Supplementary materials

Cinnamon oils and their main constituents as natural antibacterial agents of sodium alginate coatings electrophoretically deposited on austenitic stainless steel substrates

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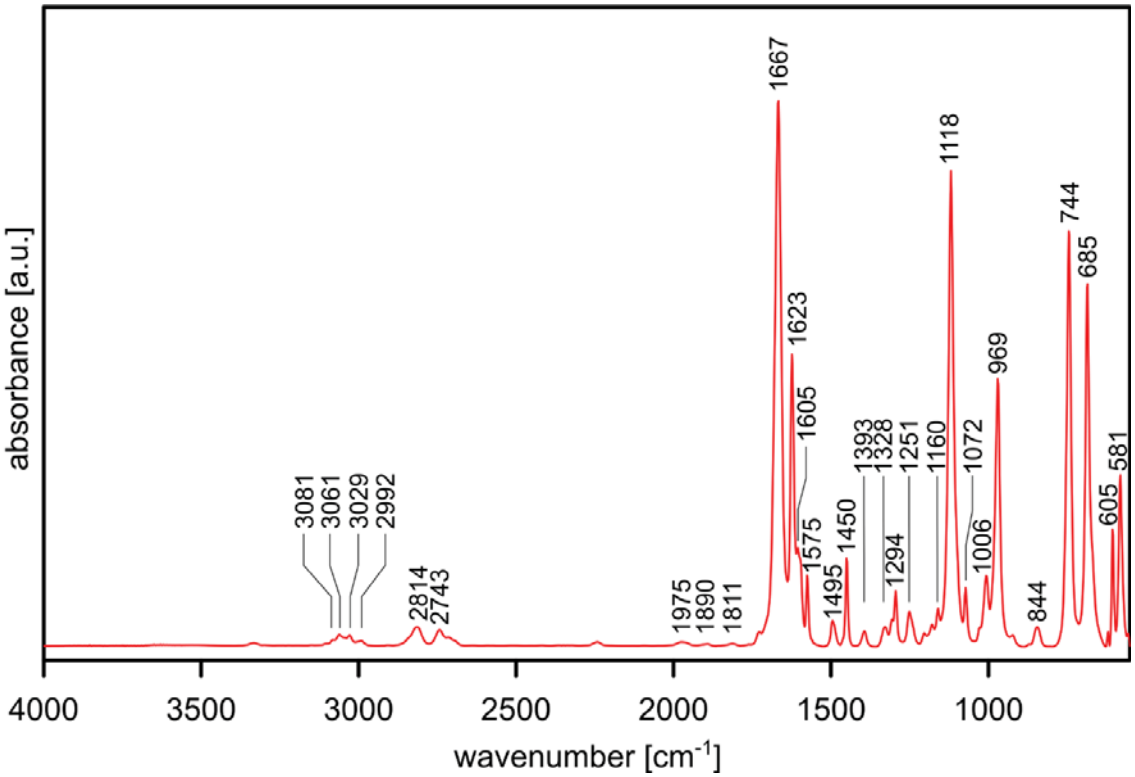

Fig. S1. FT-IR spectrum for cinnamaldehyde

Table S1. Detailed FT-IR spectrum analysis for cinnamaldehyde, abbreviations explained under the table

band position [cm^{-1}] and characteristics	**type of vibration**
3081 w	ν C-H aromatic
3061 w	ν C-H aromatic
3029 w	ν =C-H
2992 w	ν =C-H
2814 w	ν C-H in -CHO
2743 w	ν C-H in -CHO
1975 w	overtones
1890 w	overtones
1811 w	overtones
1667 vs	ν C=O α,β-unsaturated
1623 m	ν C=C conjugated with aryl
1605 m	ν C-C aromatic
1575 w	ν C-C aromatic
1495 w	ν C-C aromatic
1450 m	ν C-C aromatic
1393 w	in-plane δ_{as} C-H in -CHO
1328 w	in-plane δ =C-H
1294 m	in-plane δ =C-H
1251 w	in-plane δ Ar-H
1160 w	in-plane δ Ar-H
1118 s	ν C-O α,β-unsaturated
1072 m	in-plane δ Ar-H
1006 m	in-plane δ Ar-H
969 s	out-of-plane δ =C-H
844 w	out-of-plane δ =C-H
744 s	out-of-plane δ Ar-H
685 s	out-of-plane δ Ar-H
605 m	in-plane δ C-C
581 m	out-of-plane δ C-C

Abbreviations: bands intensity: vs - very strong, s - strong, m - medium, w - weak; bands shape: br - broad; type of vibration: ν - stretching, δ - bending, s - symmetric, as - asymmetric.

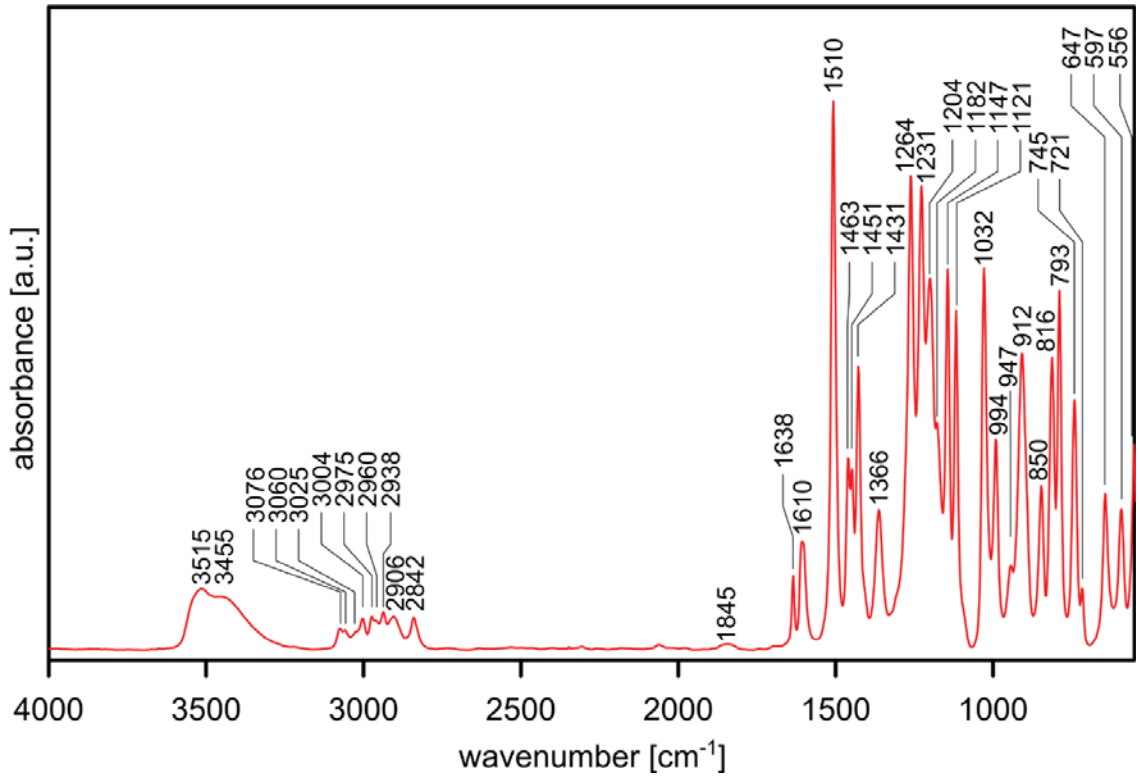

Fig. S2. FT-IR spectrum for eugenol

Table S2. Detailed FT-IR spectrum analysis for eugenol, abbreviations explained under the table

band position [cm^{-1}] and characteristics	**type of vibration**
3515 m	ν O-H in Ar-OH
3455 m	ν O-H in Ar-OH associated
3076 w	ν C-H in $=CH_2$
3060 w	ν C-H aromatic
3025 w, sh	ν C-H aromatic
3004 w	ν C-H aromatic
2975 w	ν C-H in CH_3-O-
2960 w	ν C-H in $=CH_2$
2938 w	ν C-H in Ar-CH_2-C
2906 w	ν C-H in Ar-CH_2-C
2842 w	ν C-H in CH_3-O-
1845 vw	overtones C=C
1638 m	ν C=C
1610 m	ν C-C aromatic
1510 vs	ν C-C aromatic
1463 m	in-plane δ_{as} C-H in CH_3
1451 m	ν C-C aromatic
1431 m	ν C-C aromatic
1366 m	in-plane δ_s C-H in CH_3
1264 s	ν_{as} C-O-C in CH_3-O-Ar
1231 s	ν C-O in Ar-OH
1204 s	in-plane δ Ar-H
1182 m	in-plane δ Ar-H
1147 s	in-plane δ Ar-H
1121 s	in-plane δ Ar-H
1032 s	ν_s C-O-C in CH_3-O-Ar
994 m	out-of-plane δ C-H in -CH=CH_2
947 w	out-of-plane δ C-H in -CH=CH_2
912 m	out-of-plane δ Ar-H
850 m	out-of-plane δ Ar-H
816 m	in-plane δ O-H in Ar-OH
793 s	out-of-plane δ Ar-H
745 m	out-of-plane δ Ar-H
721 m	δ C-H in Ar-CH_2-C
647 m	out-of-plane δ O-H in Ar-OH
597 m	out-of-plane δ C-C aromatic
556 m	δ C-O in CH_3-O-

Abbreviations: bands intensity: vs - very strong, s - strong, m - medium, w – weak, vw - very weak; bands shape: br - broad; type of vibration: ν - stretching, δ - bending, s - symmetric, as - asymmetric.

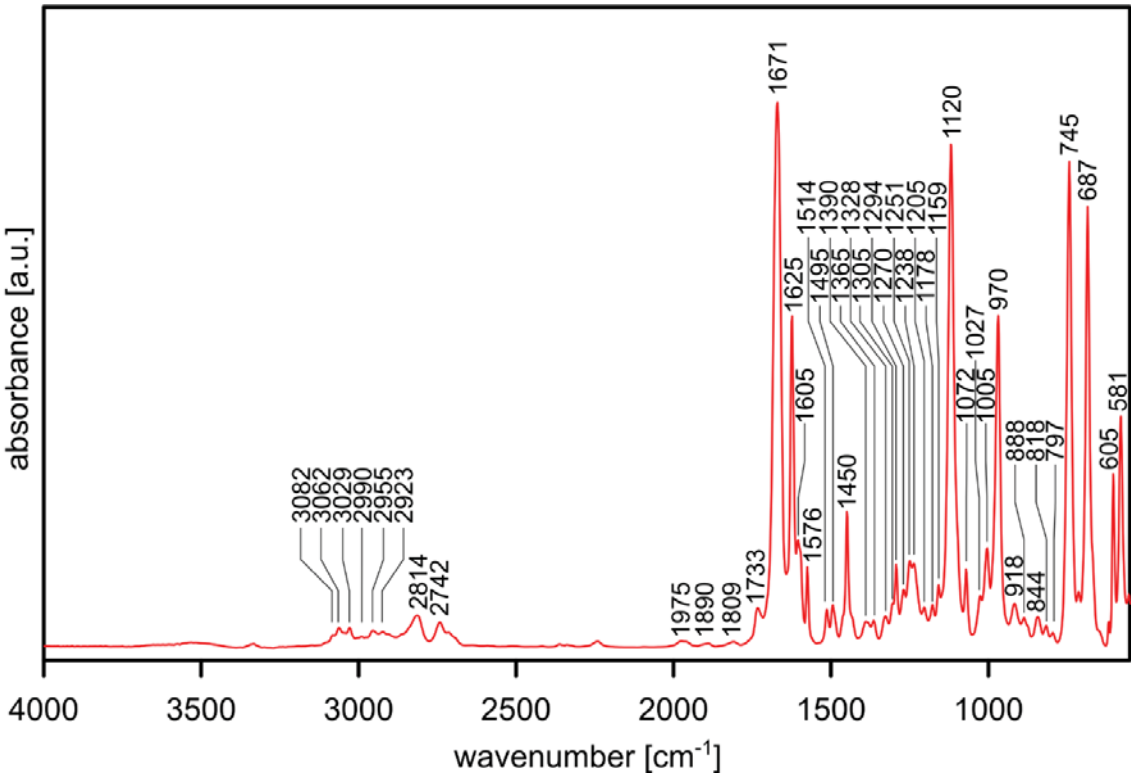

Fig. S3. FT-IR spectrum for cinnamon oil (from bark)

Table S3. Detailed FT-IR spectrum analysis for cinnamon oil (from bark), abbreviations explained under the table

band position [cm^{-1}] and characteristics	type of vibration	component of the oil
3082 w	ν C-H aromatic	cinnamaldehyde
3062 w	ν C-H aromatic	cinnamaldehyde
3029 w	ν =C-H	cinnamaldehyde
2990 w	ν =C-H	cinnamaldehyde
2955 w	ν C-H in $=CH_2$	eugenol
2923 w	ν C-H in Ar-CH_2-	(aromatic ester)
2814 w	ν C-H in -CHO	cinnamaldehyde
2742 w	ν C-H in -CHO	cinnamaldehyde
1975 w	overtones	cinnamaldehyde
1890 w	overtones	cinnamaldehyde
1809 w	overtones	cinnamaldehyde
1733 w	ν C=O in -COOR	(aromatic ester)
1671 vs	ν C=O α,β-unsaturated	cinnamaldehyde
1625 m	ν C=C conjugated with aryl	cinnamaldehyde
1605 m	ν C-C aromatic	cinnamaldehyde
1576 w	ν C-C aromatic	cinnamaldehyde
1514 w	ν C-C aromatic	eugenol
1495 w	ν C-C aromatic	cinnamaldehyde
1450 m	ν C-C aromatic	cinnamaldehyde
1390 w	in-plane δ_{as} C-H in -CHO	cinnamaldehyde
1365 w	in-plane δ_s C-H in CH_3	eugenol
1328 w	in-plane δ =C-H	cinnamaldehyde
1294 m	in-plane δ =C-H	cinnamaldehyde
1270 w	ν_{as} C-O-C in CH_3-O-Ar	eugenol
1251 w	in-plane δ Ar-H	cinnamaldehyde
1238 w	ν C-O in Ar-OH	eugenol
1205 w	in-plane δ Ar-H	eugenol
1178 w	in-plane δ Ar-H	eugenol
1159 w	in-plane δ Ar-H	cinnamaldehyde
1120 s	ν C-O α,β-unsaturated	cinnamaldehyde
1072 m	in-plane δ Ar-H	cinnamaldehyde
1027 w	ν_s C-O-C in CH_3-O-Ar	eugenol
1005 m	in-plane δ Ar-H	cinnamaldehyde
970 s	out-of-plane δ =C-H	cinnamaldehyde
918 w	out-of-plane δ Ar-H	eugenol
888 w	out-of-plane δ Ar-H	(aromatic ester)
844 w	out-of-plane δ =C-H	cinnamaldehyde
818 w	in-plane δ O-H in Ar-OH	eugenol
797 w	out-of-plane δ Ar-H	eugenol
745 s	out-of-plane δ Ar-H	cinnamaldehyde
687 s	out-of-plane δ Ar-H	cinnamaldehyde

605 m	in-plane δ C-C	cinnamaldehyde
581 m	out-of-plane δ C-C	cinnamaldehyde

Abbreviations: bands intensity: vs - very strong, s - strong, m - medium, w - weak; bands shape: br - broad; type of vibration: ν - stretching, δ - bending, s - symmetric, as - asymmetric.

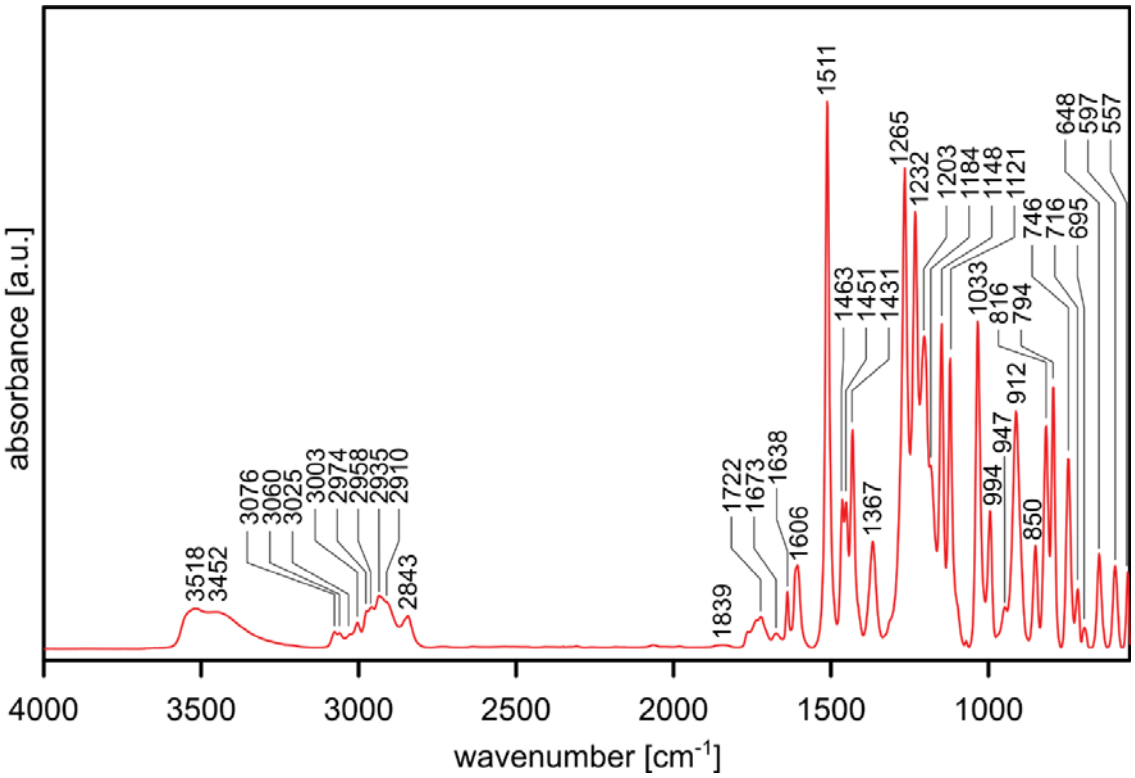

Fig. S4. FT-IR spectrum for cinnamon oil (from leaf)

Table S4. Detailed FT-IR spectrum analysis for cinnamon oil (from leaf), abbreviations explained under the table

band position [cm^{-1}] and characteristics	type of vibration	component of the oil
3518 m	ν O-H in Ar-OH	eugenol
3452 m	ν O-H in Ar-OH associated	eugenol
3076 w	ν C-H in $=CH_2$	eugenol
3060 w	ν C-H aromatic	eugenol
3025 w, sh	ν C-H aromatic	eugenol
3003 w	ν C-H aromatic	eugenol
2974 m	ν C-H in CH_3-O-	eugenol
2958 m	ν C-H in $=CH_2$	eugenol
2935 m	ν C-H in Ar-CH_2-C	eugenol
2910 m, sh	ν C-H in Ar-CH_2-C	eugenol
2843 m	ν C-H in CH_3-O-	eugenol
1839 vw	overtones C=C	eugenol
1722 w	ν C=O in -COOR	(aromatic ester)
1673 w	ν C=O in α,β-unsaturated	cinnamaldehyde
1638 w	ν C=C	eugenol
1606 m	ν C-C aromatic	eugenol
1511 vs	ν C-C aromatic	eugenol
1463 m	in-plane δ_{as} C-H in CH_3	eugenol
1451 m	ν C-C aromatic	eugenol
1431 m	ν C-C aromatic	eugenol
1367 m	in-plane δ_s C-H in CH_3	eugenol
1265 s	ν_{as} C-O-C in CH_3-O-Ar	eugenol
1232 s	ν C-O in Ar-OH	eugenol
1203 s	in-plane δ Ar-H	eugenol
1184 m	in-plane δ Ar-H	eugenol
1148 s	in-plane δ Ar-H	eugenol
1121 s	in-plane δ Ar-H	eugenol
1033 s	ν_s C-O-C in CH_3-O-Ar	eugenol
994 m	out-of-plane δ C-H in -$CH=CH_2$	eugenol
947 w	out-of-plane δ C-H in -$CH=CH_2$	eugenol
912 m	out-of-plane δ Ar-H	eugenol
850 m	out-of-plane δ Ar-H	eugenol
816 m	in-plane δ O-H in Ar-OH	eugenol
794 m	out-of-plane δ Ar-H	eugenol
746 m	out-of-plane δ Ar-H	eugenol
716 m	δ C-H in Ar-CH_2-C	eugenol
695 w	out-of-plane δ Ar-H	(aromatic ester)
648 m	out-of-plane δ O-H in Ar-OH	eugenol

597 m	out-of-plane δ C-C aromatic	eugenol
557 m	δ C-O in CH_3-O-	eugenol

Abbreviations: bands intensity: vs - very strong, s - strong, m - medium, w - weak, vw – very weak; bands shape: br - broad; type of vibration: ν - stretching, δ - bending, s - symmetric, as - asymmetric.

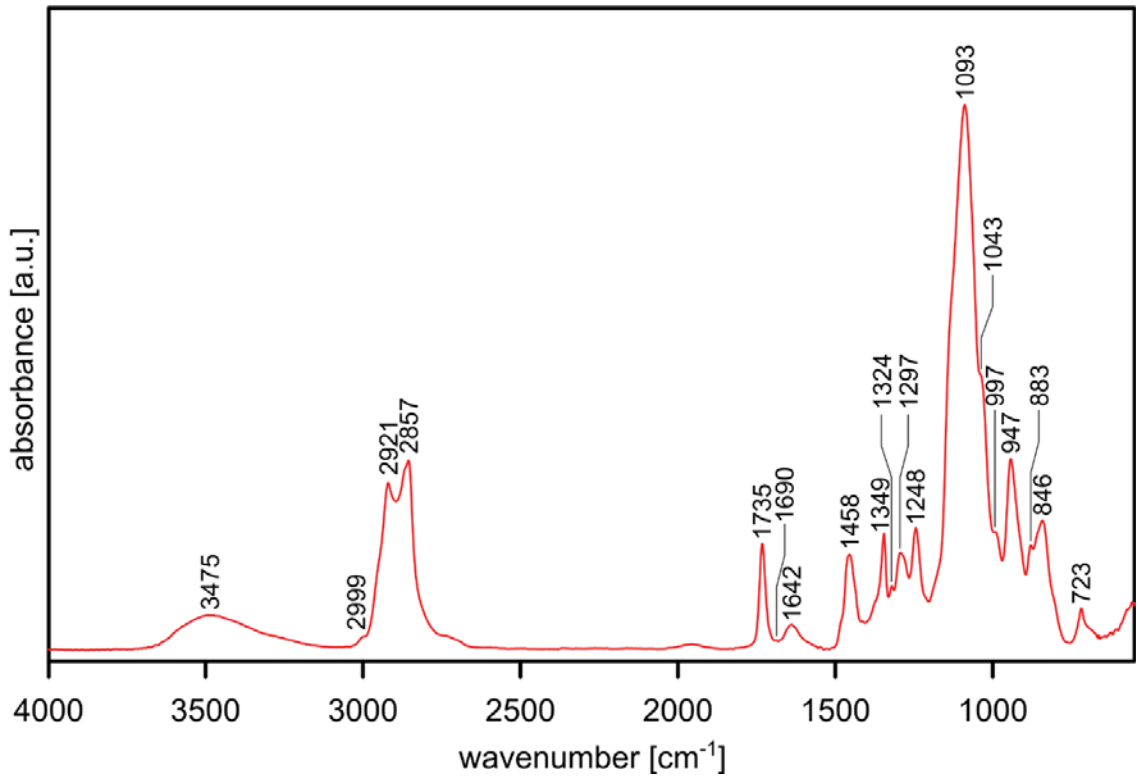

Fig. S5. FT-IR spectrum for Tween 80

Table S5. Detailed FT-IR spectrum analysis for Tween 80, abbreviations explained under the table

band position [cm^{-1}] and characteristics	**type of vibration**
3475 w	ν O-H
2999 vw, sh	ν C-H in C=C-H
2921 s	ν C-H
2857 s	ν C-H
1735 m	ν C=O
1690 vw	ν C=C
1642 w	δ O-H in H_2O
1458 m	δ C-H
1349 m	δ C-H
1324 w	δ C-H
1297 m	δ O-H in C-OH
1248 m	ν_{as} C-O in -COOR
1093 vs	ν C-O in C-O-C
1043 s, sh	ν C-O in C-OH
997 m	δ O-H in C-OH
947 s	δ C-H
883 m	ν C-C
846 m	ν C-C
723 w	δ C-C

Abbreviations: bands intensity: vs - very strong, s - strong, m - medium, w - weak, vw - very weak; bands shape: br – broad, sh - shoulder; type of vibration: ν - stretching, δ - bending, s - symmetric, as - asymmetric.

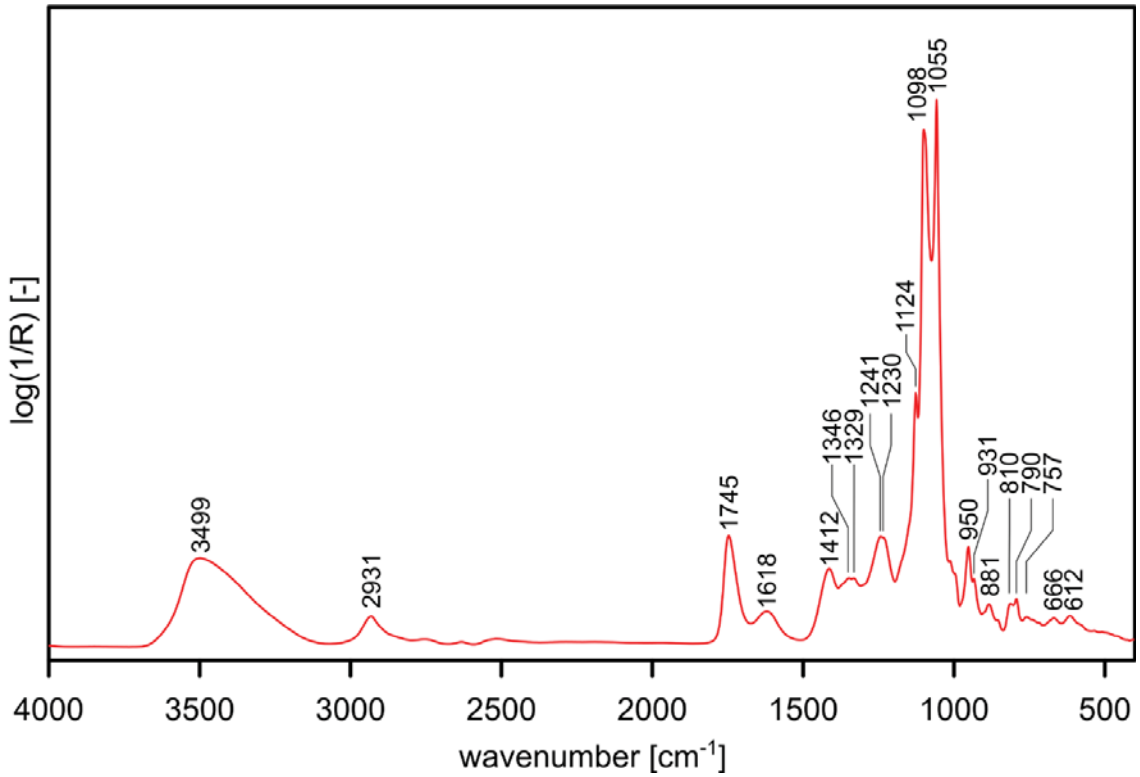

Fig. S6. FT-IR spectrum for sodium alginate coating

Table S6. Detailed FT-IR spectrum analysis for sodium alginate coating, abbreviations explained under the table

band position [cm^{-1}] and characteristics	**type of vibration**
3499 m, br	ν O-H
2931 w	ν C-H
1745 m	ν C=O in -COOH
1618 w	ν_{as} C-O in -COOH
1412 m	ν_{s} C-O in -COOH
1346 m	in-plane δ C-H
1329 m	in-plane δ C-H
1241 m	ν C-C in ring
1230 m	ν C-C in ring
1124 s	ν C-O in (ring)-OH
1098 vs	ν C-O in ring
1055 vs	ν C-O in C-O-C between rings
950 m	out-of-plane δ O-H in -COOH
931 m	out-of-plane δ O-H in -COOH
881 w	in-plane δ C-H
810 w	in-plane δ C-H
790 w	in-plane δ C-H
757 w	in-plane δ C-H
666 w	out-of-plane δ O-H in C-OH
612 w	out-of-plane δ C-O in -COOH

Abbreviations: bands intensity: vs - very strong, s - strong, m - medium, w - weak; bands shape: br - broad; type of vibration: ν - stretching, δ - bending, s - symmetric, as - asymmetric.