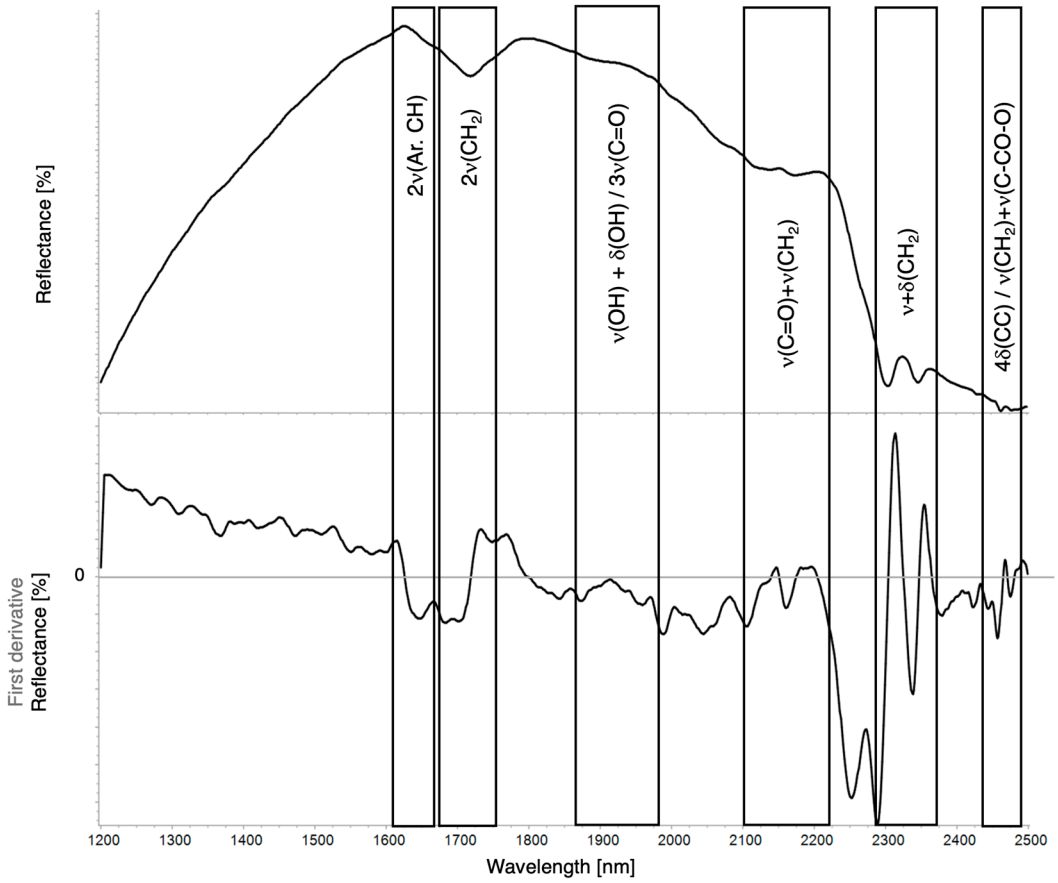

Figure S20. Linseed oil–mastic resin–pine resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S11. Linseed oil–mastic resin–pine resin–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	~1719		m	$2\nu_{a+s}(CH_2)$
	1832-1891	Less resolved	w	ν(OH)+δ(OH) and/or *3ν(C=O)
	2116-2176		w, doublet	ν(C=O)+ν(CH_2)
	2310		m	$\nu_a(CH_2)+\delta(CH_2)$
	2351	Weakens	w	$\nu_s(CH_2)+\delta(CH_2)$
	2478-2488	Broadens, less resolved	w, b	º4δ(CC) and/or *ν(CH_2)+ν(C-CO-O)aromatic/aliphatic
3398		Shift to 3464	m	ν(OH)
2924			s	$\nu_{as}(CH)$
2852			s	$\nu_s(CH)$
1737			s	ν(C=O)
1455, 1378			m	δ(CH)
1159			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

ϱ = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

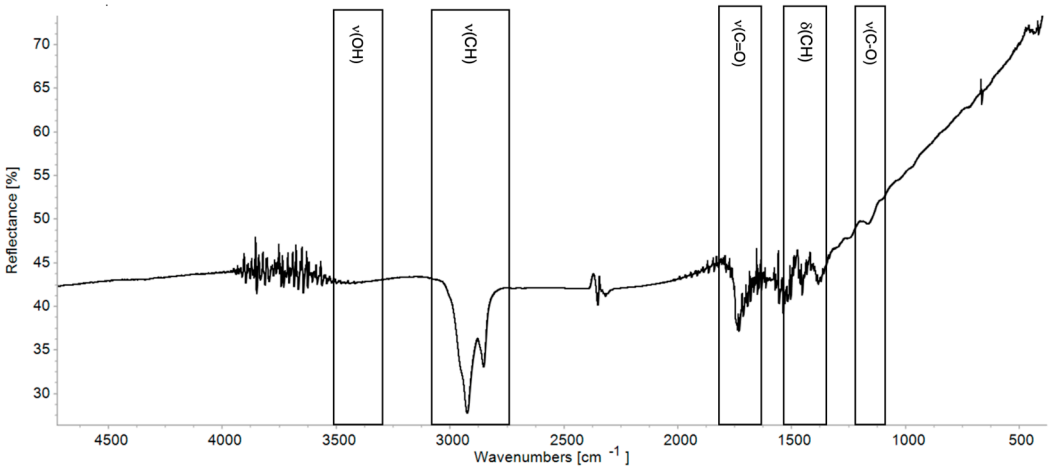

Figure S21. Linseed oil–mastic resin–pine resin–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

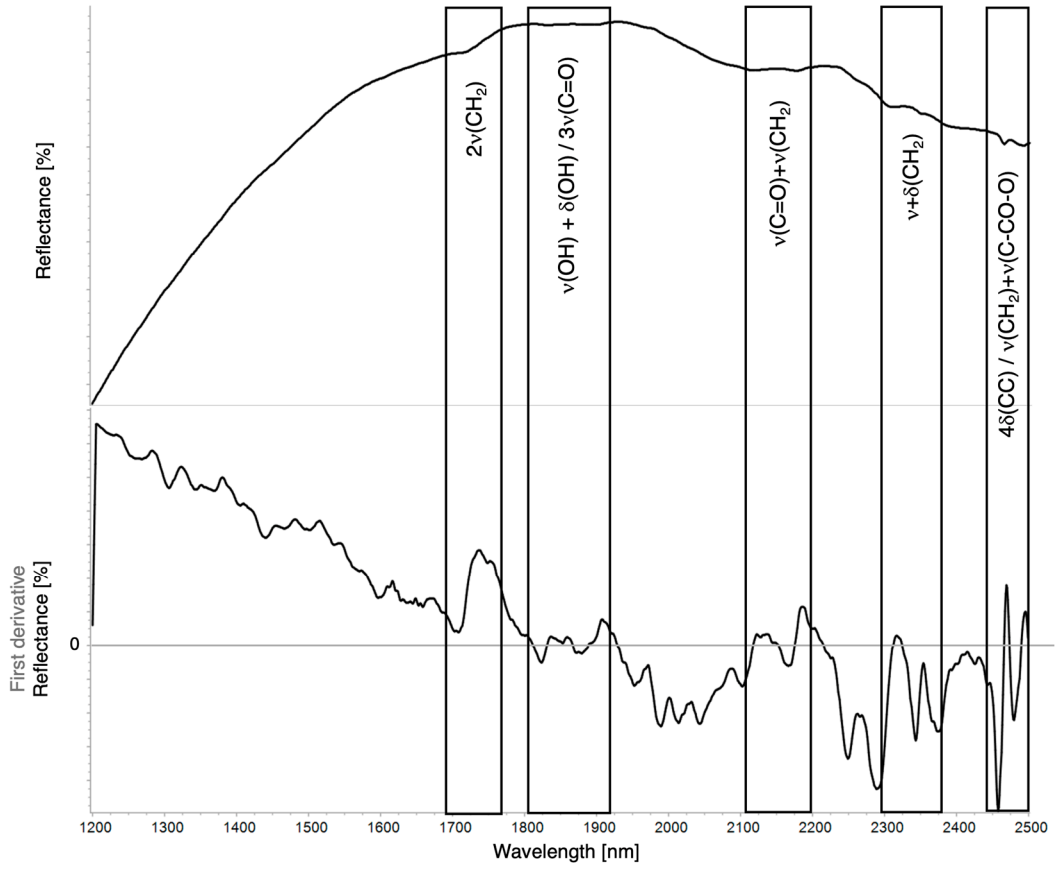

Figure S22. Linseed oil–mastic resin–pine resin–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S12. Walnut oil stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	1716	Shift to 1720 and strong intensity	m	$2\nu_{a+s}(CH_2)$

	2118-2169	Weakening	w, b, doublet	ν(C=O)+ν(CH_2)
4347	2308		FTIR: w; FORS: m	ν_a(CH_2)+δ(CH_2)
4259	2355	Shift to 2347, broadening	FTIR: w; FORS: m	ν_s(CH_2)+δ(CH_2)
	2460–2486		w, b	ν(CH_2)+ν(C-CO-O)$_{aliphatic}$
3468			m	ν(OH)
3015			sh	ν_a(CH)
2923		Further degradation of left shoulder	s	ν_a(CH)
2852			s	ν_s(CH)
1736			s	ν(C=O)
1532-1389			s	δ(CH)
1164			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; $_a$: asymmetric; $_s$: symmetric

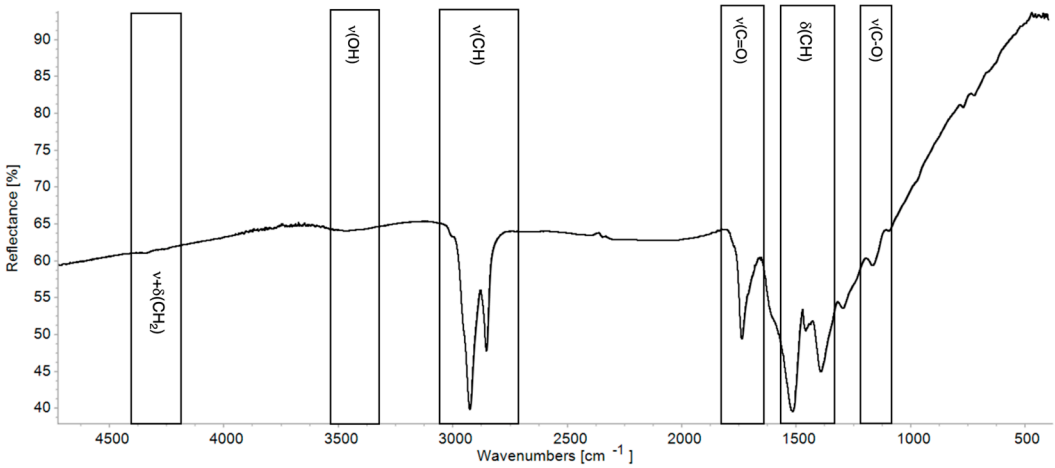

Figure S23. Walnut oil stoved on metal coupon ER-FTIR spectrum with assigned bands.

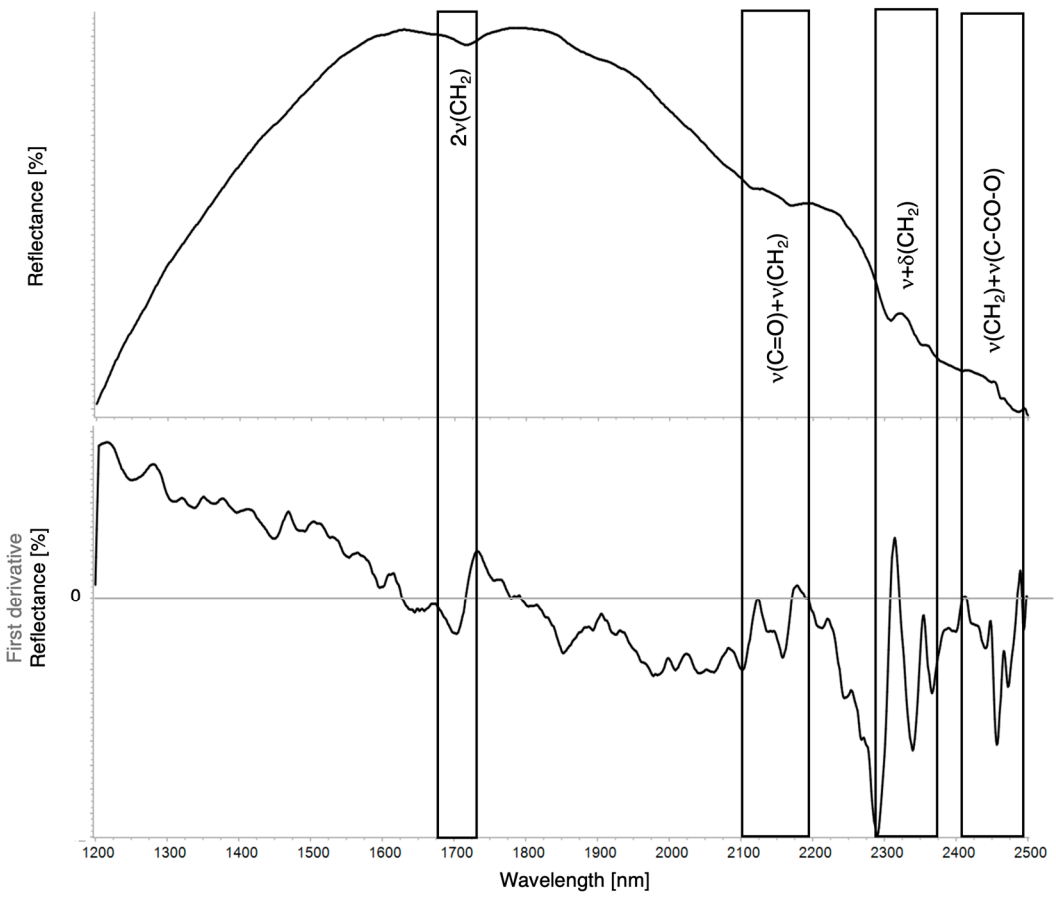

Figure S24. Walnut oil stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S13. Walnut oil–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	1716		s	$2\nu(CH_2)$
	2117-2169	Less definition	w, b doublet	$\nu(C=O)+\nu(CH_2)$
4330	2312		FTIR: w; FORS: m	$\nu_a(CH_2)+\delta(CH_2)$
4256	2349		FTIR: w; FORS: w	$\nu_s(CH_2)+\delta(CH_2)$
	2424–2488		w, b	$\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{aliphatic}$
		3379, poorly defined in the stoved sample	m	ν(OH)
3000		Disappears	m, sh	$\nu_a(CH)$
2925		Further degradation of left shoulder	s	$\nu_a(CH)$
2852			s, doublet with ^	$\nu_s(CH)$
1740			s	ν(C=O)
1457, 1392			m	δ(CH)
1164-1081			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

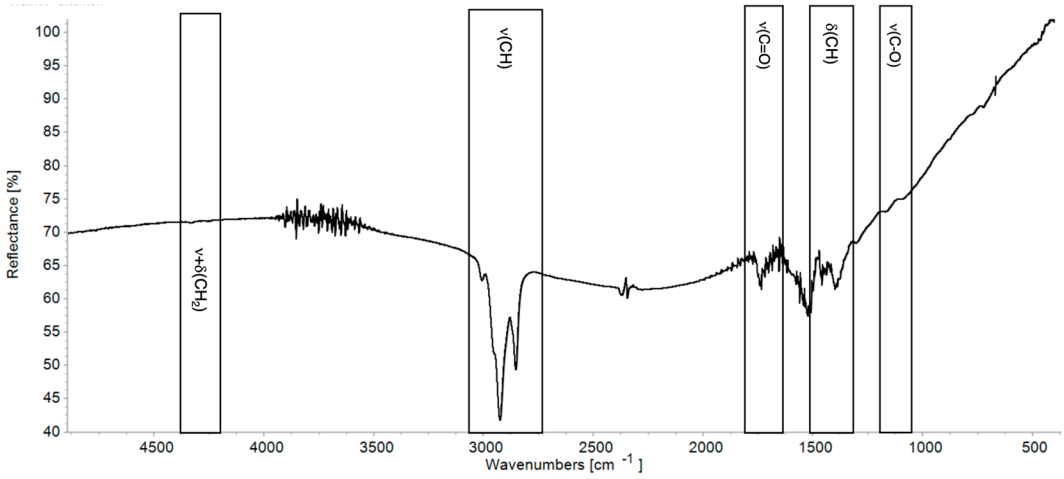

Figure S25. Walnut oil–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

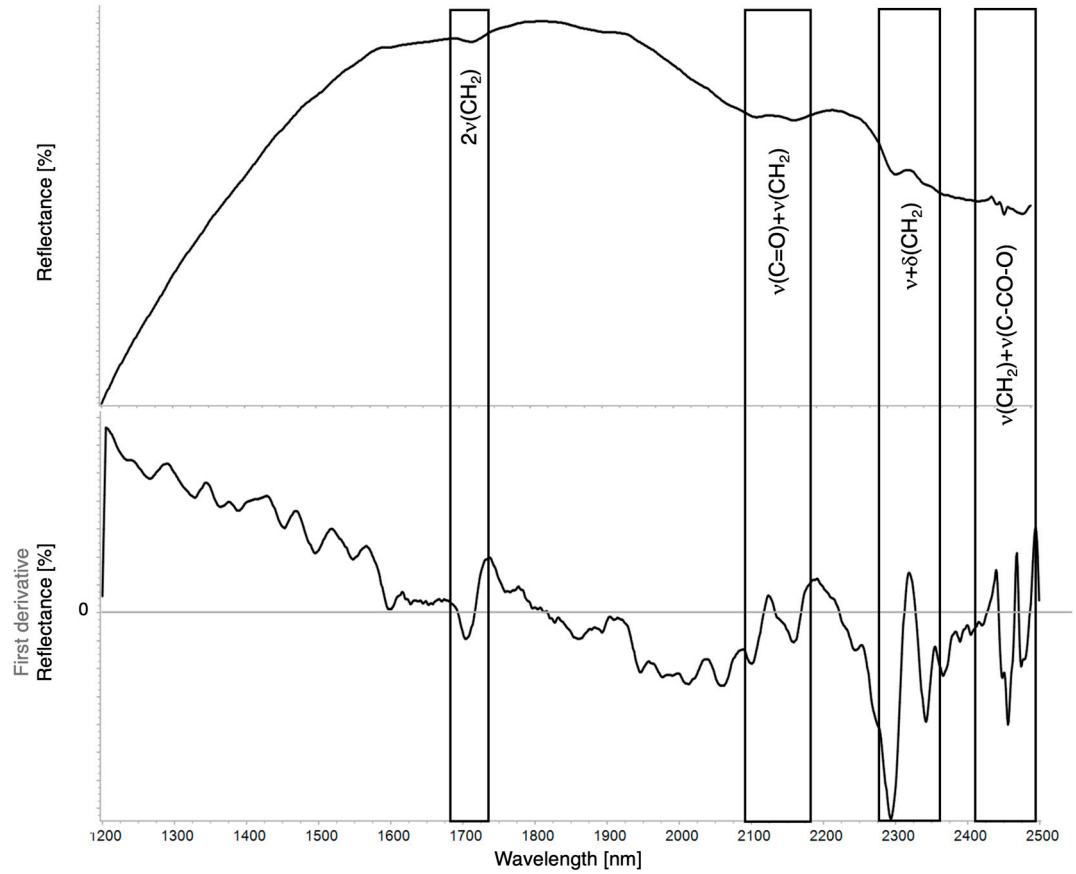

Figure 26. Walnut oil–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S14. Walnut oil–mastic resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	~1707	Shift left	m	$2\nu_{a+s}(CH_2)$
	1870-1950		w, b	ν(OH)+δ(OH) and/or *3ν(C=O)
	2122-2162		w	ν(C=O)+ν(CH_2)

			doublet	
	2307	Shift to 2305	FORS: m	$\nu_a(CH_2)+\delta(CH_2)$
	2351	Shift to 2346	FORS: w	$\nu_s(CH_2)+\delta(CH_2)$
	2380–2500	Weakens	m, b Series of oscillating weak bands	ºδ(CC) and/or *$\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{aromatic/aliphatic}$
3484		Shifts to 3455	m	ν(OH)
2928			s	$\nu_a(CH)$
2856			s	$\nu_s(CH)$
1739			s	ν(C=O)
1542			w	ν(C=O)
1459, 1379			s	δ(CH)
1156			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

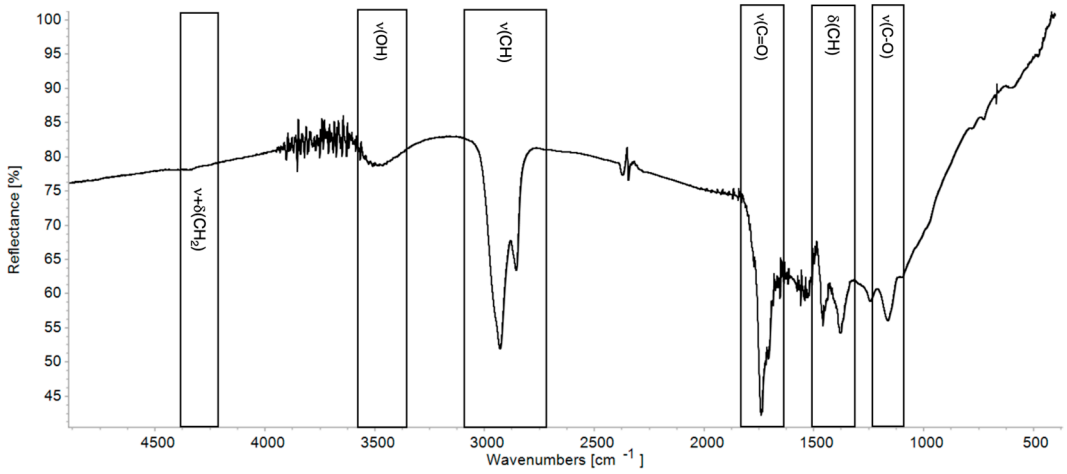

Figure S27. Walnut oil–mastic resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

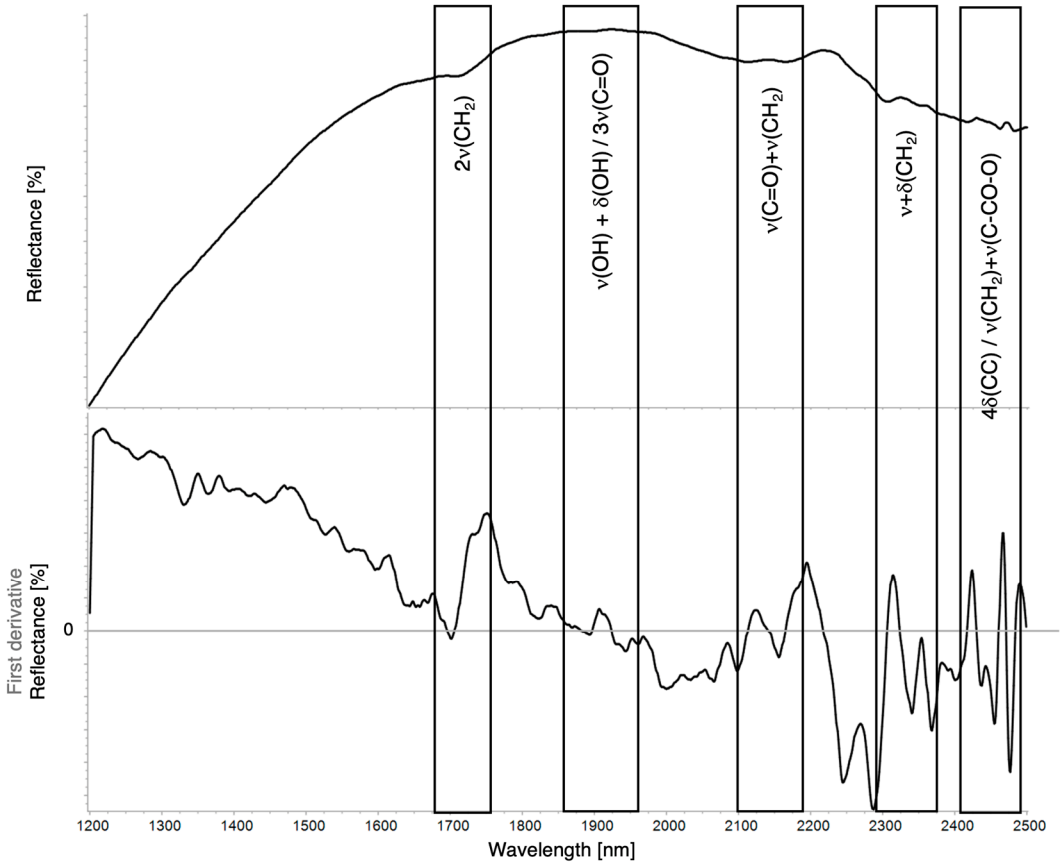

Figure S28. Walnut oil–mastic resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S15. Walnut oil–mastic resin–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity**[1]	**Assignment**[2]
FTIR (cm^{-1})	FORS (nm)			
	~1712	Shift to 1704	w	$2\nu_{a+s}(CH_2)$
	1815-1895	Shift right	w, b	ν(OH)+δ(OH) and/or *3ν(C=O)
	2127-2171	Weaken	w Doublet/triplet	ν(C=O)+$\nu(CH_2)$
	2309		m	$\nu_a(CH_2)+\delta(CH_2)$
	~2355		w	$\nu_s(CH_2)+\delta(CH_2)$
	2409-2492		w, b Series of oscillating weak bands	º4δ(CC) and/or *$\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{aromatic/aliphatic}$
3456			m	ν(OH)
2930			s	$\nu_a(CH)$
2852			s	$\nu_s(CH)$
1736			s	ν(C=O)
1543			w	ν(C=O)
1457, 1374			s	δ(CH)
1155			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder
[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric
º = unique, characteristic feature of tree resins
* = unique, characteristic feature of drying oils

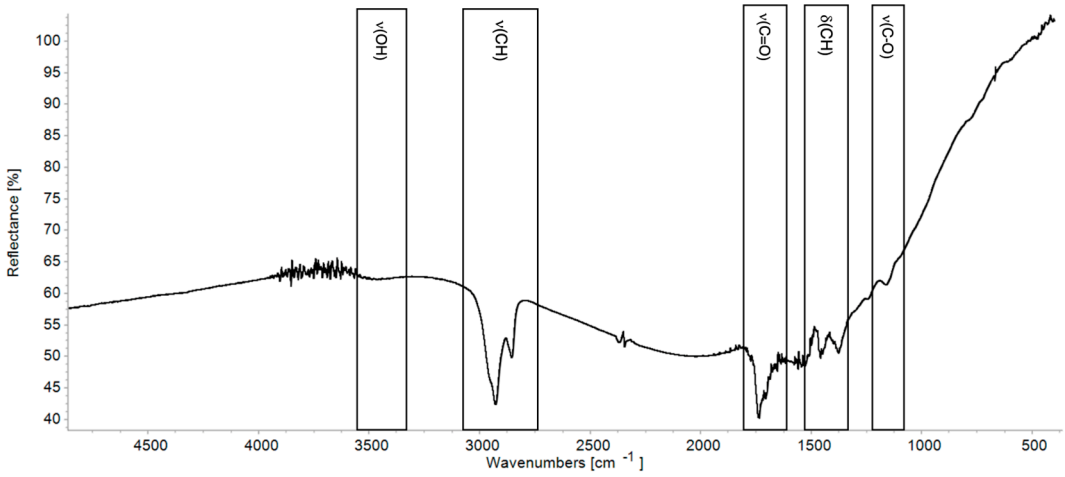

Figure S29. Walnut oil–mastic resin–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

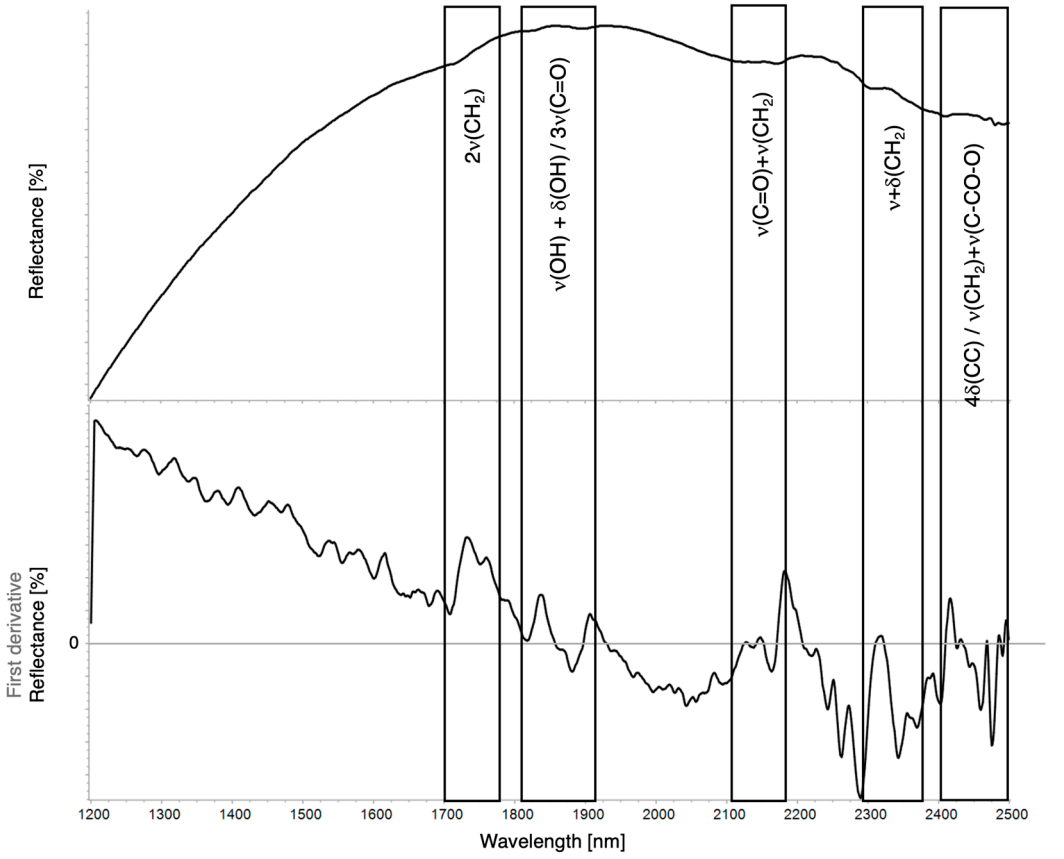

Figure S30. Walnut oil–mastic resin–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S16. Walnut oil–pine resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		Observed shift after artificial ageing	Intensity[1]	Assignment[2]
FTIR (cm^{-1})	FORS (nm)			

	1674-1707	Not detected	w	ºν(Ar. CH)
	1708	Possibly around 1701, not detected	s	$2\nu_{a+s}(CH_2)$
	1818-1992	Shift to 1809-1933	w, b	Possibly *3ν(C=O)
	2114-2207		w, b, doublet	$\nu(C=O)+\nu(CH_2)$
4344	2305	Not visible in FTIR & FORS	FTIR: w; FORS: s	$\nu_a(CH_2)+\delta(CH_2)$
4253	2349	Not visible in FTIR & FORS	FTIR: w; FORS: s	$\nu_s(CH_2)+\delta(CH_2)$
	2374–2472		w, b	$*\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{aliphatic/aromatic}$ and/or ºδ(CC)
3479		Shift to 3411	s	ν(OH)
2856			s	$\nu_a(CH)$
2866			s, doublet with ^	$\nu_s(CH)$
1737			s	ν(C=O)
1523-1382			s, series of 3 abs	δ(CH)
1164			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; $_a$: asymmetric; $_s$: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

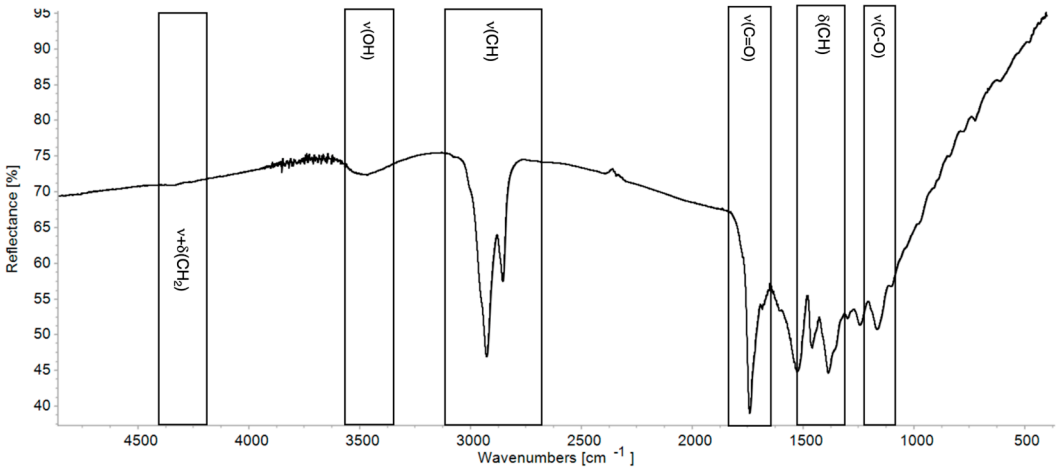

Figure S31. Walnut oil–pine resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

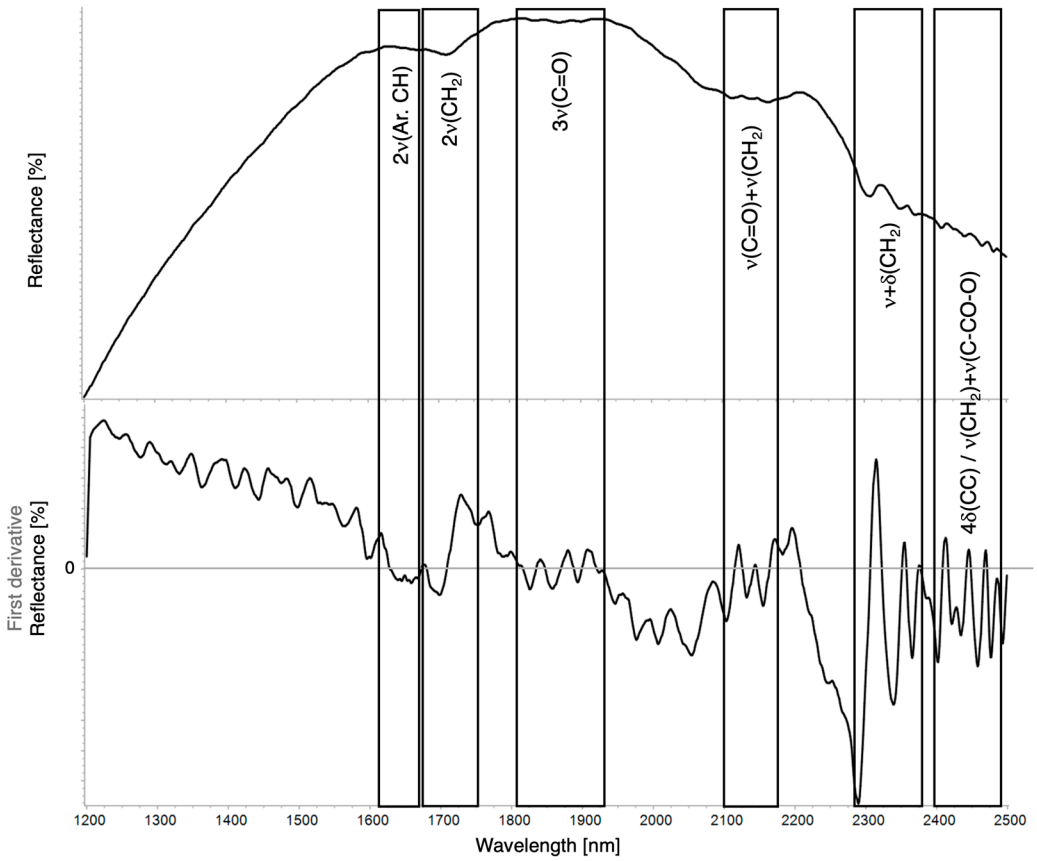

Figure S32. Walnut oil–pine resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S17. Walnut oil–pine resin–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	1715	Shift to 1722, does not touch 0, weakens	m	$2\nu_{a+s}(CH_2)$
	1847-1897	Not resolved	w, b	Possibly *3ν(C=O)
	2112-2168	Shift left and not resolved as doublet	w, b Doublet	ν(C=O)+ν(CH_2)
	2310	Shift to 2314	s	$\nu_a(CH_2)+\delta(CH_2)$
	~2349	Not resolved	w	$\nu_s(CH_2)+\delta(CH_2)$
	2375–2486	Less resolved	w, b	*ν(CH_2)+ν(C-CO-O)$_{aliphatic/aromatic}$ and/or º4δ(CC)
3406			m	ν(OH)
2924		Shoulder at 3006 disappears	s	ν_a(CH)
2855			s, doublet with ^	ν_s(CH)
1740		Noisy	m	ν(C=O)
1522-1383		Noisy	s, series of 3 abs	δ(CH)
1163			w	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

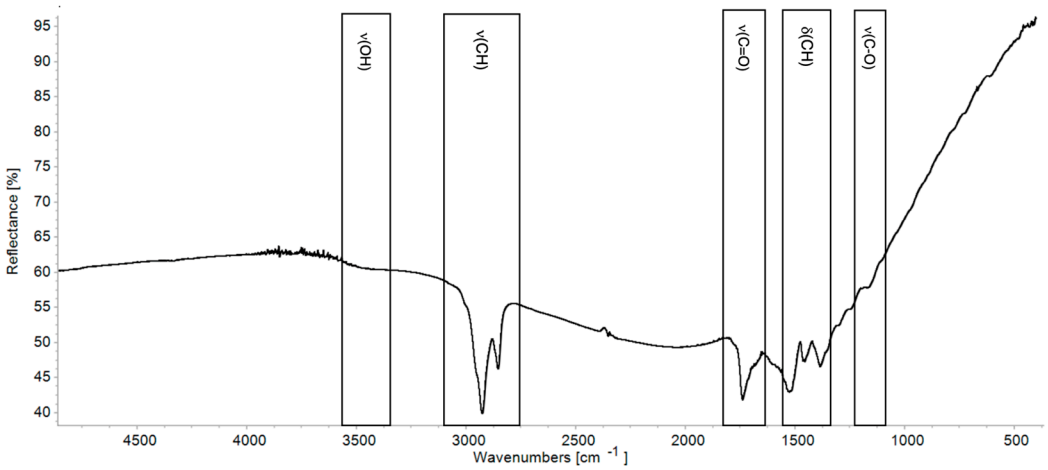

Figure S33. Walnut oil–pine resin–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

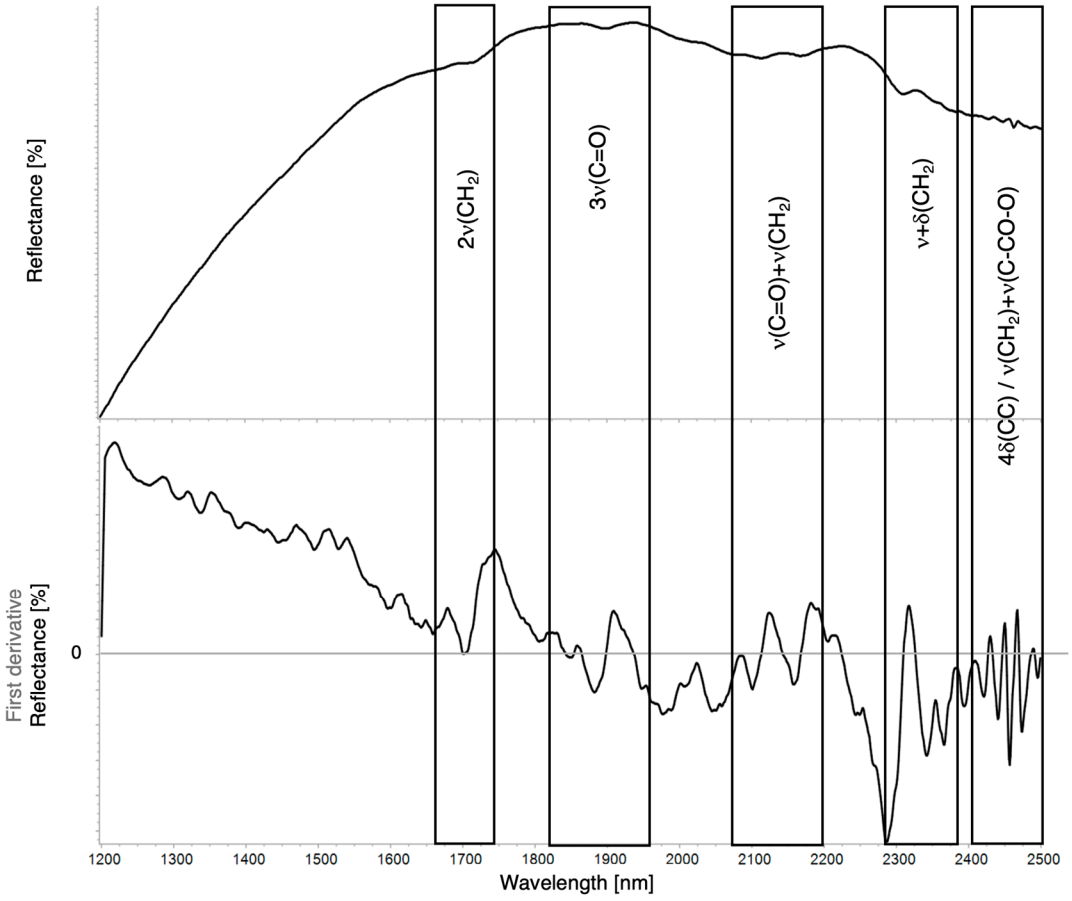

Figure S34. Walnut oil–pine resin–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S18. Walnut oil–mastic resin–pine resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position	Intensity[1]	Assignment[2]

FTIR (cm^{-1})	FORS (nm)	**Observed shift after artificial ageing**		
	1612-1701	Not visible	m	ºν(Ar. CH) and/or $2\nu_{a+s}(CH_2)$
	1825-1910	Not visible	w, b	Maybe ν(OH)+δ(OH) and/or *3ν(C=O)
	2118-2225	Shift to 2109-2233	w, doublet	ν(C=O)+ν(CH_2)
4348	2305	Not visible in FTIR	FTIR: w; FORS: m	$\nu_a(CH_2)+\delta(CH_2)$
4262	2351	Not visible in FTIR Less absorbance in FORS, possibly around 2356	FTIR: w; FORS: m	$\nu_s(CH_2)+\delta(CH_2)$
	2423	Weakens	w, b	º4δ(CC) and/or $^{º}\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{aromatic}$
	2486	Shifts to 2481		$^{*}\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{aliphatic}$
3493		Shifts to 3457	m	ν(OH)
2929			s	$\nu_a(CH)$
2852			s	$\nu_s(CH)$
1737			s	ν(C=O)
1528, 1455, 1382		Weakens	m	$\delta(CH_3)$
1164			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

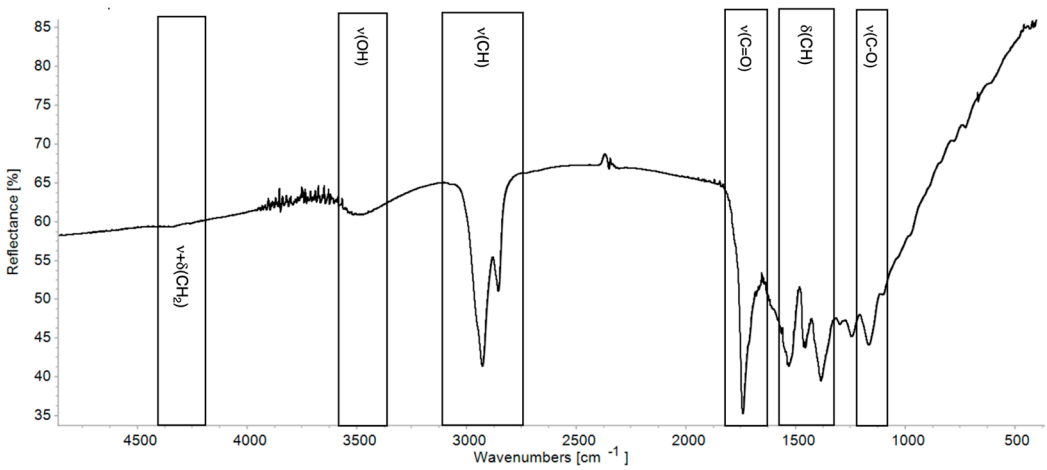

Figure S35. Walnut oil–mastic resin–pine resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

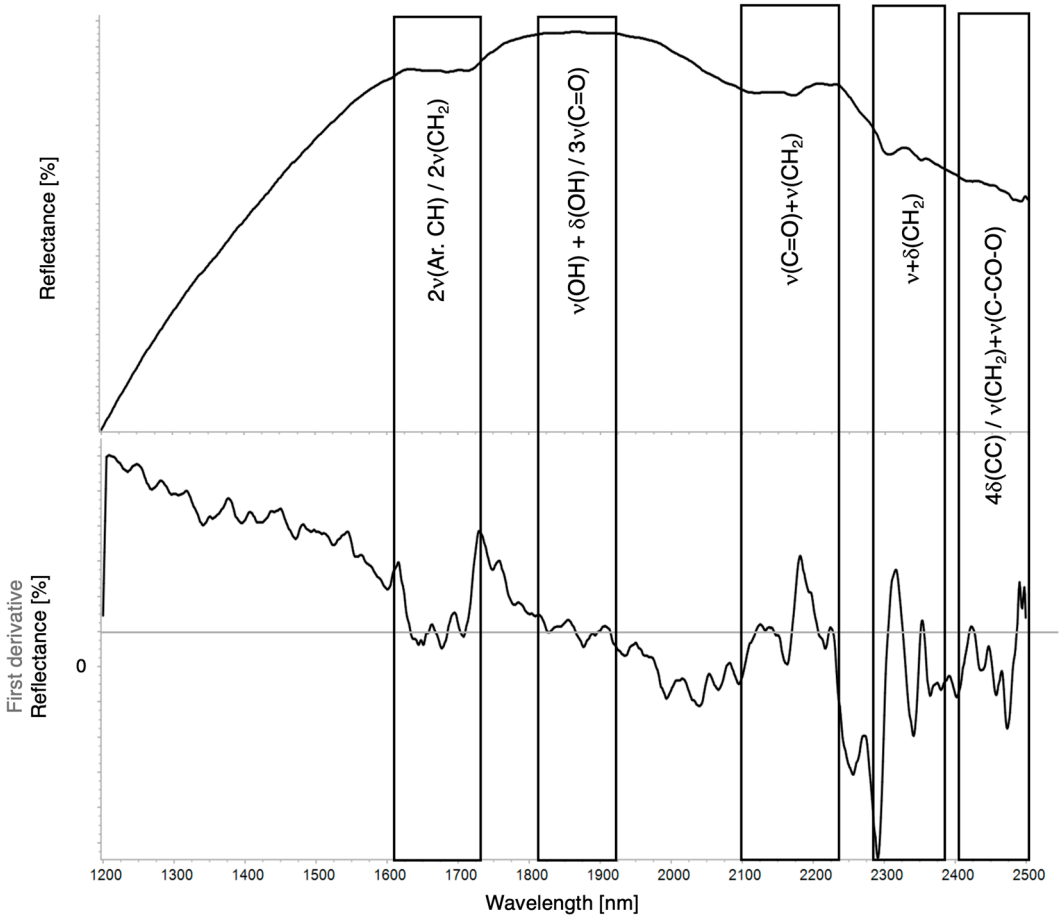

Figure S36. Walnut oil–mastic resin–pine resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S19. Walnut oil–mastic resin–pine resin–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	~1705	Shifts to ~1721	m	º2ν(Ar. CH) and/or $2\nu_{a+s}(CH_2)$
	1894-1952	Not visible	w, b	Maybe ν(OH)+δ(OH) and/or *3ν(C=O)
	2111-2164		w, doublet	ν(C=O)+$\nu(CH_2)$
4334	2310	Not visible in FTIR; shifts to 2308	FTIR: w; FORS: s	$\nu_a(CH_2)$+$\delta(CH_2)$
4255	2347	Not well resolved in FORS; Not visible in FTIR	FTIR: w; FORS: w	$\nu_s(CH_2)$+$\delta(CH_2)$
	2383-2444	Weakens and shifts right	w, b	º4δ(CC) and/or ºν(CH_2)+ν(C-CO-O)$_{aromatic}$
	2482	Shifts to 2486		*ν(CH_2)+ν(C-CO-O)$_{aliphatic}$
3476		Shifts to 3447	m	ν(OH)
2927			s	$\nu_a(CH_3)CH_2$
2852			s	$\nu_s(CH_3)$
1740			s	ν(C=O)
1532, 1457, 1382			m	δ(CH)
1157			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder
[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric
º = unique, characteristic feature of tree resins
* = unique, characteristic feature of drying oils

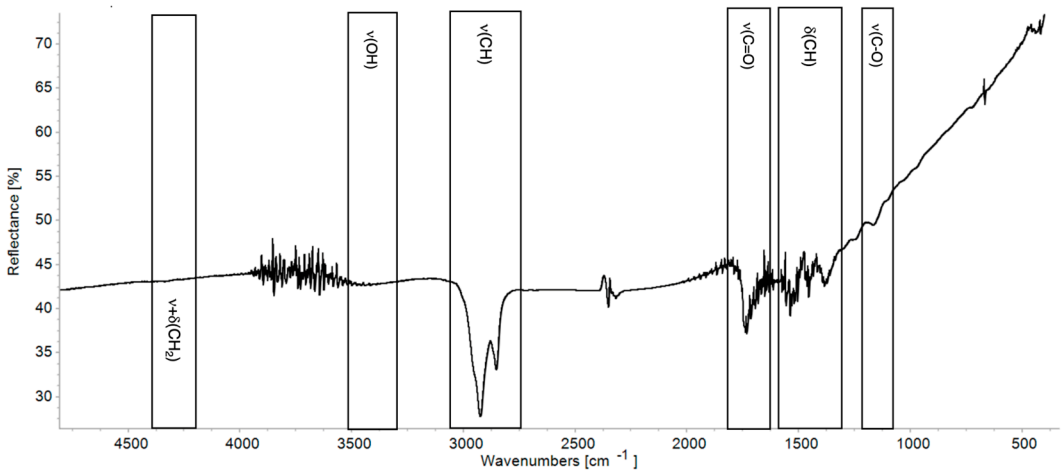

Figure S37. Walnut oil–mastic resin–pine resin–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

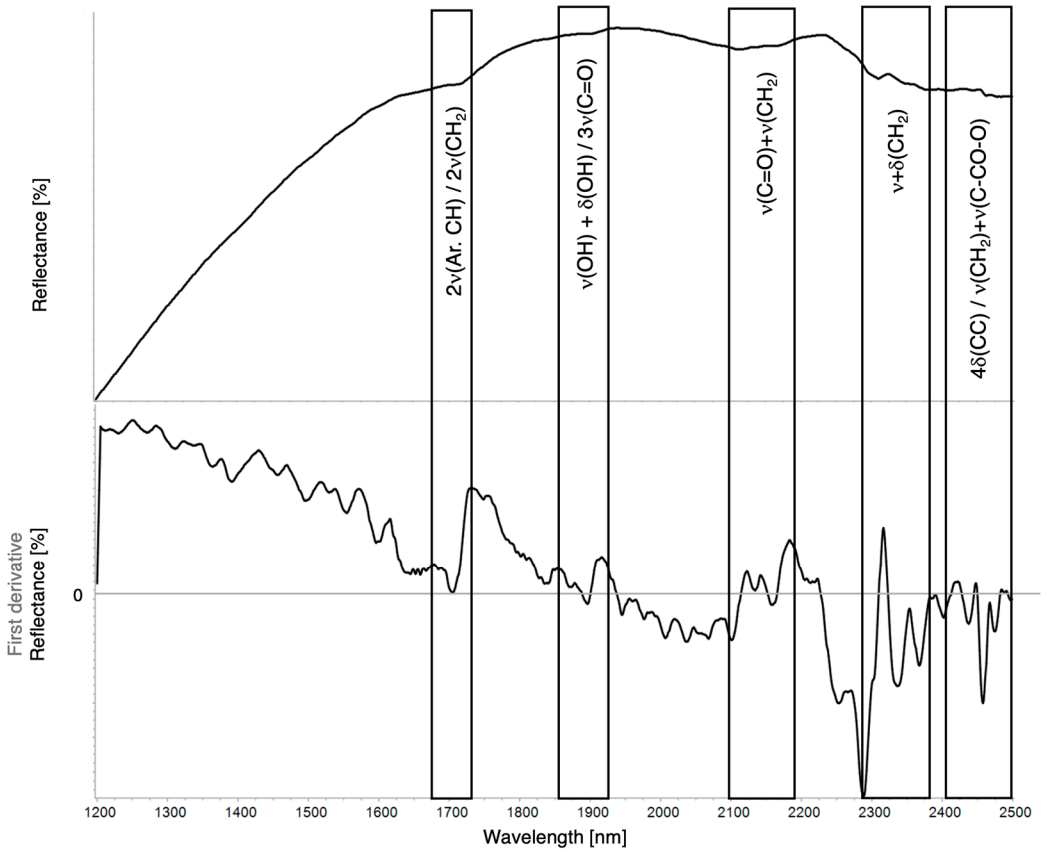

Figure S38. Walnut oil–mastic resin–pine resin–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S20. Linseed oil–walnut oil stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		Observed shift after artificial ageing	Intensity[1]	Assignment[2]
FTIR (cm^{-1})	FORS (nm)			
	1714	Very weak	m	2ν(CH_2)

	~2101	Shifts to 2116-2160 as weak and broad doublet	w, b	ν(C=O)+ν(CH_2)
	2306		s	$\nu_a(CH_2)+\delta(CH_2)$
	2347		s	$\nu_s(CH_2)+\delta(CH_2)$
	2440–2480		w, b Series of oscillating weak bands	$\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{aliphatic}$
3468			m	ν(OH)
2927		Further degradation of left shoulder	s	$\nu_a(CH)$
2852			s	$\nu_s(CH)$
1736		Broadening	s	ν(C=O)
1515-1370			s	δ(CH)
1166			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; $_a$: asymmetric; $_s$: symmetric

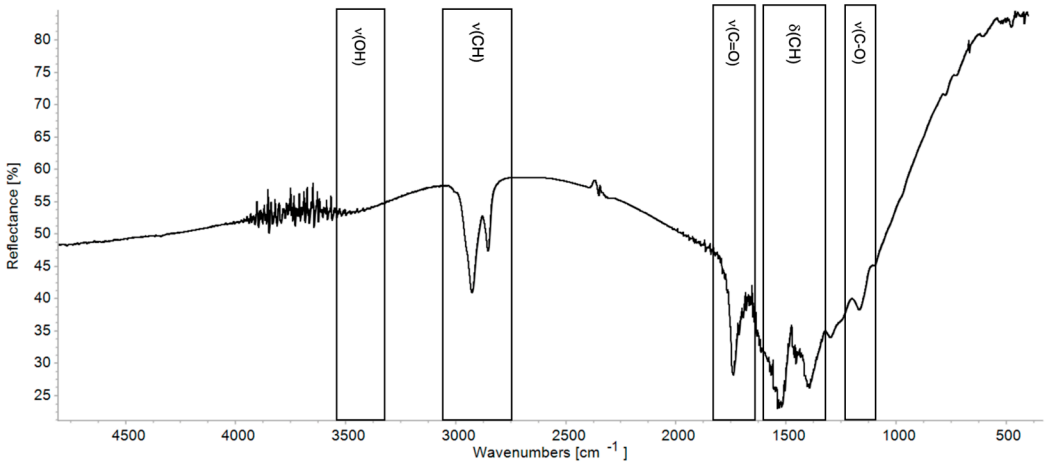

Figure S39. Linseed oil–walnut oil stoved on metal coupon ER-FTIR spectrum with assigned bands.

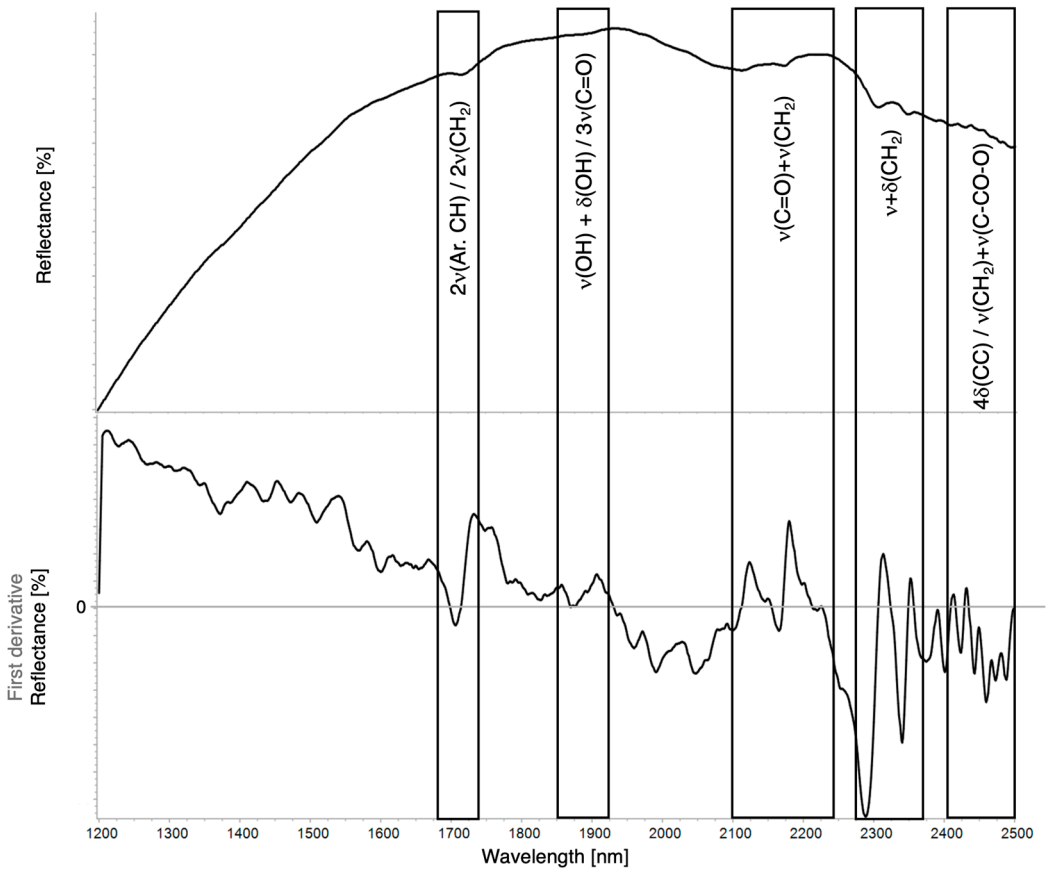

Figure S40. Linseed oil–walnut oil stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S21. Linseed oil–walnut oil–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		Observed shift after artificial ageing	Intensity[1]	Assignment[2]
FTIR (cm^{-1})	FORS (nm)			
	1713	Very weak	s	2ν(CH_2)
	2116-2171	2116-2160 weakens and broad doublet	s, b	ν(C=O)+ν(CH_2)
	2309	Not resolved in FTIR	s	ν_a(CH_2)+δ(CH_2)
	~2348	Not resolved in FTIR	w, not resolved	ν_s(CH_2)+δ(CH_2)
	2404–2491	Shift to 2411-2487	w, b Series of oscillating weak bands	*ν(CH_2)+ν(C-CO-O)$_{aliphatic}$
3385		Strengthens	m	ν(OH)
3010		Disappears	s, sh	ν_a(CH_3)
2923			s	ν_a(CH_3)CH_2
2852			s	ν_s(CH_3)
~1737		Very noisy	m	ν(C=O)
~1509, 1392		Noisy	s	δ(CH)
~1170		Weakens	w	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; $_a$: asymmetric; $_s$: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

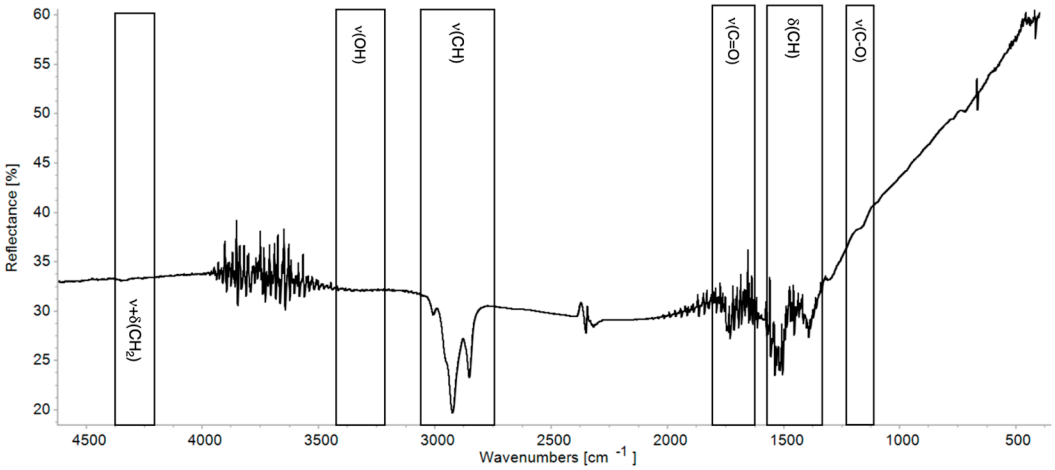

Figure S41. Linseed oil–walnut oil–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

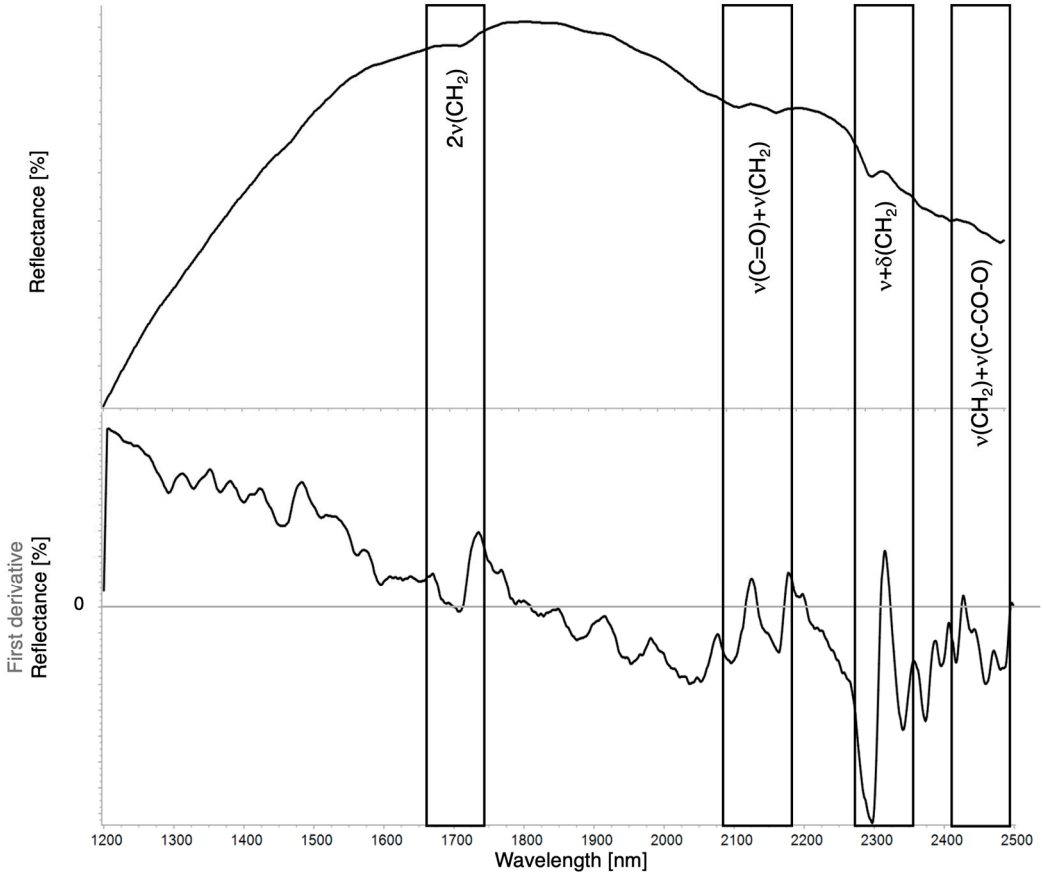

Figure S42. Linseed oil–walnut oil–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S22. Linseed oil–walnut oil–mastic resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		Observed shift after artificial ageing	Intensity[1]	Assignment[2]
FTIR (cm^{-1})	FORS (nm)			
	~1609		w, sh	º2ν(Ar. CH)

	~1710	Not resolved	w	$2\nu_{a+s}(CH_2)$
	2105-2171		w	$\nu(C=O)+\nu(CH_2)$
	2265		sh	
4341	2302	Shifts to 2306	FTIR: w; FORS: m	$\nu_a(CH_2)+\delta(CH_2)$
4253	2347	Shifts to 2349	FTIR: w; FORS: w	$\nu_s(CH_2)+\delta(CH_2)$
	2380–2500		w, b Series of oscillating weak bands	ºδ(CC) and/or *$\nu(CH_2)+\nu$(C-CO-O)$_{aliphatic/aromatic}$
3439			m	ν(OH)
2931			s	$\nu_a(CH)$
2856			s	$\nu_s(CH)$
1736			s	ν(C=O)
1545		Shifts to 1532	w	ν(C=O)
1457, 1382		First abs shifts to 1453	m	$\delta(CH_3)CH_2$
1162			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

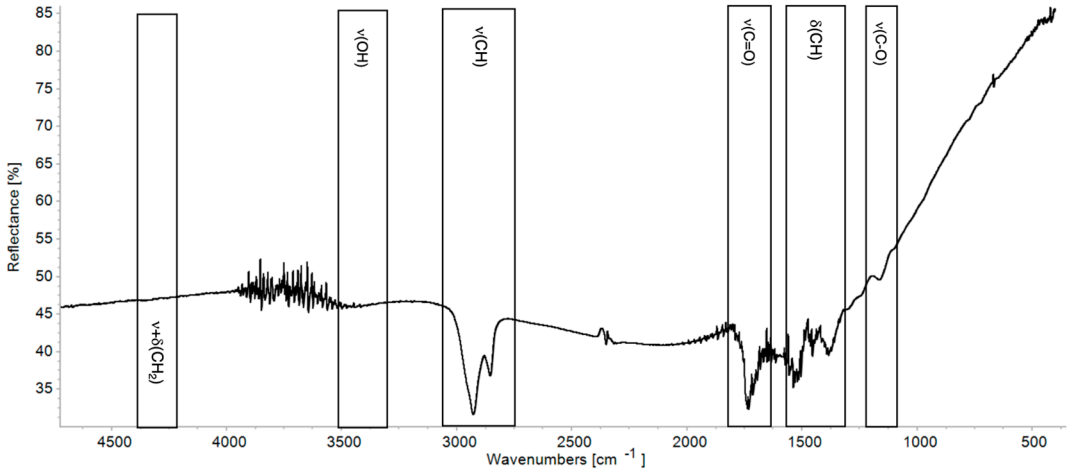

Figure S43. Linseed oil–walnut oil–mastic resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

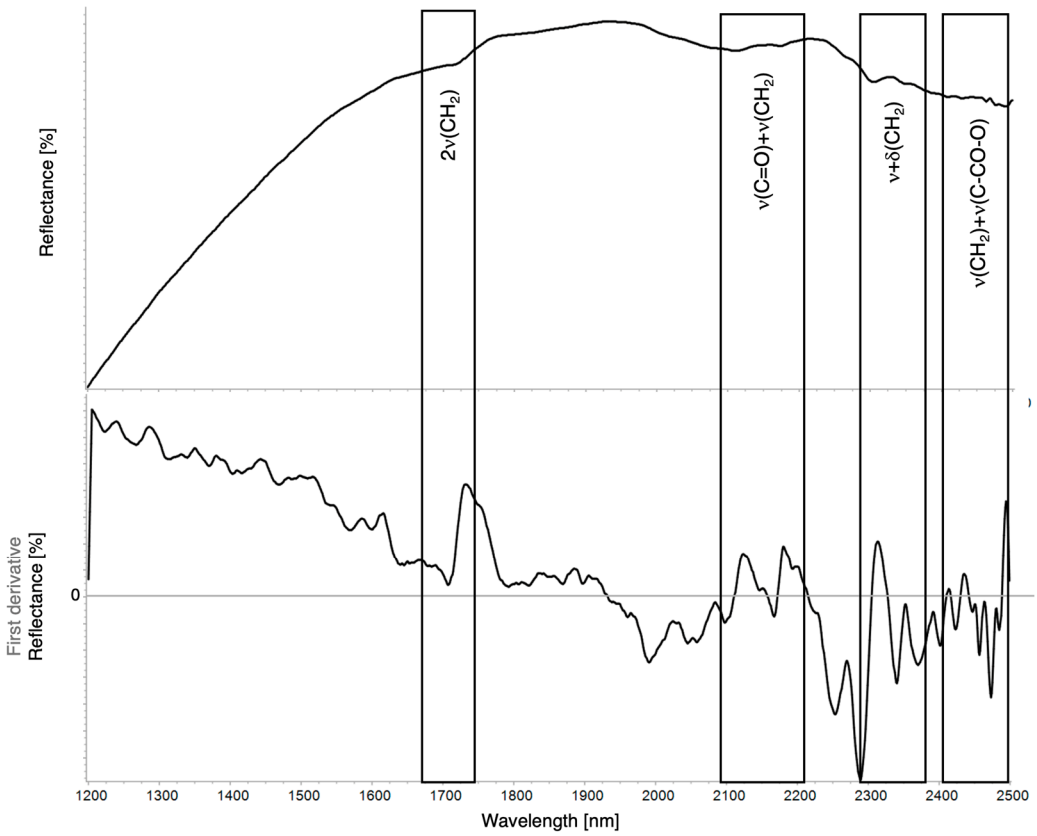

Figure S44. Linseed oil–walnut oil–mastic resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S23. Linseed oil–walnut oil–mastic resin–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	~1721	No abs	w, doesn't go through 0 but there is a dip	$2\nu_{a+s}(CH_2)$
	1841–1940		w, triplet	Maybe ν(OH)+δ(OH) and/or *3ν(C=O)
	2117-2172		m, doublet	$\nu(C{=}O)+\nu(CH_2)$
4329	2309	Weak abs, doesn't go through 0	FTIR: w; FORS: m	$\nu_a(CH_2)+\delta(CH_2)$
4254	~2352	No abs, doesn't go through 0	FTIR: w; FORS: w	$\nu_s(CH_2)+\delta(CH_2)$
	2407–2491	Significantly weaker and less defined	w, b Series of oscillating weak bands	º4δ(CC) and/or $*\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{aliphatic/aromatic}$
3438		Shifts to 3402	m	ν(OH)
2924			s	$\nu_a(CH)$
2852			s	$\nu_s(CH)$
1737, 1519			s	$\nu(C{=}O)$
1456, 1383			s	δ(CH)
1159			s	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

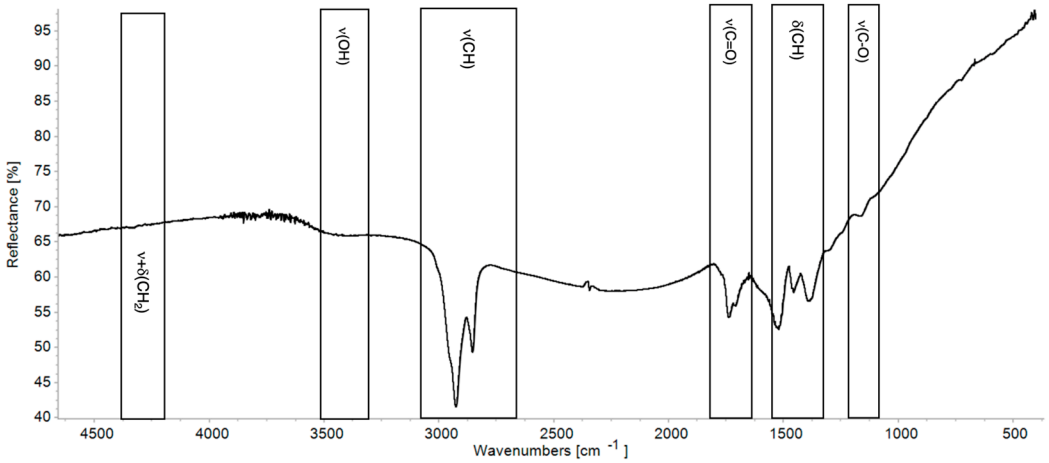

Figure S45. Linseed oil–walnut oil–mastic resin–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

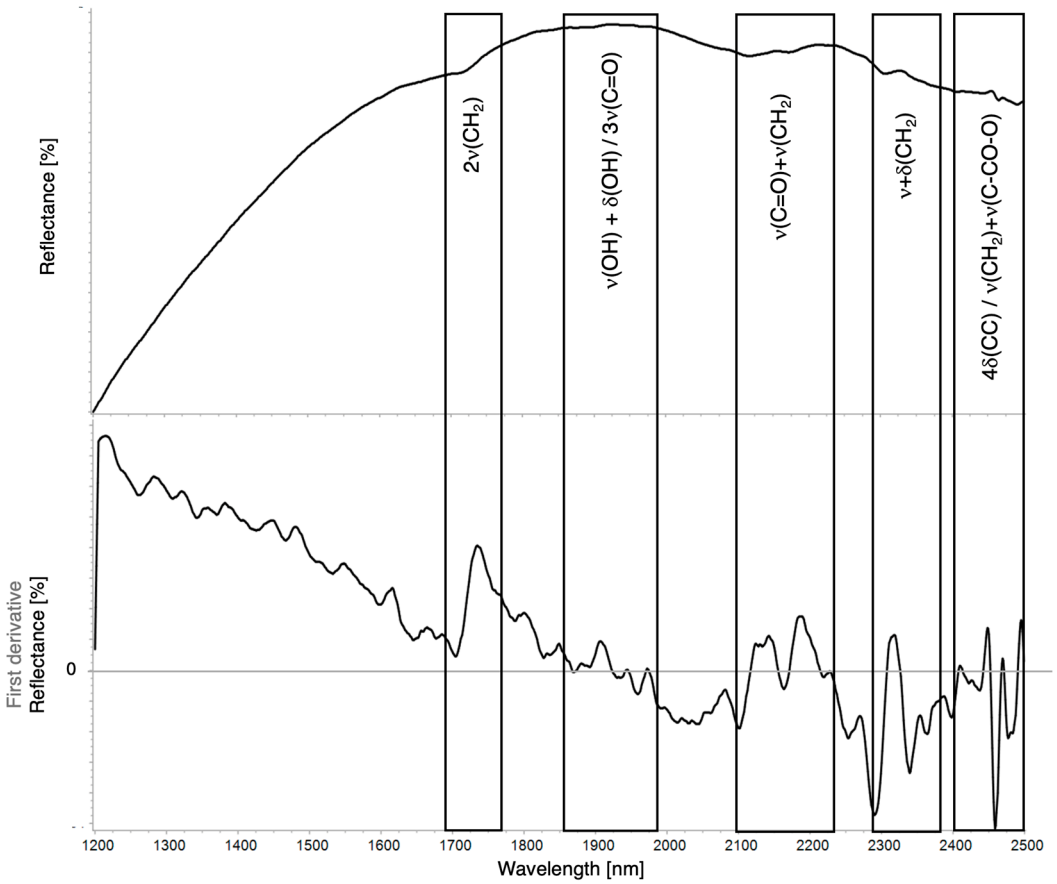

Figure S46. Linseed oil–walnut oil–mastic resin–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S24. Linseed oil–walnut oil–pine resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position	Intensity[1]	Assignment[2]

FTIR (cm^{-1})	FORS (nm)	**Observed shift after artificial ageing**	
	~1710	w, doesn't go through 0 but there is a dip	$2\nu_{a+s}(CH_2)$
	~1880	w	Maybe ν(OH)+δ(OH) and/or *3ν(C=O)
	2129-2200	w, b	ν(C=O)+ν(CH_2)
	2308	s	$\nu_a(CH_2)+\delta(CH_2)$
	-		$\nu_s(CH_2)+\delta(CH_2)$
	2414–2487	w, b	*ν(CH_2)+ν(C-CO-O)$_{aliphatic/aromatic}$ and/or º4δ(CC)
3434		s	ν(OH)
2892		s	ν_a(CH)
2852		s, doublet with ^	ν_s(CH)
1733		s	ν(C=O)
1523-1382		s	δ(CH_3)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; $_a$: asymmetric; $_s$: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

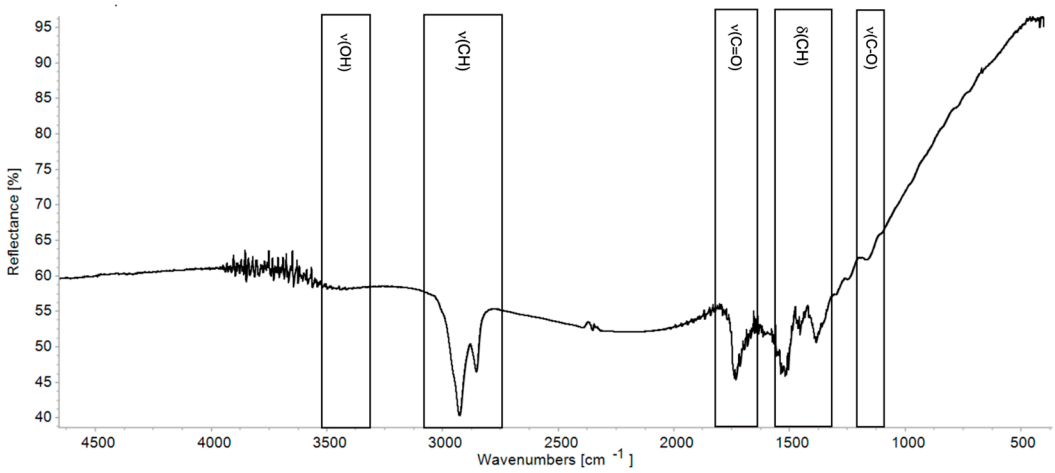

Figure S47. Linseed oil–walnut oil–pine resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

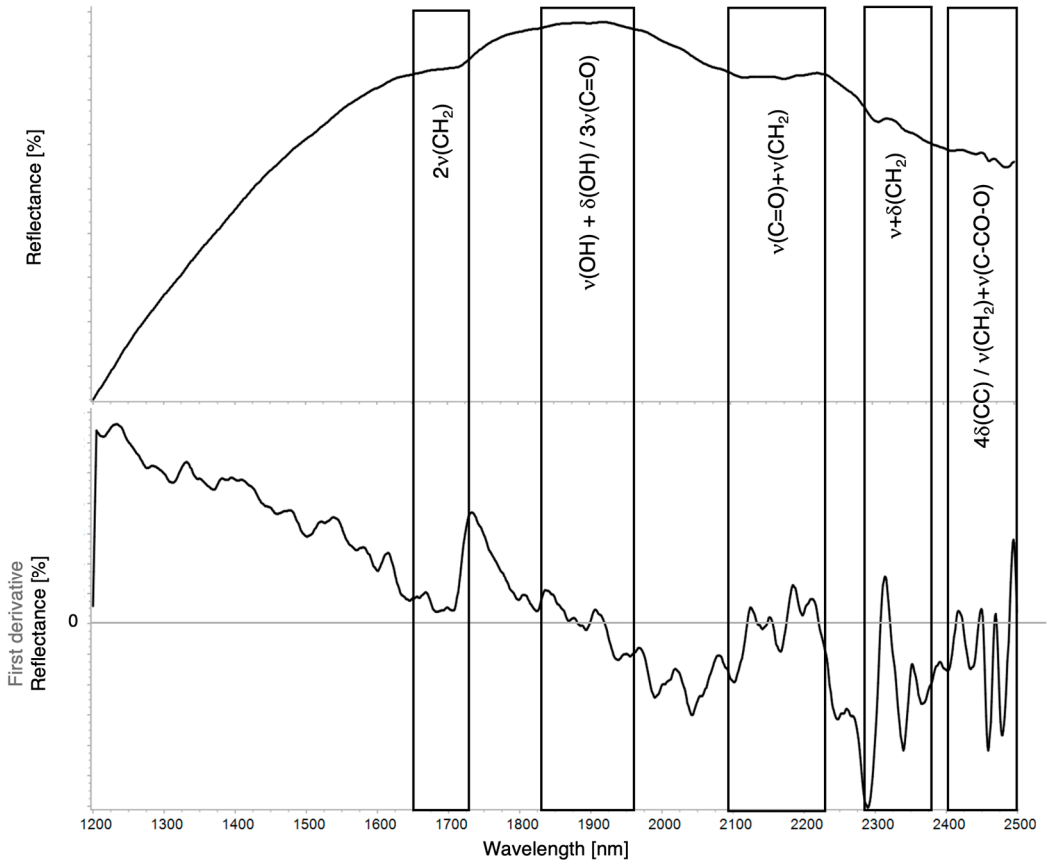

Figure S48. Linseed oil–walnut oil–pine resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S25. Linseed oil–walnut oil–pine resin–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	~1705	Weakens	m	$2\nu_{a+s}(CH_2)$
	1843–1901	Weakens and broadens	w, triplet	Possibly *3ν(C=O)
	2113–2171	2108–2169	w, b, doublet	ν(C=O)+ν(CH_2)
	2314	Not visible in FTIR; weakens and broadens	w	$\nu_a(CH_2)+\delta(CH_2)$
	-	Weakens, around 2171, Not visible in FTIR or FORS		$\nu_s(CH_2)+\delta(CH_2)$
	2421-2493	Weakens	w, b	*ν(CH_2)+$\nu(C\text{-}CO\text{-}O)_{aliphatic/aromatic}$ and/or º4δ(CC)
3420			w, b	ν(OH)
2924			s	$\nu_a(CH)$
2852			s, doublet with ^	$\nu_s(CH)$
~1728, 1514			m	ν(C=O)
~1455, 1382			w, m	$\delta(CH_3)CH_2$

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

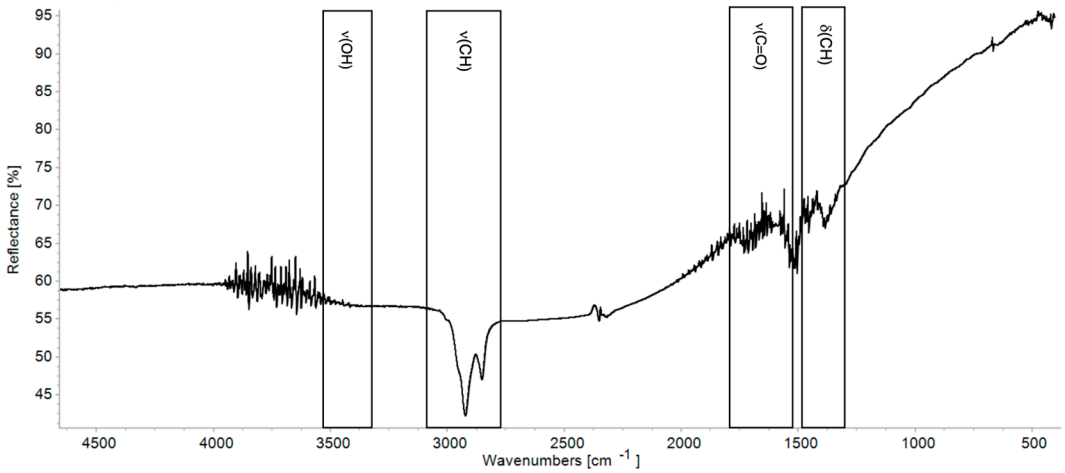

Figure S49. Linseed oil–walnut oil–pine resin–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

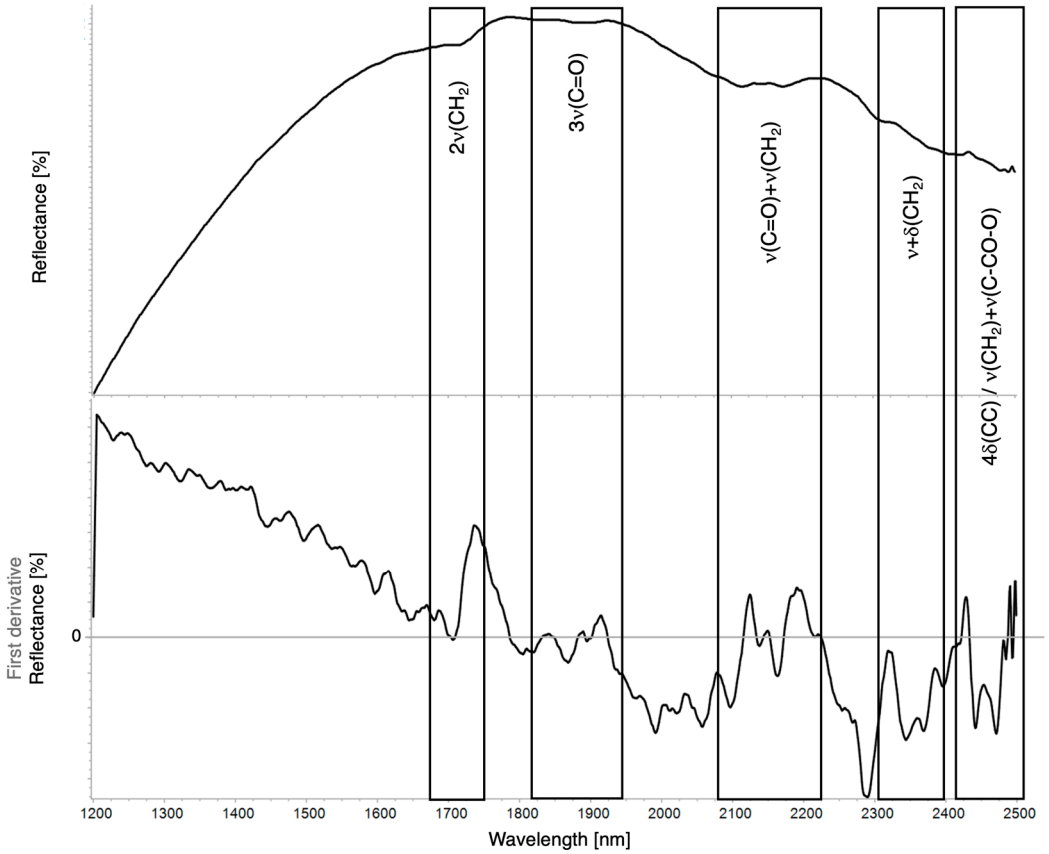

Figure S50. Linseed oil–walnut oil–pine resin–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S26. Linseed oil–walnut oil–mastic resin–pine resin stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	1615	Not visible	m	º2ν(Ar. CH) and/or $2\nu_{a+s}(CH_2)$

		Visible around 1818-1900		Maybe ν(OH)+δ(OH) and/or *3ν(C=O)
	2117-2172	Shifts to 2114-2168	w, doublet	ν(C=O)+ν(CH_2)
	2384-2411	ν_a(CH_2)+δ(CH_2) visible at 2307	w	ν_{a+s}(CH_2)+δ(CH_2)
	2441	Not visible	w, b	º4δ(CC) and/or *ν(CH_2)+ν(C-CO-O)$_{aromatic}$
	2489	Shifts to 2485		ν(CH_2)+ν(C-CO-O)$_{aliphatic}$
3444			w	ν(OH)
2924			s	ν_a(CH)
2852			s	ν_s(CH)
1728			s	ν(C=O)
1528, 1455, 1382		Second abs weakens	m	δ(CH)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder

[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric

º = unique, characteristic feature of tree resins

* = unique, characteristic feature of drying oils

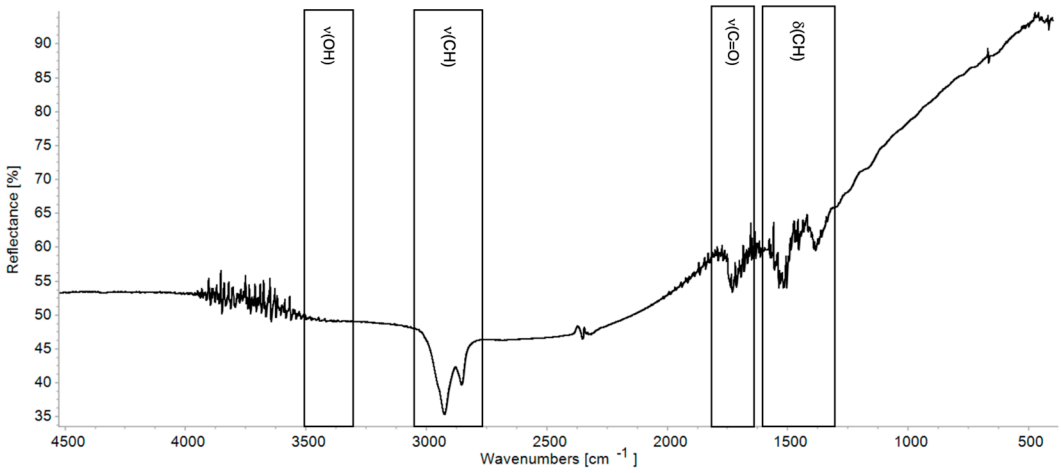

Figure S51. Linseed oil–walnut oil–mastic resin–pine resin stoved on metal coupon ER-FTIR spectrum with assigned bands.

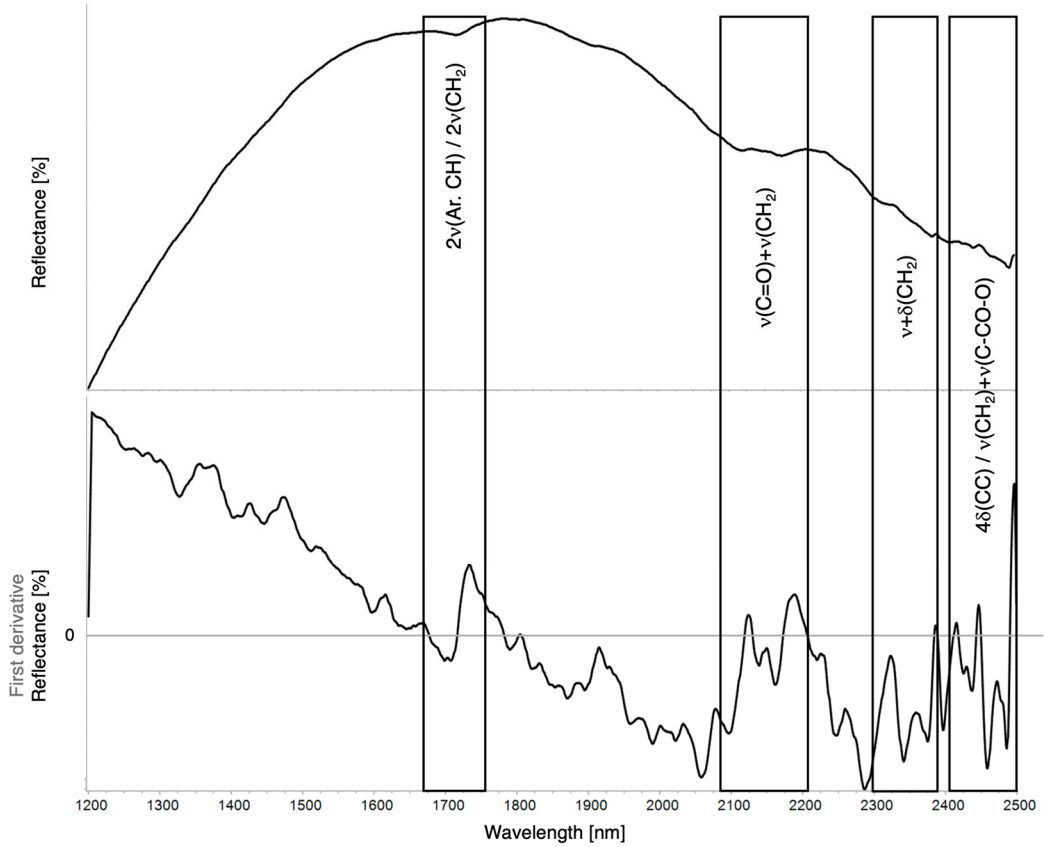

Figure S52. Linseed oil–walnut oil–mastic resin–pine resin stoved on metal coupon FORS spectrum and first derivative with assigned bands.

Table S27. Linseed oil–walnut oil–mastic resin–pine resin–bitumen stoved on metal coupon ER-FTIR and FORS band assignments.

Stoved band position		**Observed shift after artificial ageing**	**Intensity[1]**	**Assignment[2]**
FTIR (cm^{-1})	FORS (nm)			
	~1721	Weakens	w, doesn't cross 0 but there's an abs	$2\nu_{a+s}(CH_2)$
	1800–1878	Weakens and broadens	w, b	Maybe ν(OH)+δ(OH) and/or *3ν(C=O)
	2114-2171	2109–2168	w, doublet	$\nu(C{=}O)+\nu(CH_2)$
	2315	2312	m	$\nu_a(CH_2)+\delta(CH_2)$
	~2352	No second abs	w	$\nu_s(CH_2)+\delta(CH_2)$
	2409–2491		w, b, series of oscillating bands	º4δ(CC) and/or $\nu(CH_2)+\nu(C\text{-}CO\text{-}O)_{aromatic/aliphatic}$
3410			w	ν(OH)
2923			s	$\nu_a(CH)$
2852			s	$\nu_s(CH)$
1732			s	ν(C=O)
1524, 1453, 1386		Second abs shifts to 1457	m	δ(CH)
1162		Weakens	w	ν(C-O)

[1] s: strong, m: medium, w: weak, b: broad, sh: shoulder
[2] ν: stretching; δ: bending; a: asymmetric; s: symmetric
º = unique, characteristic feature of tree resins
* = unique, characteristic feature of drying oils

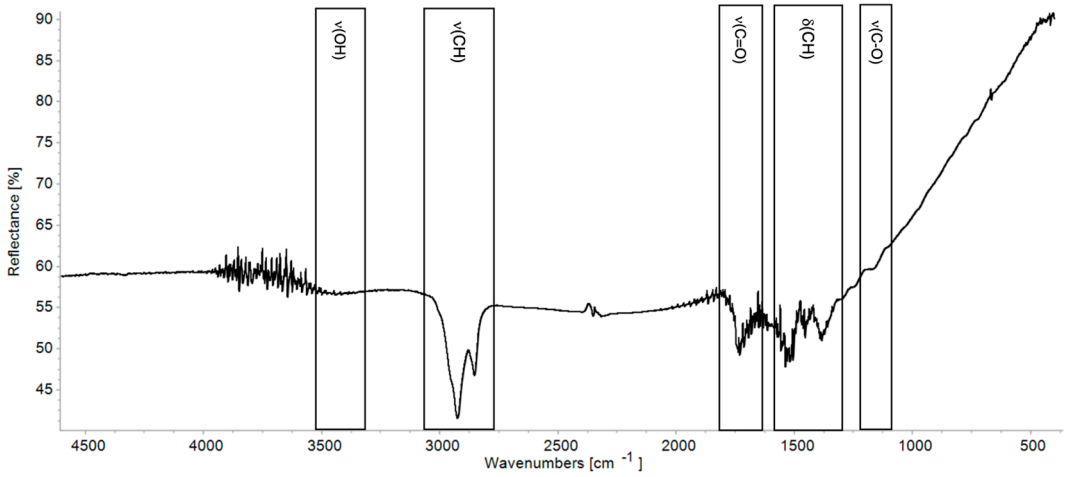

Figure S53. Linseed oil–walnut oil–mastic resin–pine resin–bitumen stoved on metal coupon ER-FTIR spectrum with assigned bands.

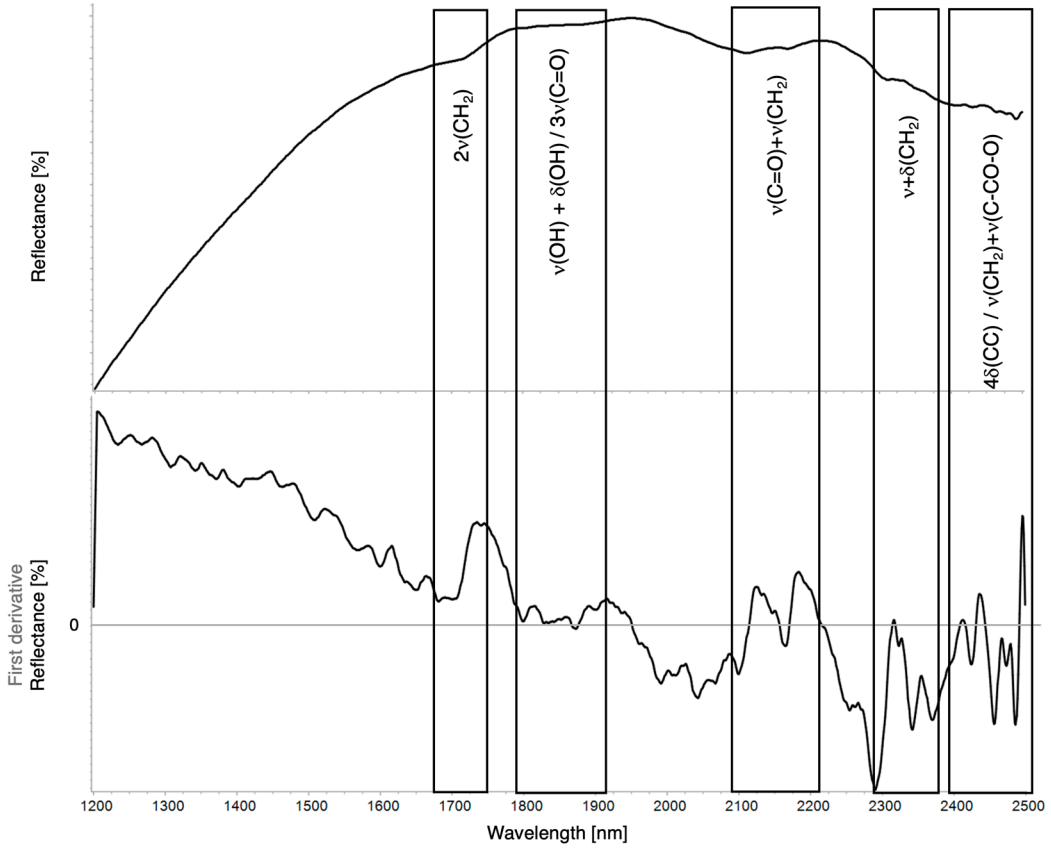

Figure S54. Linseed oil–walnut oil–mastic resin–pine resin–bitumen stoved on metal coupon FORS spectrum and first derivative with assigned bands.

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