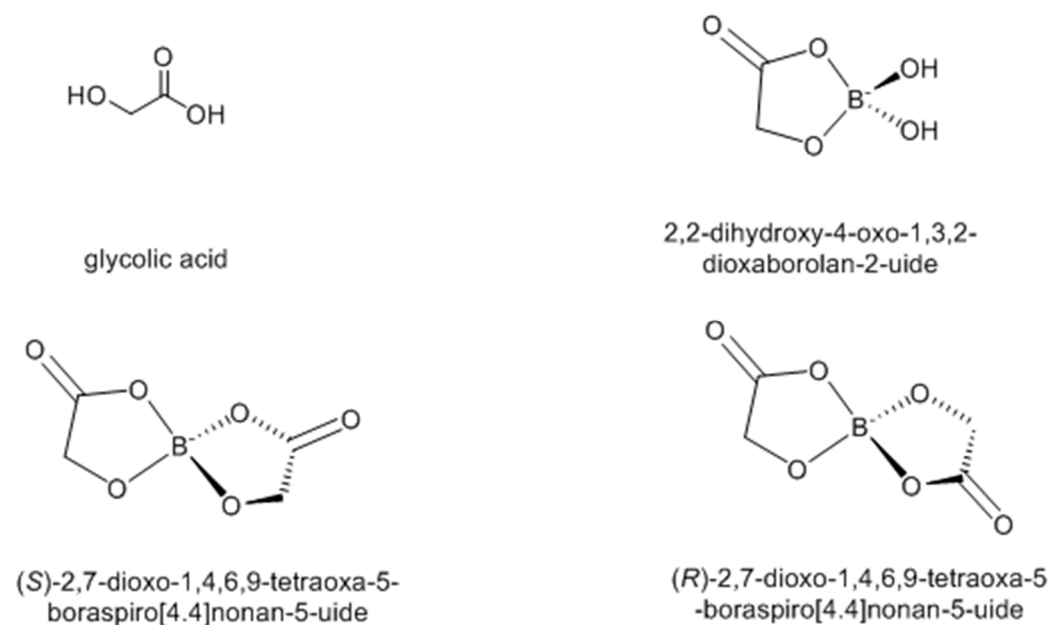
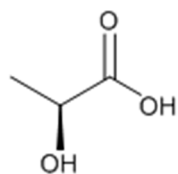


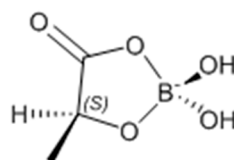
## Supplementary Information



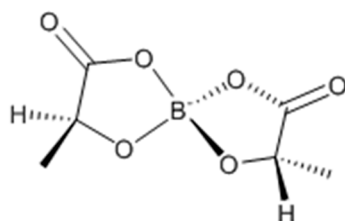
**Figure S1.** Complexes formed by glycolic acid and boric acid.



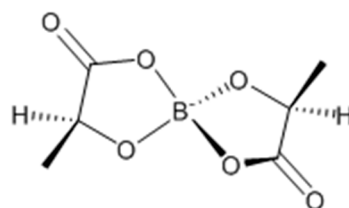
(*S*)-2-hydroxypropanoic acid



(*S*)-2,2-dihydroxy-4-methyl-5-oxo-1,3,2-dioxaborolan-2-uide

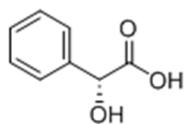


(*2S,5S,7S*)-2,7-dimethyl-3,8-dioxo-1,4,6,9-tetraoxa-5-borasp[iro[4.4]nonan-5-uide

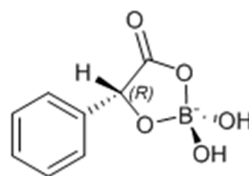


(*2S,5R,7S*)-2,7-dimethyl-3,8-dioxo-1,4,6,9-tetraoxa-5-borasp[iro[4.4]nonan-5-uide

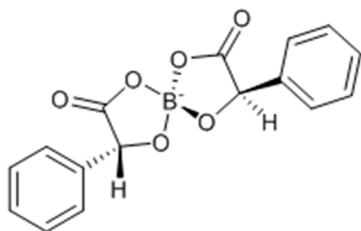
**Figure S2.** Complexes formed by D-(-)-lactic acid and boric acid.



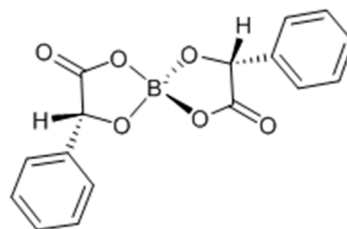
(*R*)-2-hydroxy-2-phenylacetic acid



(*R*)-2,2-dihydroxy-4-oxo-5-phenyl-1,3,2-dioxaborolan-2-uide

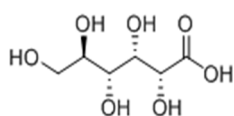


(3*R*,5*S*,8*R*)-2,7-dioxo-3,8-diphenyl-1,4,6,9-tetraoxa-5-borasp[iro[4.4]nonan-5-uide

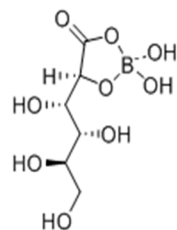


(3*R*,5*R*,8*R*)-2,7-dioxo-3,8-diphenyl-1,4,6,9-tetraoxa-5-borasp[iro[4.4]nonan-5-uide

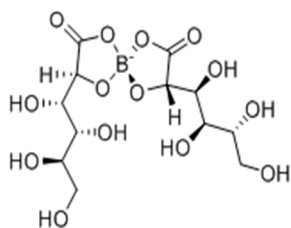
**Figure S3.** Complexes formed by (*R*)-(-)-mandelic acid and boric acid.



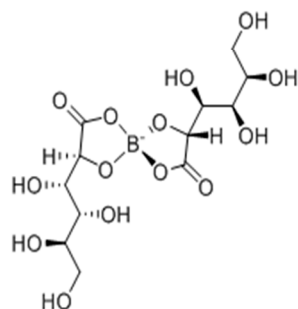
(2*R*,3*S*,4*R*,5*R*)-2,3,4,5,6-pentahydroxyhexanoic acid



(*S*)-2,2-dihydroxy-4-oxo-5-((1*S*,2*R*,3*R*)-1,2,3,4-tetrahydroxybutyl)-1,3,2-dioxaborolan-2-uide

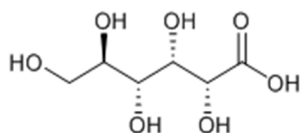


(3*S*,5*S*,8*S*)-2,7-dioxo-3,8-bis((1*S*,2*R*,3*R*)-1,2,3,4-tetrahydroxybutyl)-1,4,6,9-tetraoxa-5-borasp[4.4]nonan-5-uide

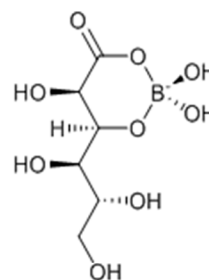


(3*R*,5*R*,8*S*)-2,7-dioxo-3,8-bis((1*S*,2*R*,3*R*)-1,2,3,4-tetrahydroxybutyl)-1,4,6,9-tetraoxa-5-borasp[4.4]nonan-5-uide

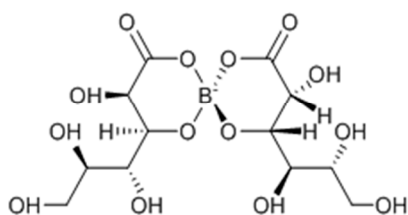
**Figure S4.** Complexes of D-gluconic acid with boric acid forming five-membered rings.



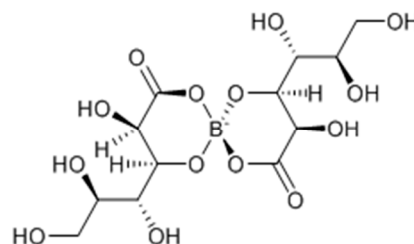
(2*R*,3*S*,4*R*,5*R*)-2,3,4,5,6-pentahydroxyhexanoic acid



(5*R*,6*S*)-2,2,5-trihydroxy-4-oxo-6-((1*R*,2*R*)-1,2,3-trihydroxypropyl)-1,3,2-dioxaborinan-2-uide

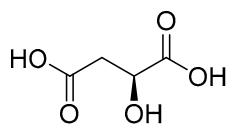


(3*R*,4*S*,6*S*,9*R*,10*S*)-3,9-dihydroxy-2,8-dioxo-4,10-bis((1*R*,2*R*)-1,2,3-trihydroxypropyl)-1,5,7,11-tetraoxa-6-borasp[5.5]undecan-6-uide

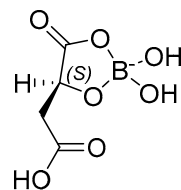


(3*R*,4*S*,6*R*,9*R*,10*S*)-3,9-dihydroxy-2,8-dioxo-4,10-bis((1*R*,2*R*)-1,2,3-trihydroxypropyl)-1,5,7,11-tetraoxa-6-borasp[5.5]undecan-6-uide

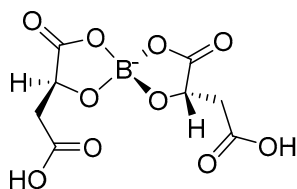
**Figure S5.** Complexes of D-gluconic acid with boric acid forming six-membered rings.



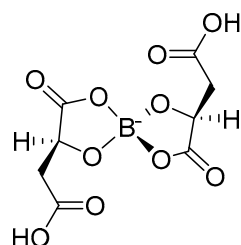
(*S*)-2-hydroxysuccinic acid



(*S*)-4-(carboxymethyl)-2,2-dihydroxy-5-oxo-1,3,2-dioxaborolan-2-uide

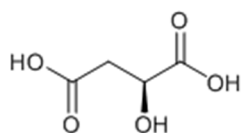


(*2S,5S,7S*)-2,7-bis(carboxymethyl)-3,8-dioxo-1,4,6,9-tetraoxa-5-borasp[iro[4.4]nonan-5-uide

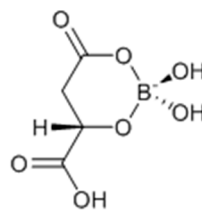


(*2S,5R,7S*)-2,7-bis(carboxymethyl)-3,8-dioxo-1,4,6,9-tetraoxa-5-borasp[iro[4.4]nonan-5-uide

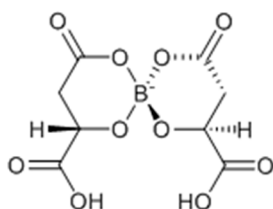
**Figure S6.** Complexes of L-(-)-malic acid with boric acid forming five-membered rings.



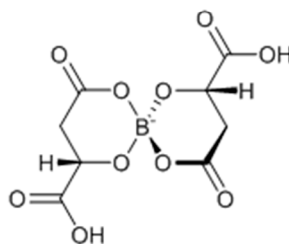
(S)-2-hydroxysuccinic acid



(S)-4-carboxy-2,2-dihydroxy-6-oxo-1,3,2-dioxaborinan-2-uide

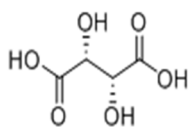


(2S,6S,8S)-2,8-dicarboxy-4,10-dioxo-1,5,7,11-tetraoxa-6-borasp[iro[5.5]undecan-6-uide

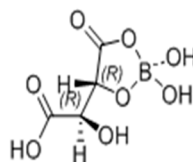


(2S,6R,8S)-2,8-dicarboxy-4,10-dioxo-1,5,7,11-tetraoxa-6-borasp[iro[5.5]undecan-6-uide

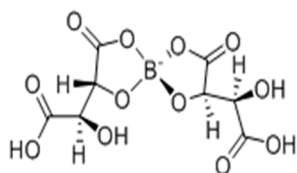
**Figure S7.** Complexes of L-(-)-malic acid with boric acid forming six-membered rings.



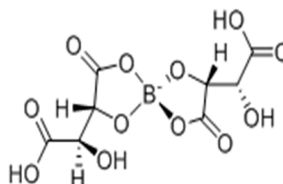
(2*R*,3*R*)-2,3-dihydroxysuccinic acid



(*R*)-4-((*R*)-carboxy(hydroxy)methyl)-  
2,2-dihydroxy-5-oxo-1,3,2-dioxaborolan-2-uide



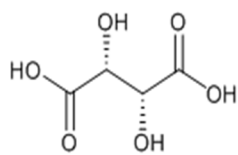
(2*R*,5*S*,7*R*)-2,7-bis((*R*)-carboxy(hydroxy)methyl)-  
3,8-dioxo-1,4,6,9-tetraoxa-5-borasp[4.4]nonan-5-uide



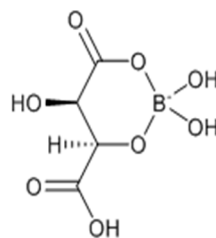
(2*R*,5*R*,7*R*)-2,7-bis((*R*)-carboxy(hydroxy)methyl)-  
3,8-dioxo-1,4,6,9-tetraoxa-5-borasp[4.4]nonan-5-uide

**Figure S8.** Complexes of L-(+)-tartaric acid with boric acid forming five-membered rings.

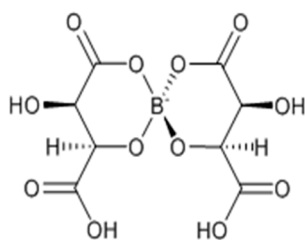




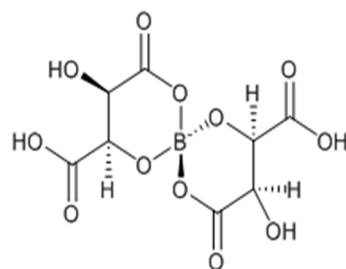
(2*R*,3*R*)-2,3-dihydroxysuccinic acid



(4*R*,5*R*)-4-carboxy-2,2,5-trihydroxy-6-oxo-1,3,2-dioxaborinan-2-uide

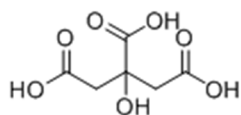


(2*R*,3*R*,6*S*,8*S*,9*S*)-2,8-dicarboxy-3,9-dihydroxy-4,10-dioxo-1,5,7,11-tetraoxa-6-borasp[5.5]undecan-6-uide

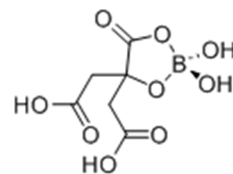


(2*R*,3*R*,6*R*,8*R*,9*R*)-2,8-dicarboxy-3,9-dihydroxy-4,10-dioxo-1,5,7,11-tetraoxa-6-borasp[5.5]undecan-6-uide

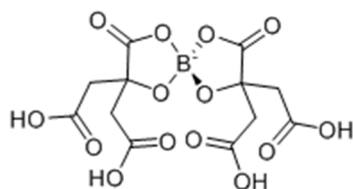
**Figure S9.** Complexes of L-(+)-tartaric acid with boric acid forming six-membered rings.



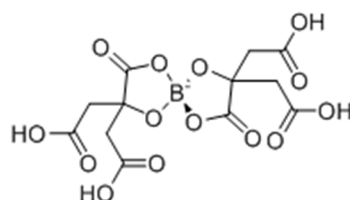
2-hydroxypropane-1,2,3-tricarboxylic acid



4,4-bis(carboxymethyl)-2,2-dihydroxy-5-oxo-1,3,2-dioxaborolan-2-uide

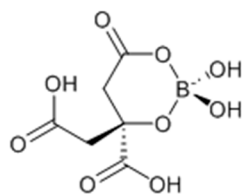


(*S*)-2,2,7,7-tetrakis(carboxymethyl)-3,8-dioxo-1,4,6,9-tetraoxa-5-borasp[iro[4.4]nonan-5-uide

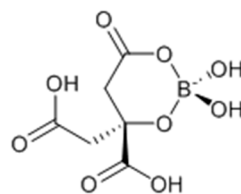


(*R*)-2,2,7,7-tetrakis(carboxymethyl)-3,8-dioxo-1,4,6,9-tetraoxa-5-borasp[iro[4.4]nonan-5-uide

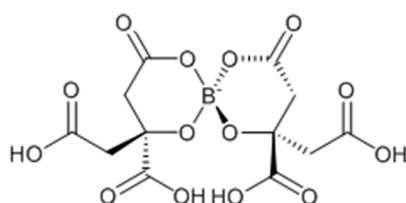
**Figure S10.** Complexes of citric acid with boric acid forming five-membered rings.



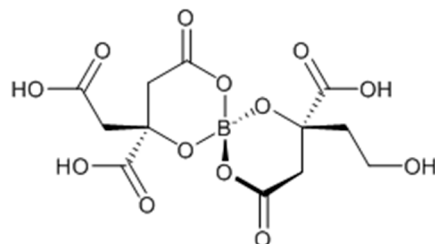
(*S*)-4-carboxy-4-(carboxymethyl)-2,2-dihydroxy-6-oxo-1,3,2-dioxaborinan-2-uide



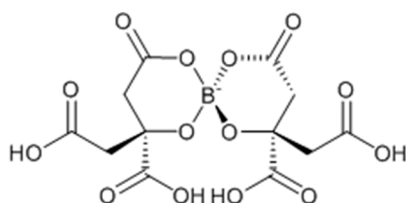
(*R*)-4-carboxy-4-(carboxymethyl)-2,2-dihydroxy-6-oxo-1,3,2-dioxaborinan-2-uide



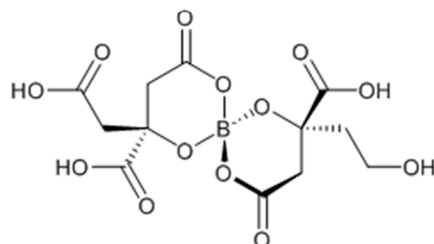
(*2S,6S,8S*)-2,8-dicarboxy-2,8-bis(carboxymethyl)-4,10-dioxo-1,5,7,11-tetraoxa-6-borasp[5.5]undecan-6-uide



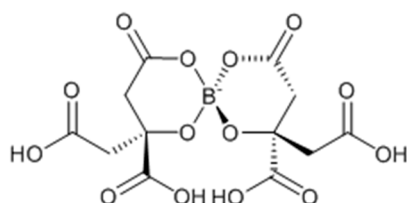
(*2S,6R,8S*)-2,8-dicarboxy-2-(carboxymethyl)-8-(2-hydroxyethyl)-4,10-dioxo-1,5,7,11-tetraoxa-6-borasp[5.5]undecan-6-uide



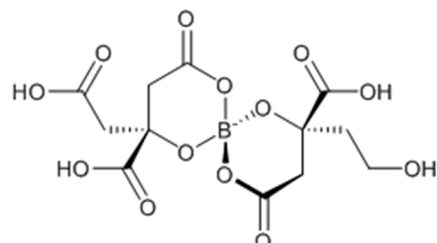
(*2R,6S,8S*)-2,8-dicarboxy-2,8-bis(carboxymethyl)-4,10-dioxo-1,5,7,11-tetraoxa-6-borasp[5.5]undecan-6-uide



(*2S,6R,8R*)-2,8-dicarboxy-2-(carboxymethyl)-8-(2-hydroxyethyl)-4,10-dioxo-1,5,7,11-tetraoxa-6-borasp[5.5]undecan-6-uide

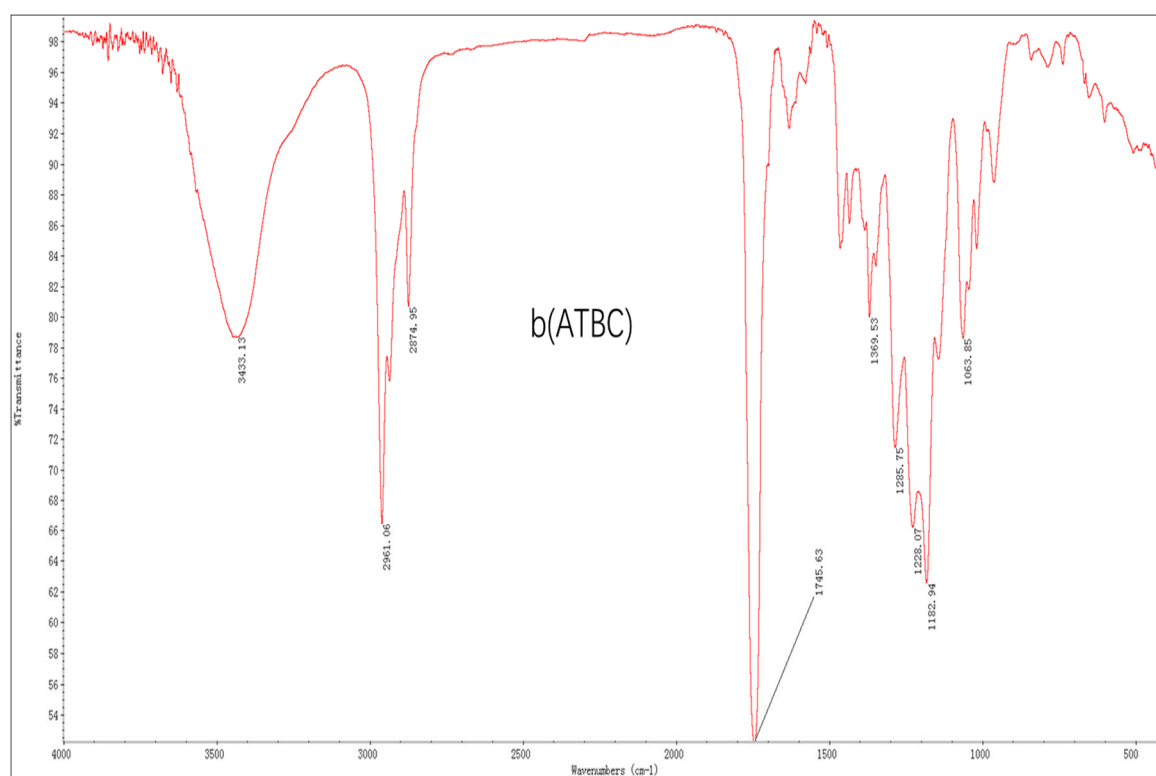
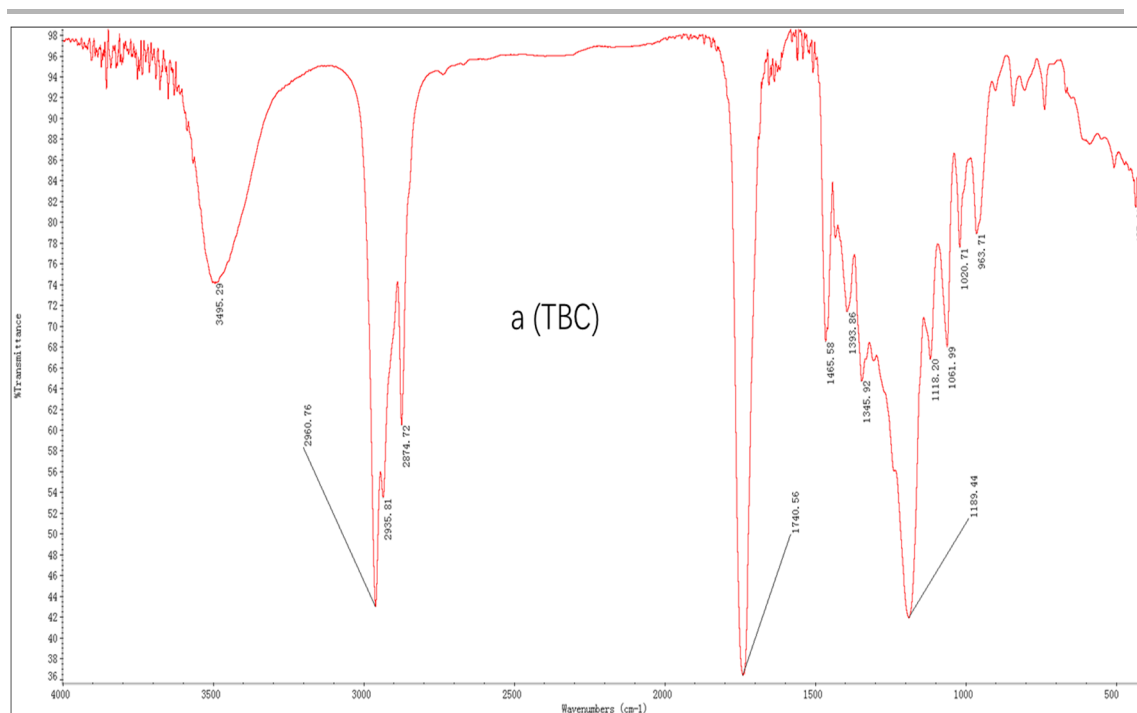


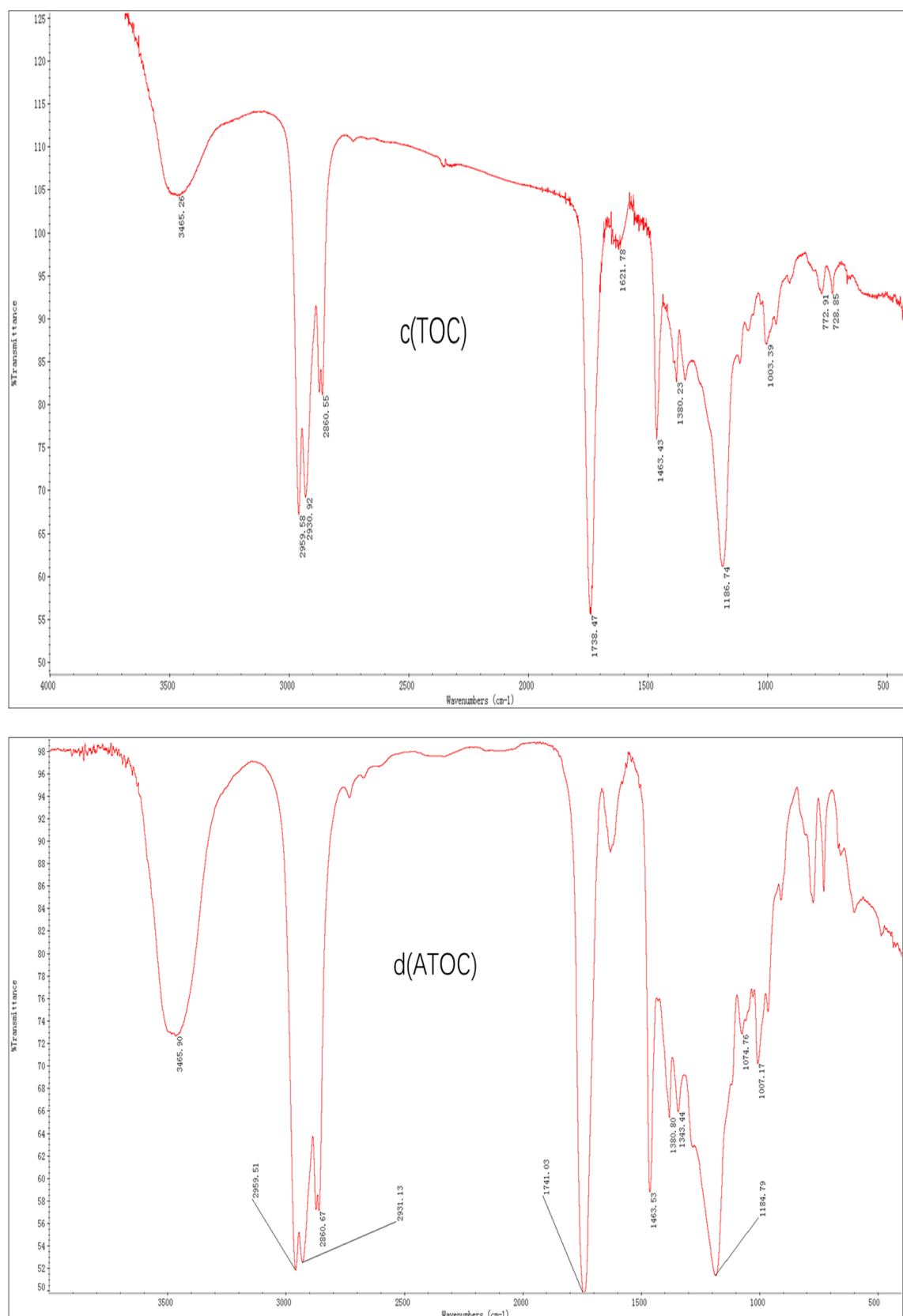
(*2R,6S,8R*)-2,8-dicarboxy-2,8-bis(carboxymethyl)-4,10-dioxo-1,5,7,11-tetraoxa-6-borasp[5.5]undecan-6-uide



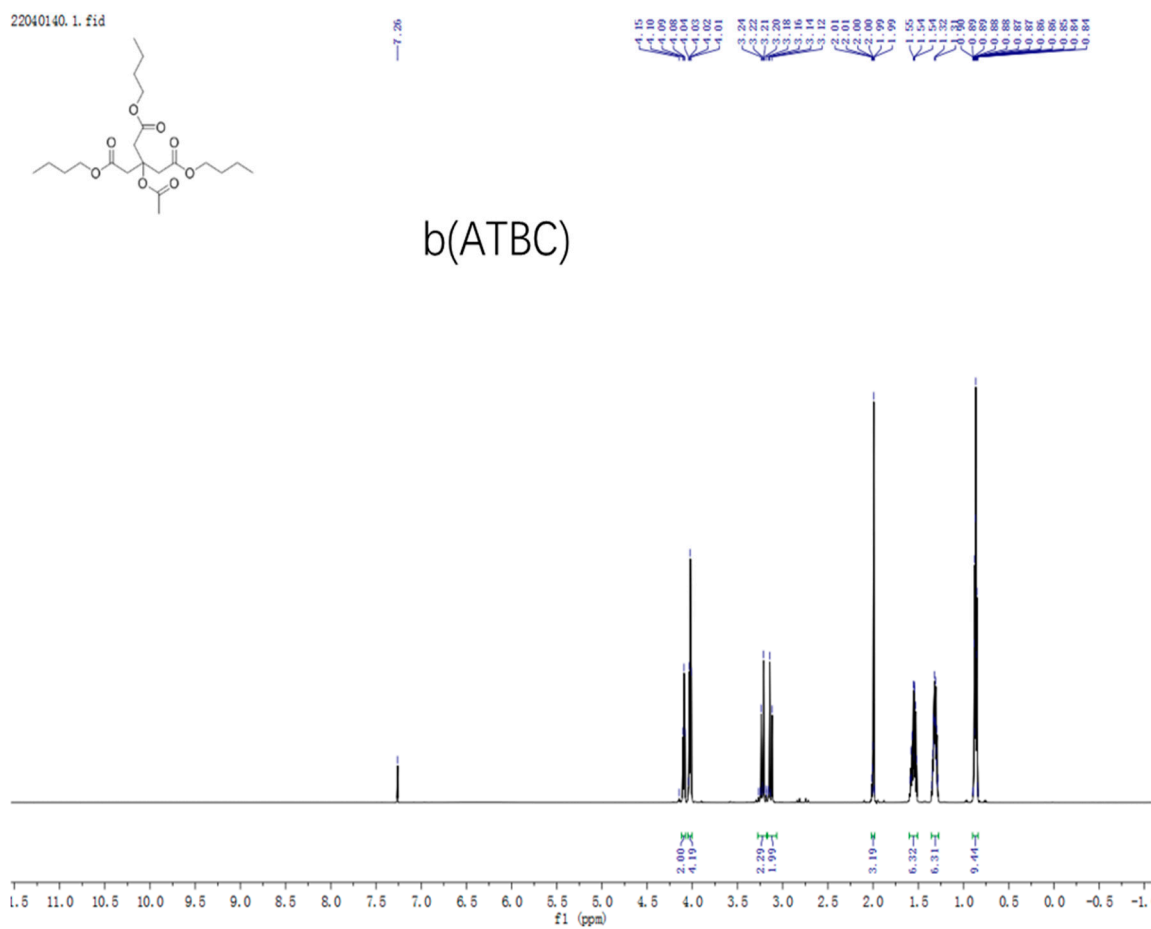
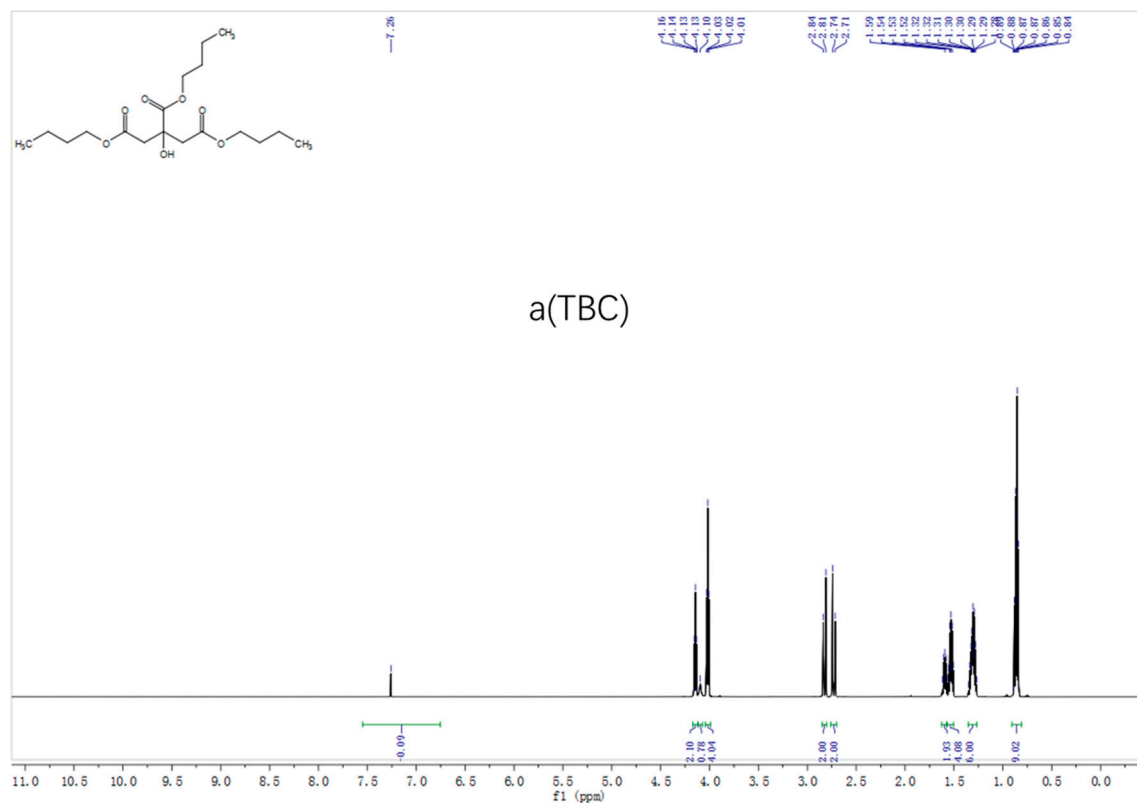
(*2R,6R,8R*)-2,8-dicarboxy-2-(carboxymethyl)-8-(2-hydroxyethyl)-4,10-dioxo-1,5,7,11-tetraoxa-6-borasp[5.5]undecan-6-uide

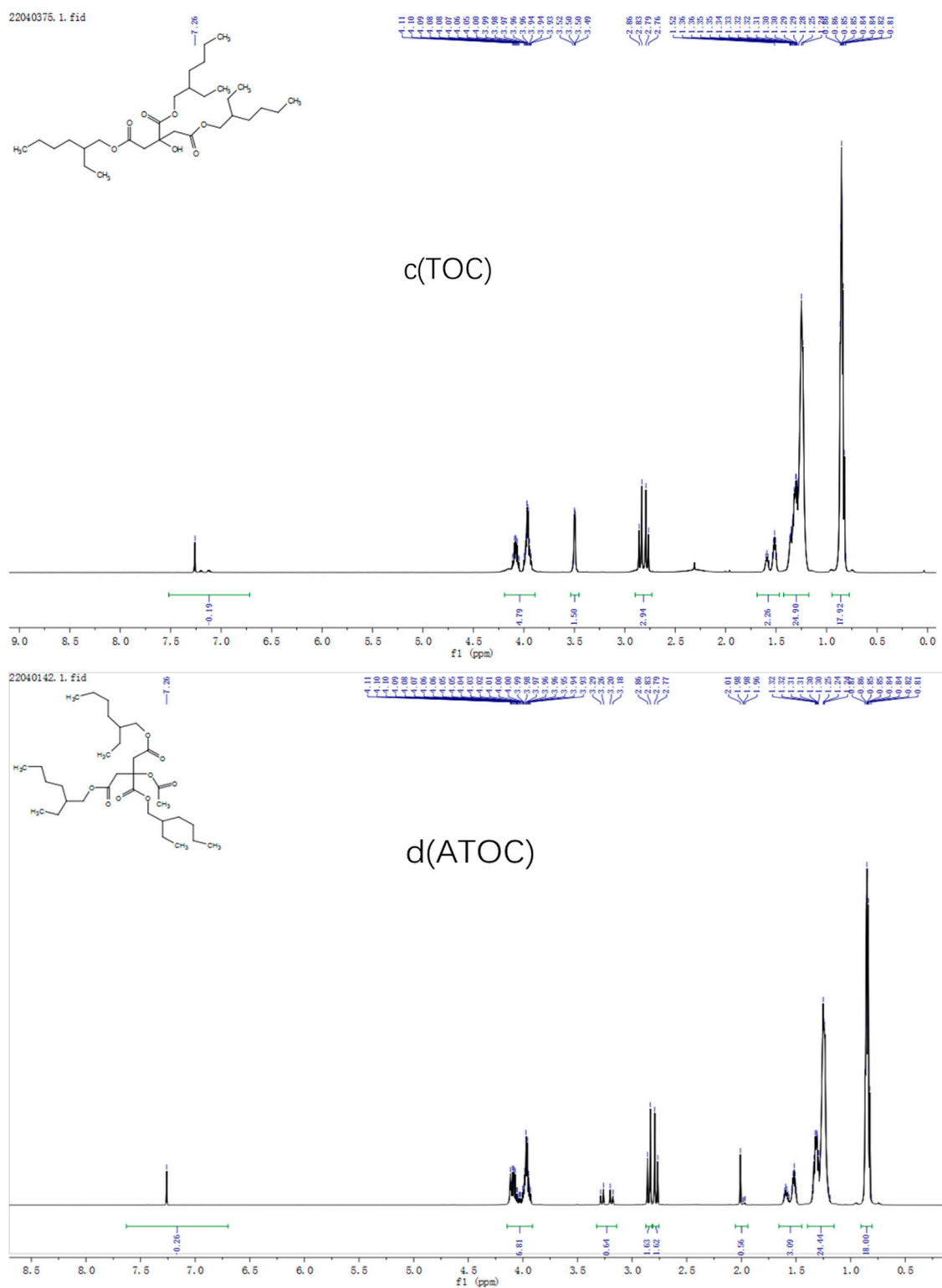
**Figure S11.** Complexes of citric acid with boric acid forming six-membered rings.



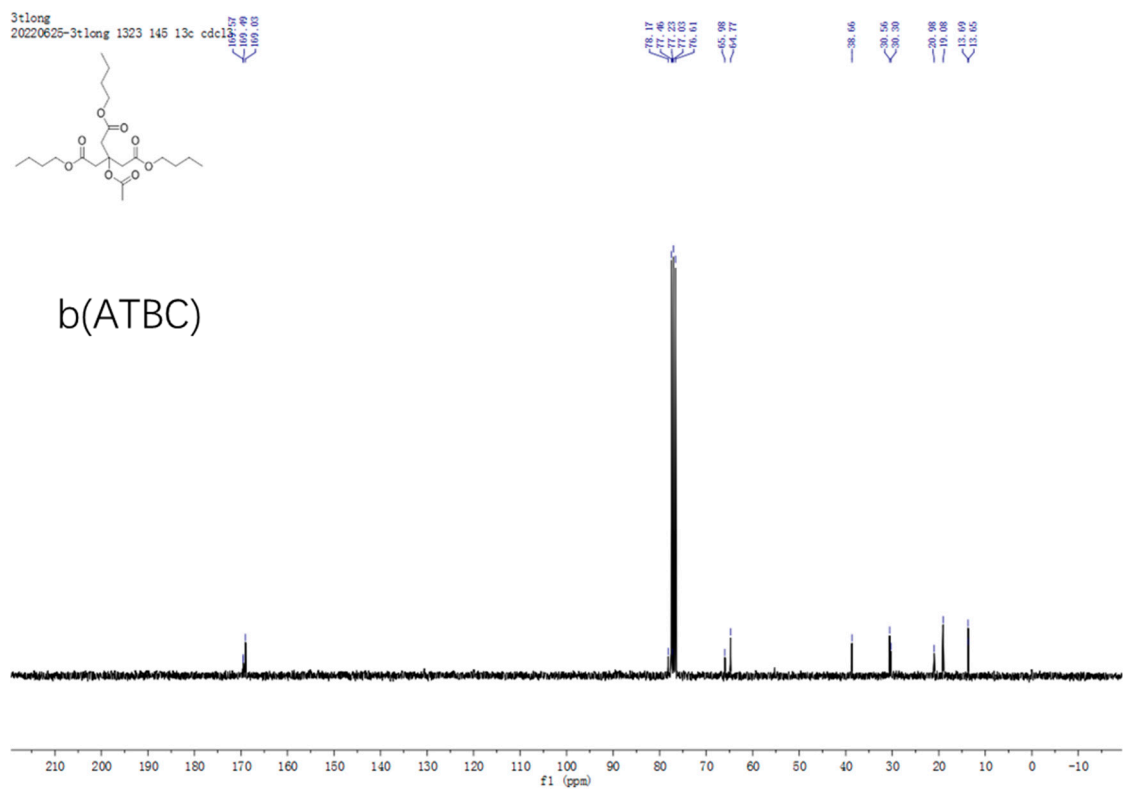
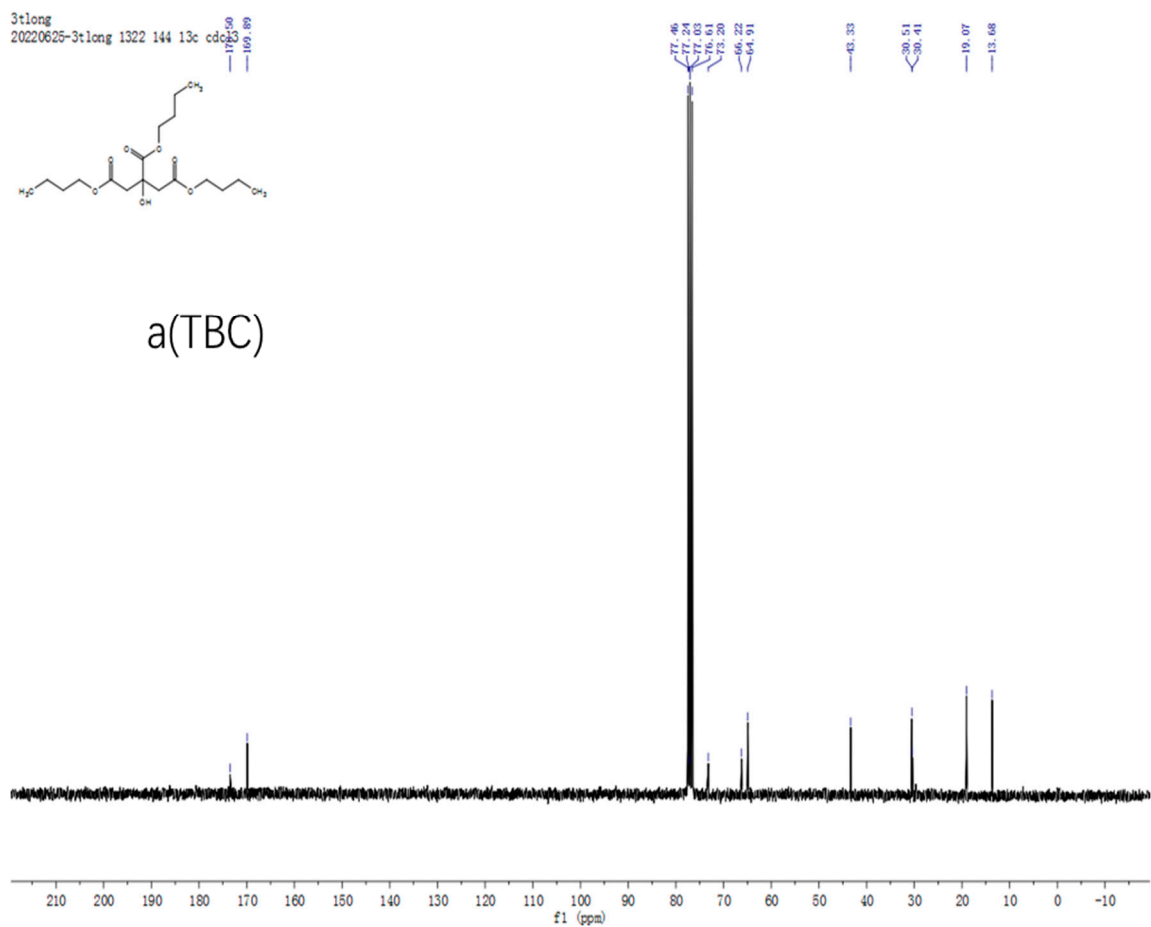


**Figure S12.** IR spectra of products TBC, ATBC, TOC, and ATOC. (a). The IR characteristic peaks appeared at the following wavenumbers ( $\text{cm}^{-1}$ ): 3495 (-OH), 1740 (-C=O), 1189 (C-O-C), and 1062 (C-O). (b). The IR characteristic peaks appeared at the following wavenumbers ( $\text{cm}^{-1}$ ): 1745 (-C=O), 1182 (C-O-C), and 1063 (C-O). (c). The IR characteristic peaks appeared at the following wavenumbers ( $\text{cm}^{-1}$ ): 3522 (-OH), 1739 (-C=O), and 1188 (C-O-C). (d). The IR characteristic peaks appeared at the following wavenumbers ( $\text{cm}^{-1}$ ): 1741 (-C=O), 1184 (C-O-C), and 1074 (C-O).

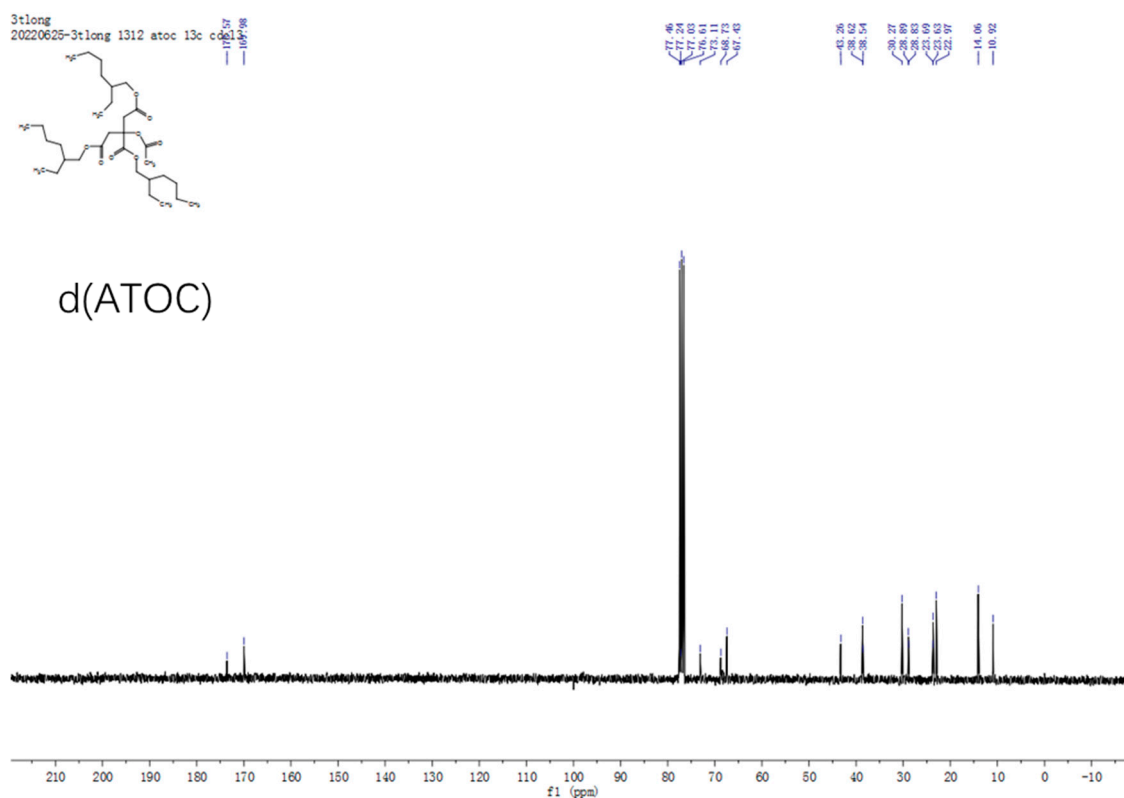
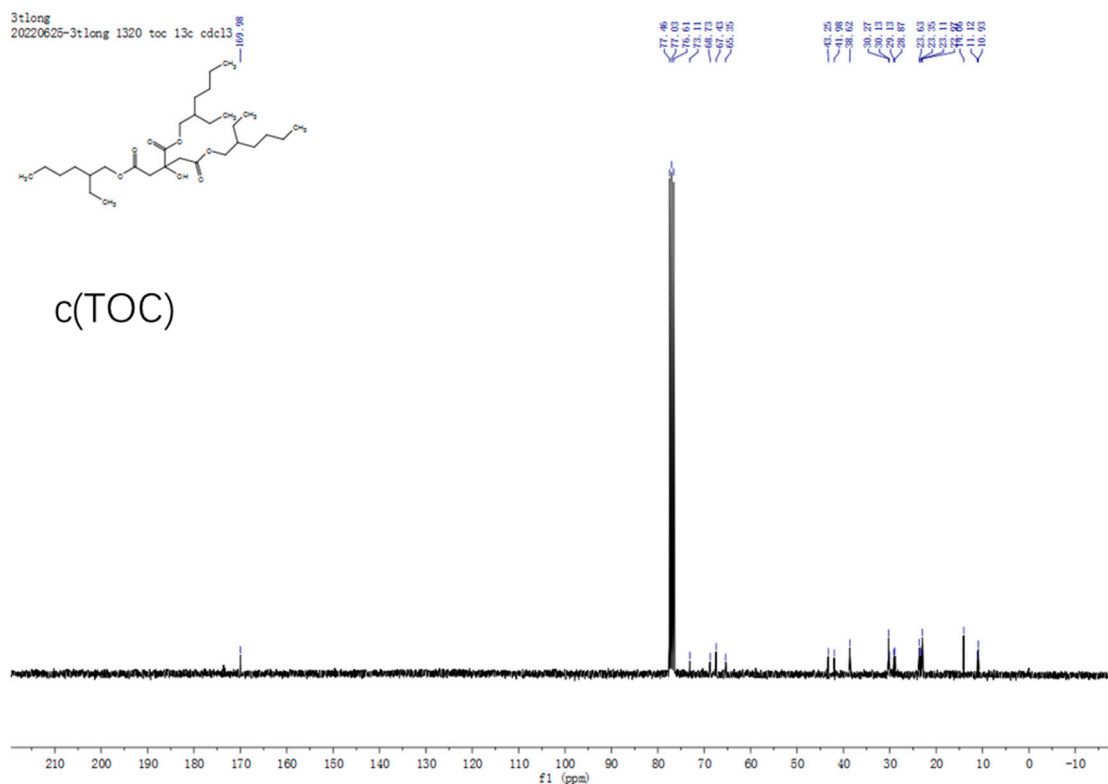




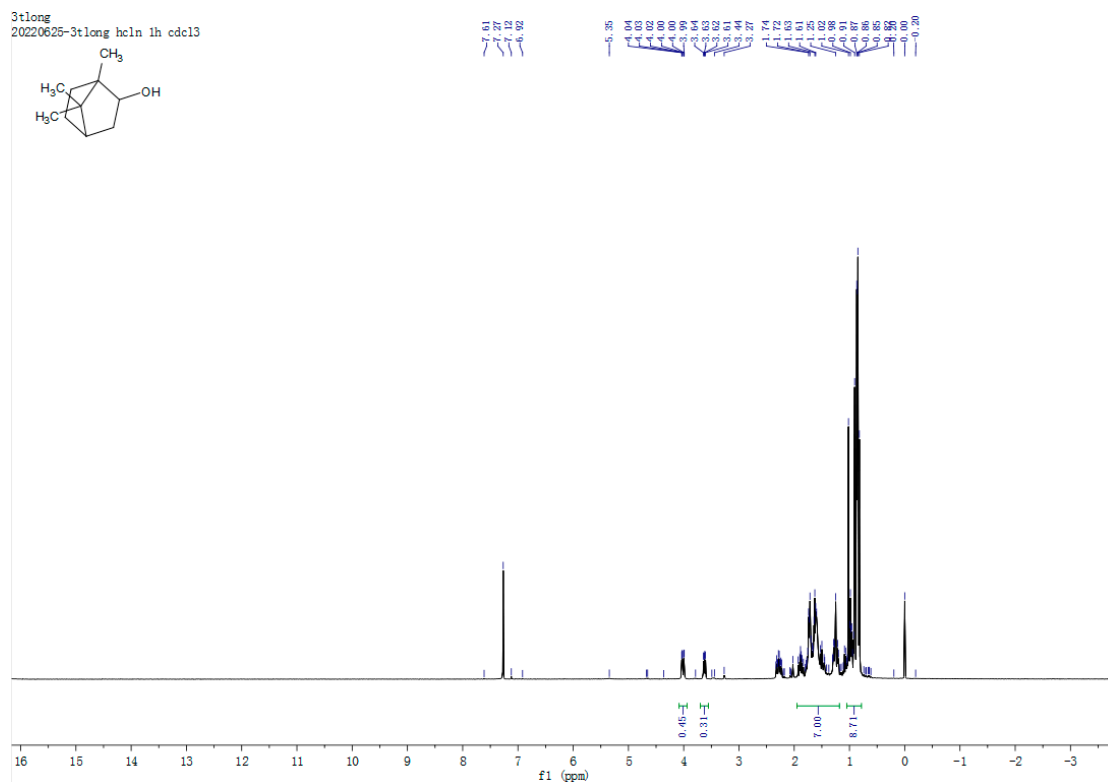
**Figure S13.**  $^1\text{H}$ -NMR spectra of products TBC, ATBC, TOC, and ATOC. (a). The  $^1\text{H}$  NMR (600 MHz,  $\text{CDCl}_3$ ) values were  $\delta$  4.14 (t,  $J$  = 9.0 Hz, 2H), 4.10 (s, 1H), 4.02 (t,  $J$  = 6.0 Hz, 4H), 2.83 (d,  $J$  = 18 Hz, 2H), 2.73 (d,  $J$  = 18 Hz, 2H), 1.62–1.58 (m, 2H), 1.57–1.51 (m, 4H), 1.35–1.27 (m, 6H), 0.89–0.84 (m, 9H). (b). The  $^1\text{H}$  NMR (600 MHz,  $\text{CDCl}_3$ ) values were  $\delta$  4.14 (t,  $J$  = 9.0 Hz, 2H), 4.02 (t,  $J$  = 6.0 Hz, 4H), 2.83 (d,  $J$  = 18 Hz, 2H), 2.73 (d,  $J$  = 18 Hz, 2H), 2.00 (m, 3H), 1.57–1.51 (m, 6H), 1.35–1.27 (m, 6H), and 0.89–0.84 (m, 9H). (C). The  $^1\text{H}$  NMR (600 MHz,  $\text{CDCl}_3$ ) values were  $\delta$  4.12–4.05 (m, 2H), 4.00–3.93 (m, 4H), 2.88–2.76 (m, 4H), 1.61–1.57 (m, 1H), 1.53–1.49 (m, 2H), 1.35–1.19 (m, 24H), and 0.88–0.80 (m, 18H). (d). The  $^1\text{H}$  NMR (600 MHz,  $\text{CDCl}_3$ ) values were  $\delta$  4.15–3.93 (m, 7H), 3.29–3.18 (m, 1H), 2.85 (d,  $J$  = 12.0 Hz, 2H), 2.78 (d,  $J$  = 12.0 Hz, 2H), 2.01–1.96 (m, 1H), 1.61–1.50 (m, 3H), 1.32–1.24 (m, 24H), and 0.85–0.81 (m, 18H).



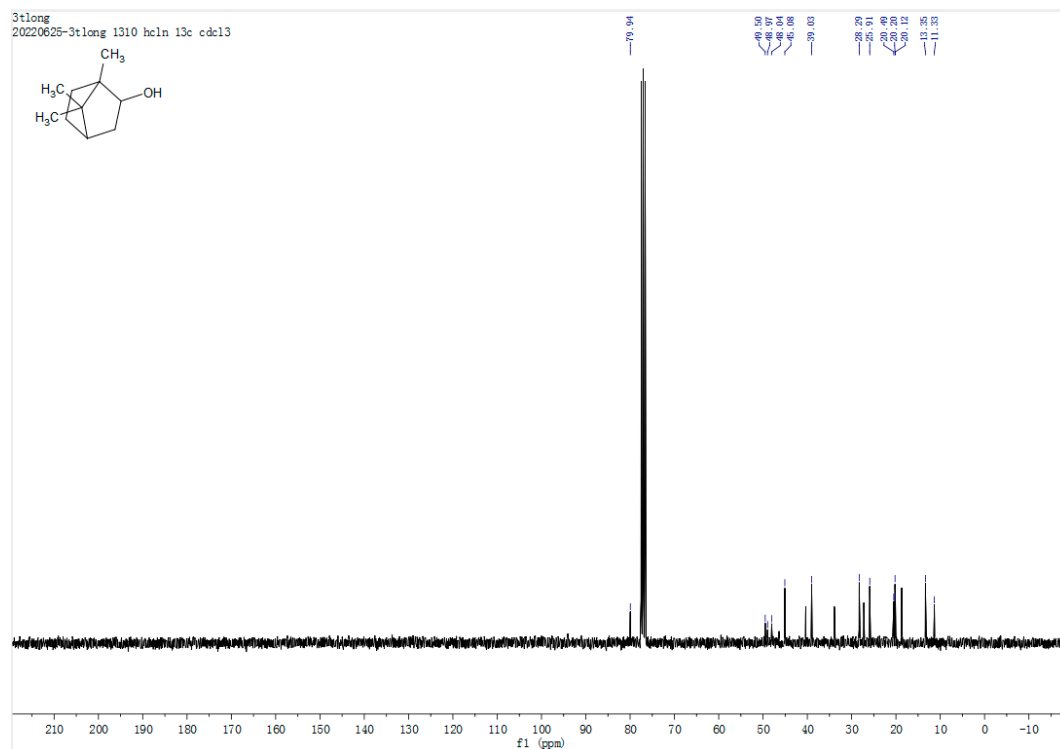




**Figure S14.**  $^{13}\text{C}$ -NMR spectra of products TBC, ATBC, TOC, and ATOC. (a). The  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) values were  $\delta$  178.50, 169.89, 73.20, 66.22, 64.91, 43.33, 30.51, 30.41, 19.07, and 13.68. (b). The  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) values were  $\delta$  169.57, 169.49, 169.03, 85.98, 84.77, 38.66, 30.56, 30.30, 20.98, 19.08, 13.69, and 13.65. (c). The  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) values were  $\delta$  169.98, 73.11, 68.73, 67.43, 65.35, 43.25, 41.98, 38.62, 30.27, 30.13, 29.13, 28.87, 23.63, 23.35, 23.11, 22.97, 14.06, 11.12, and 10.93. (d). The  $^{13}\text{C}$  NMR (75 MHz,  $\text{CDCl}_3$ ) values were  $\delta$  175.57, 165.98, 73.11, 68.73, 67.43, 43.26, 38.62, 38.54, 30.27, 28.89, 28.83, 23.69, 23.63, 22.97, 14.06, and 10.92.



**Figure S15.**  $^1\text{H}$ -NMR spectra of borneol



**Figure S16.**  $^{13}\text{C}$ -NMR spectra of borneol