

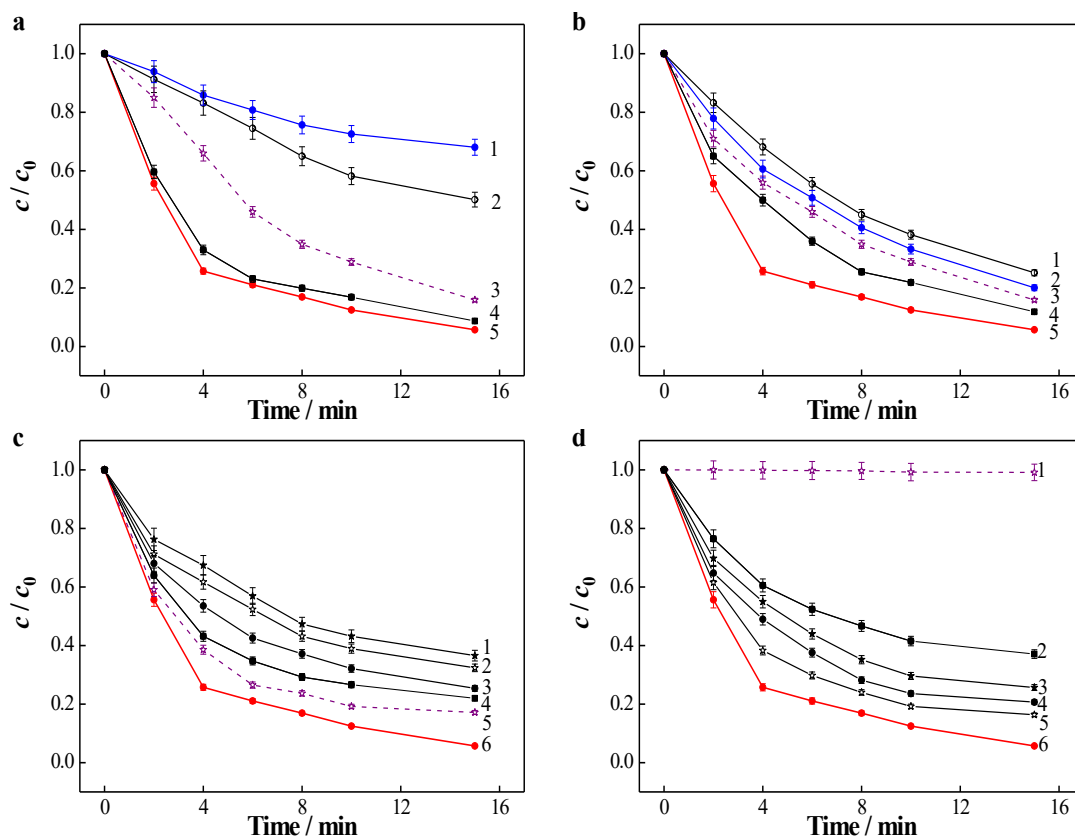
Supplement Information

Removal of water-soluble lignin model pollutants with graphene oxide loaded Ionic sulfide as an efficient adsorbent and heterogeneous Fenton catalyst

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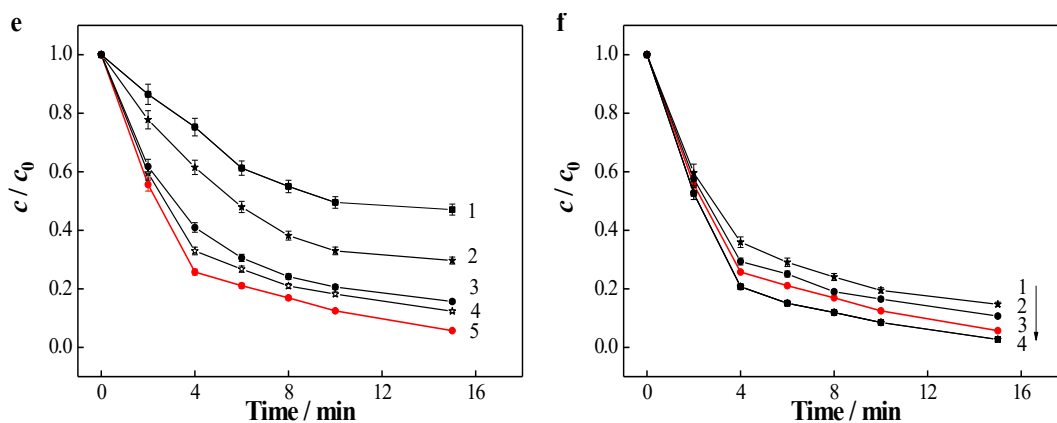


Fig. S1 Effects of (a) preparation temperature and (b) graphene oxide content of GO-Fe₃S₄ composite on the degradation of vanillic acid. The graphene oxide content was 4% in (a), and the preparation temperature of the composite was 180 °C in (b). Dependence of vanillic acid degradation on (c) catalyst load, (d) initial H₂O₂ concentration, (e) solution pH value and (f) reactive temperature for GO-Fe₃S₄ composite. Other reaction conditions: vanillic acid concentration 35 mg L⁻¹, GO-Fe₃S₄ composite load 0.4 g L⁻¹(a, b, d, e, f), initial H₂O₂ concentration 12 mmol L⁻¹(a, b, c, e, f), solution pH 4 (a, b, c, d, f), and reactive temperature 35 °C (a, b, c, d, e).

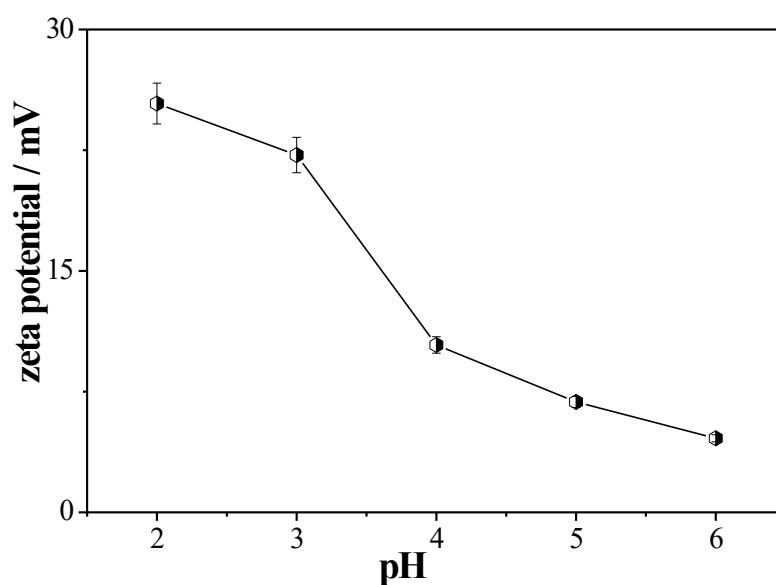


Fig. S2 Zeta potential of GO-Fe₃S₄ composite nanoparticles at different pH values

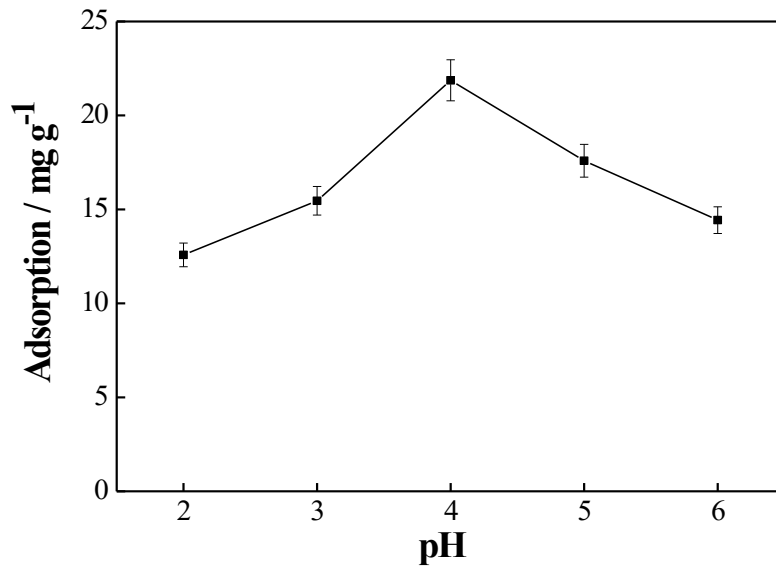


Fig. S3 Adsorption of vanillic acid on GO-Fe₃S₄ composite at different pH values

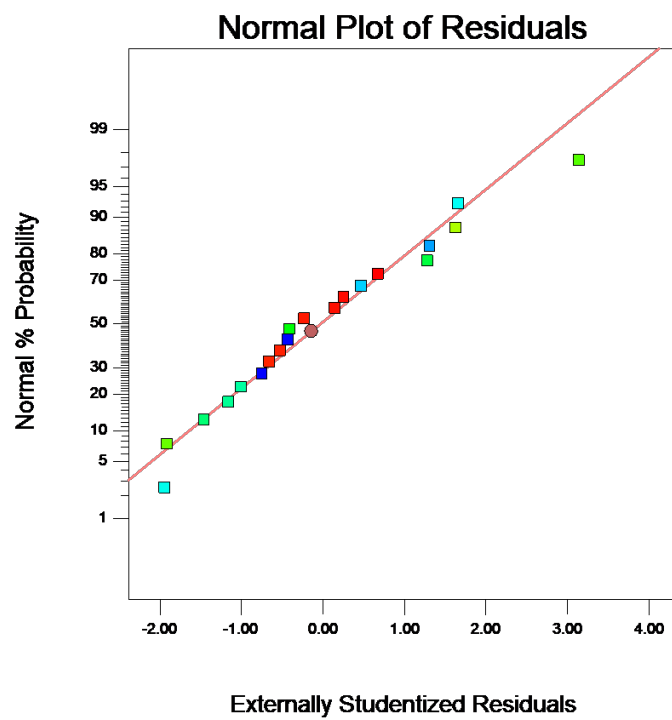


Fig. S4 The normal probability distribution of residuals

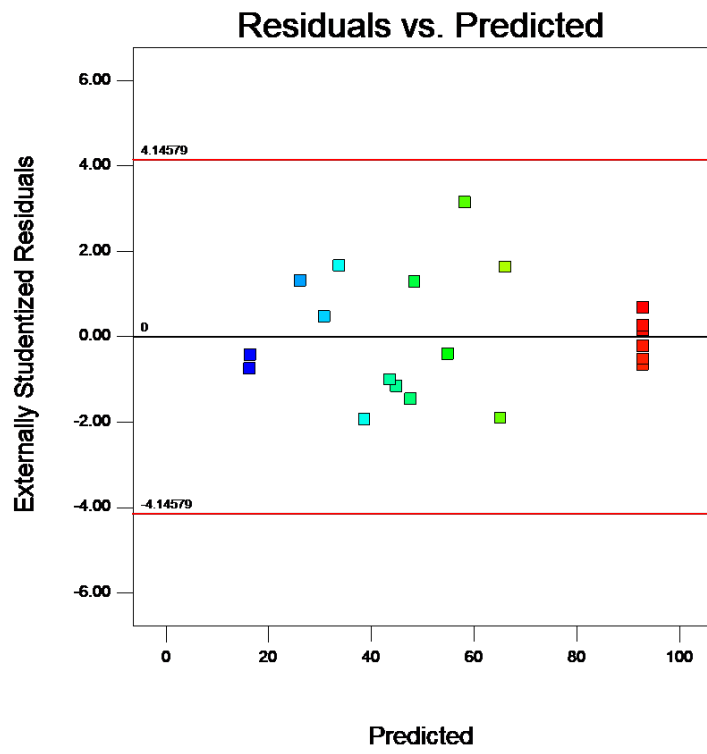
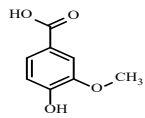
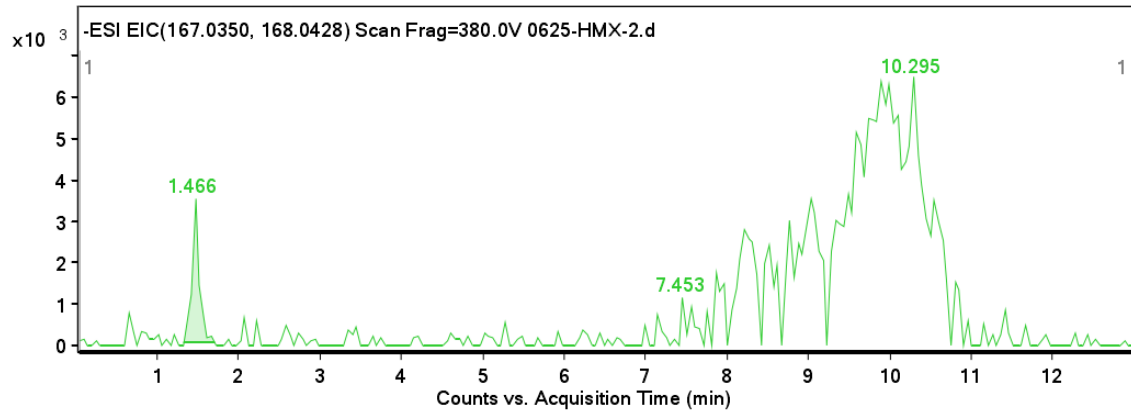


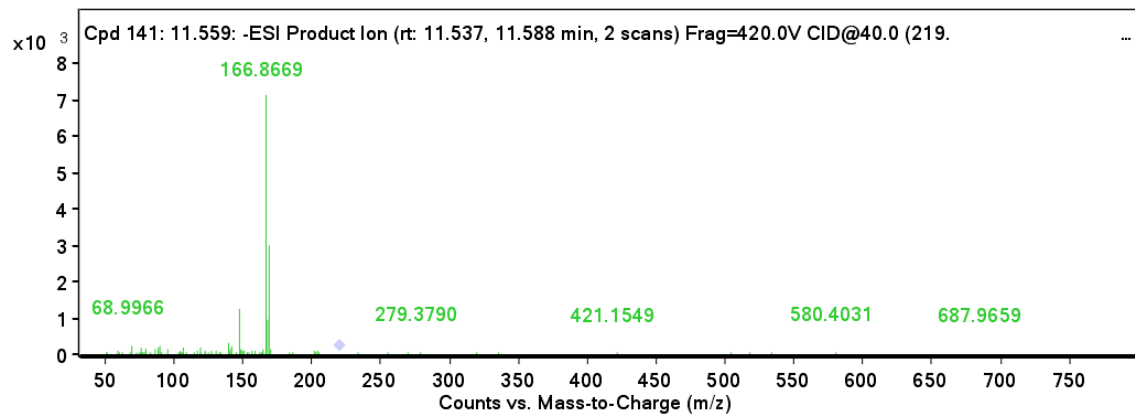
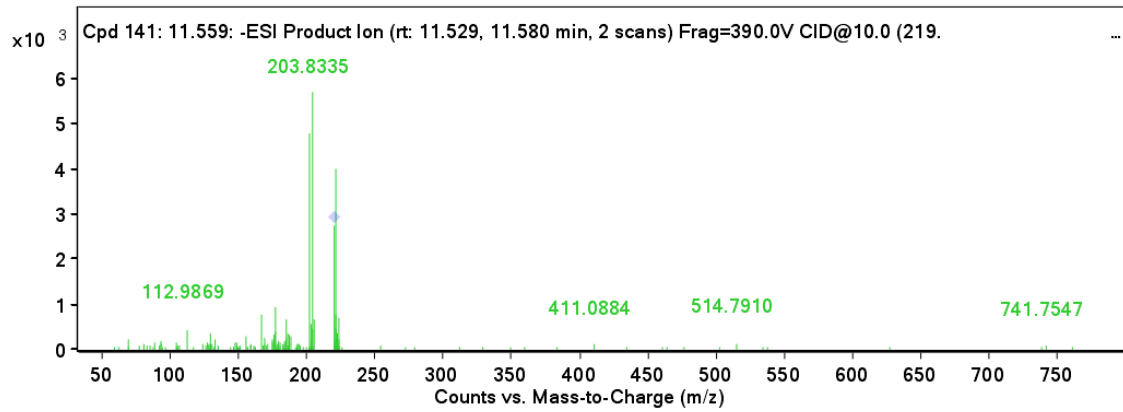
Fig. S5 the distribution of residuals vs. predicted

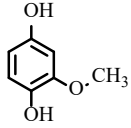
Table S1 Analysis of variance table

Source	Sum of Squares	df	Mean Square	F Value	p-value Prob>F
Model	14188.96	9	1576.55	331.34	<0.0001
A-catalyst load	1930.22	1	1930.22	405.66	<0.0001
B-H ₂ O ₂	904.43	1	904.43	190.08	<0.0001
C-pH	258.84	1	258.84	54.40	<0.0001
AB	166.62	1	166.62	35.02	0.0001
AC	63.68	1	63.68	13.38	0.0044
BC	19.56	1	19.56	4.11	0.0701
A ²	3935.54	1	3935.54	827.11	<0.0001
B ²	4217.43	1	4217.43	886.36	<0.0001
C ²	4838.43	1	4838.43	1016.87	<0.0001
Residual	47.58	10	4.76		
Lack of Fit	42.14	5	8.43	7.75	0.0211
Pure Error	5.44	5	1.09		
Cor Tobal	14236.55	19			

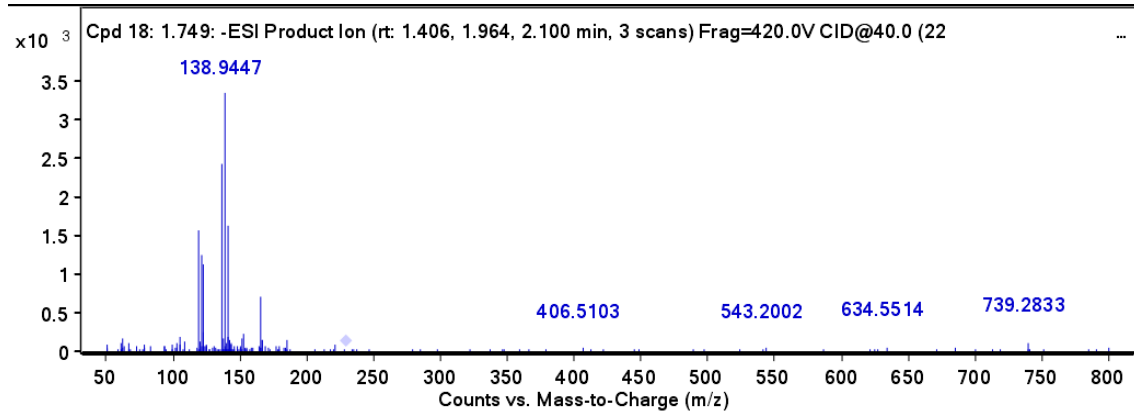
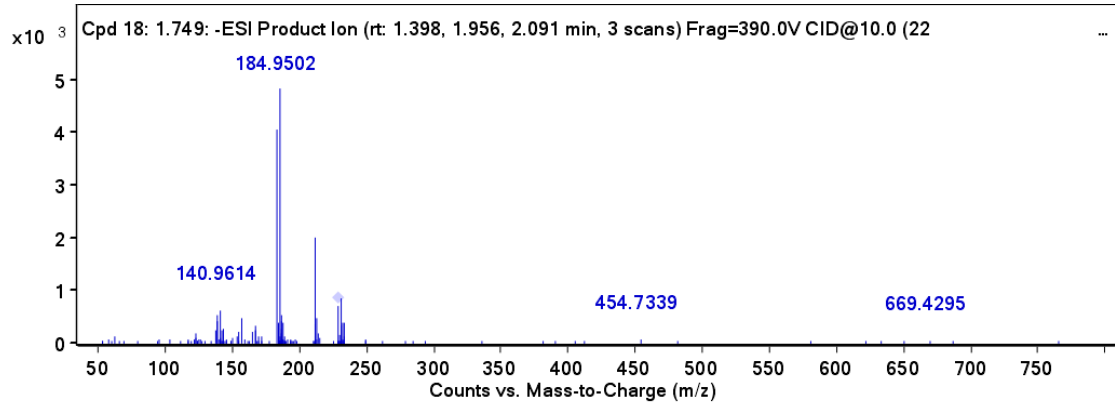


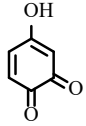
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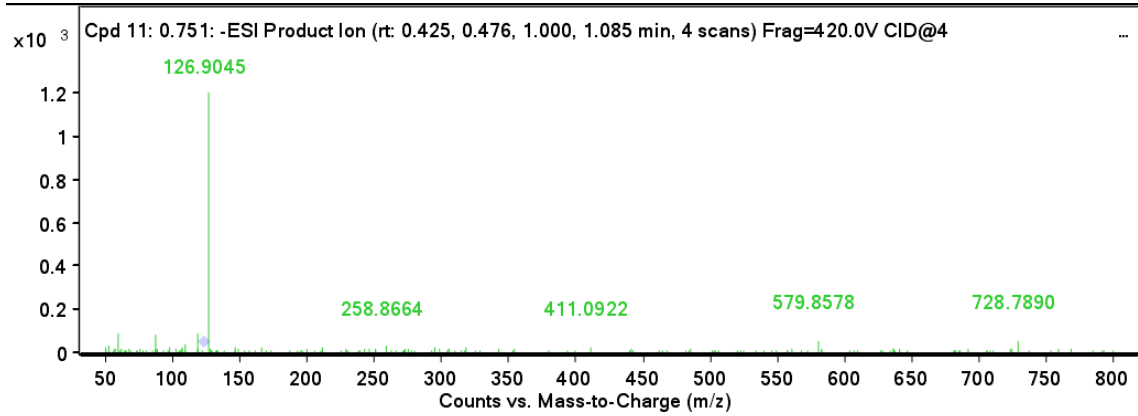
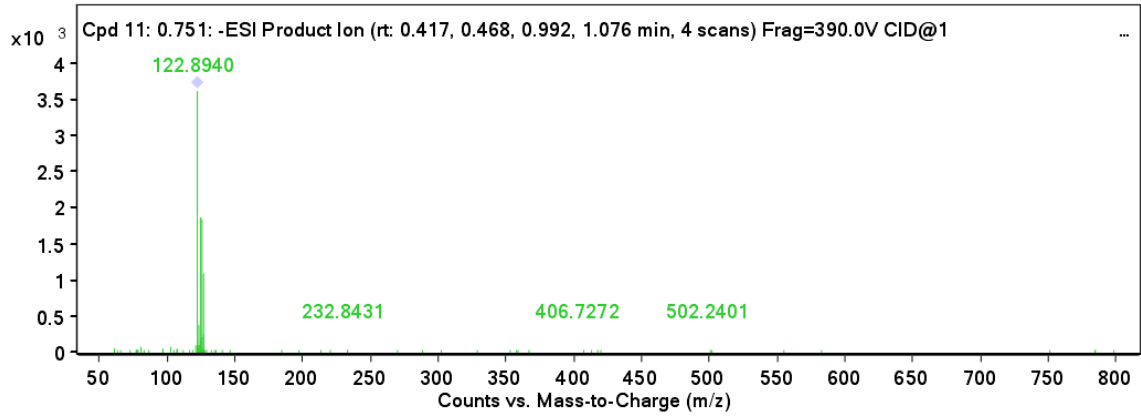


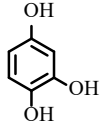
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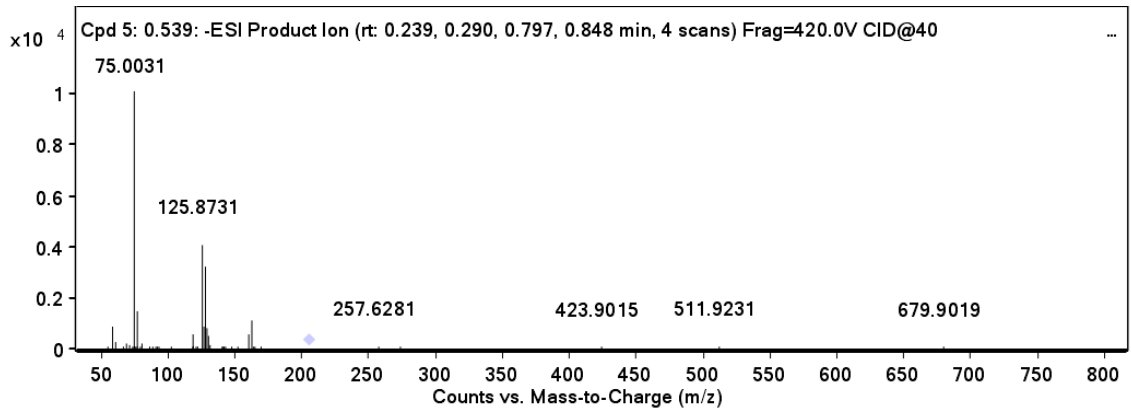
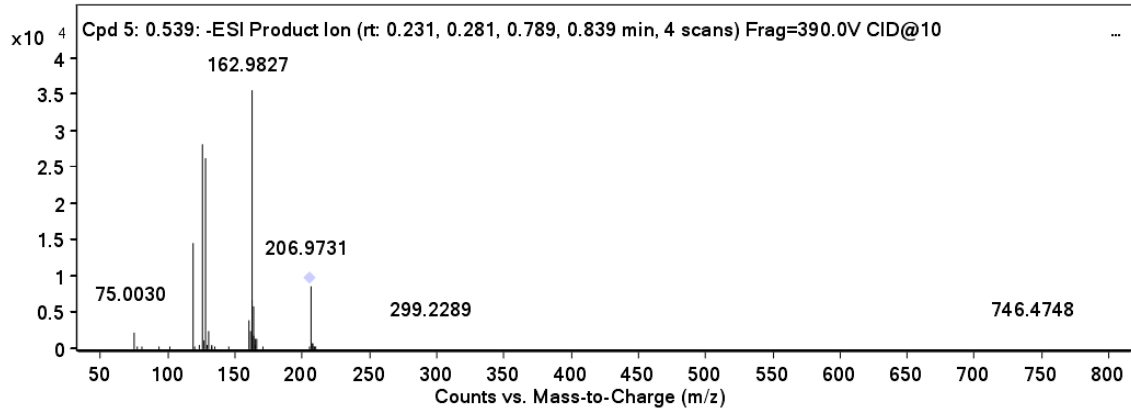


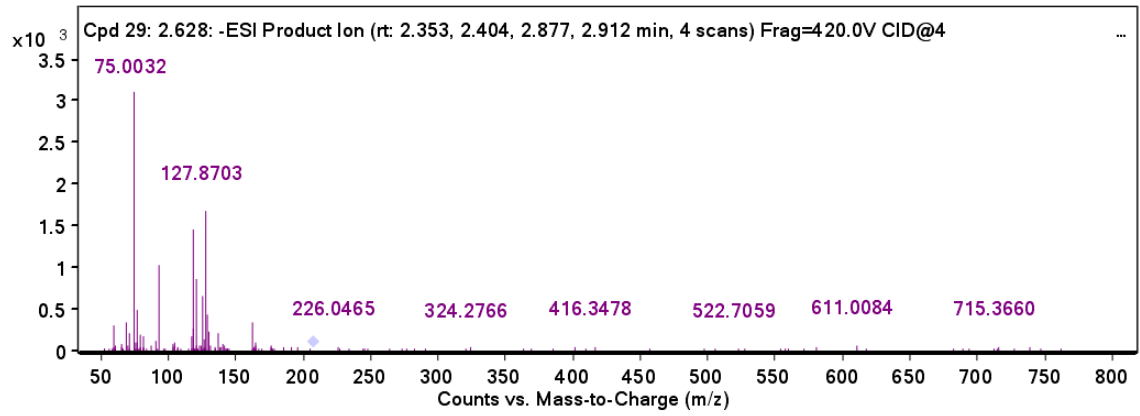
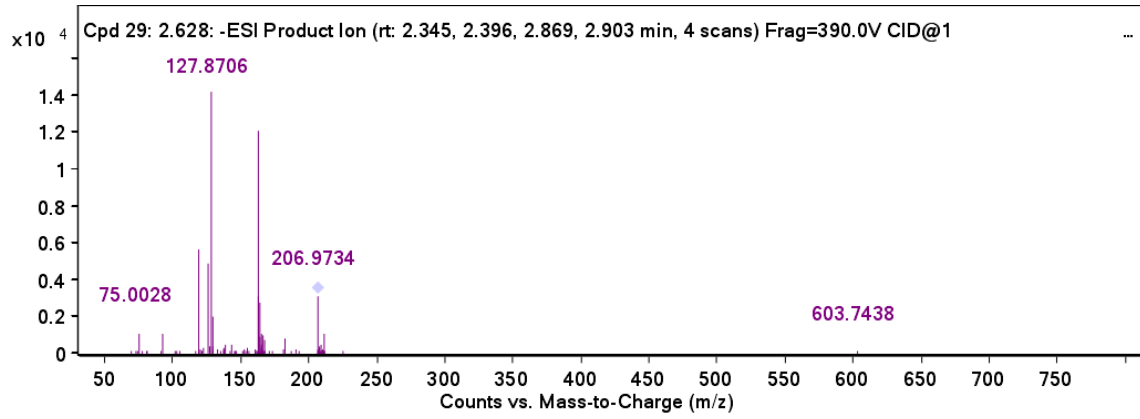
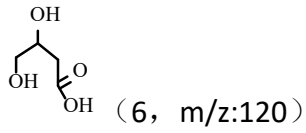
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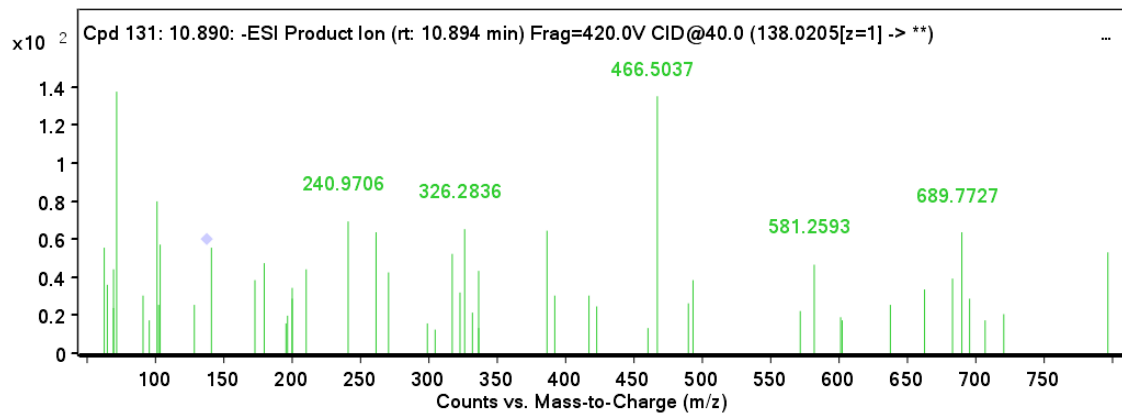
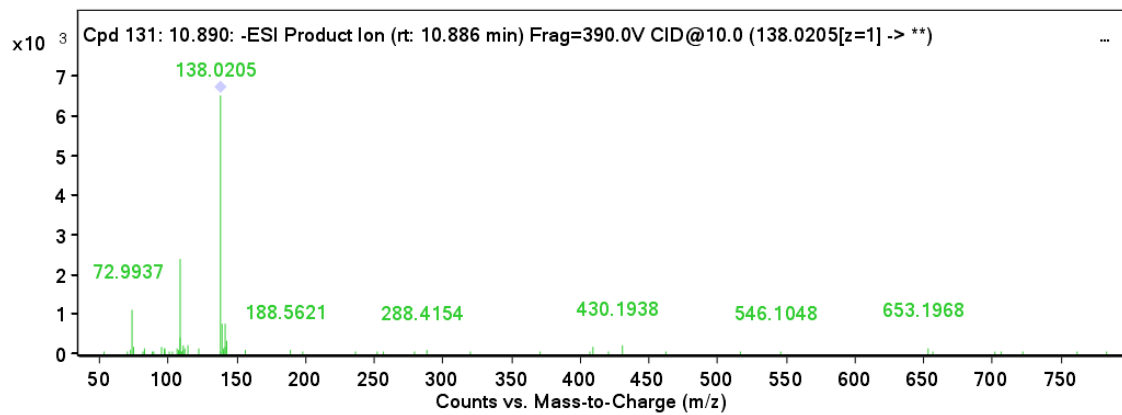
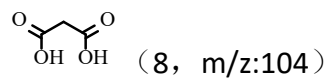


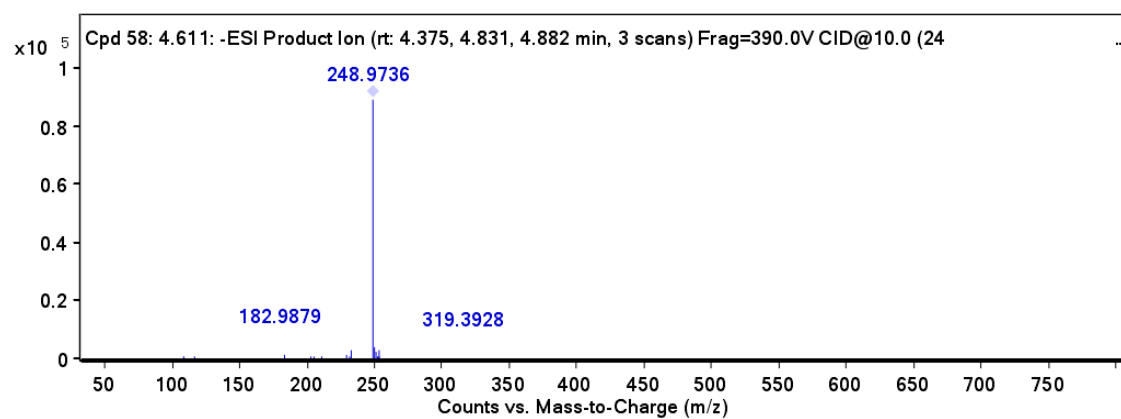
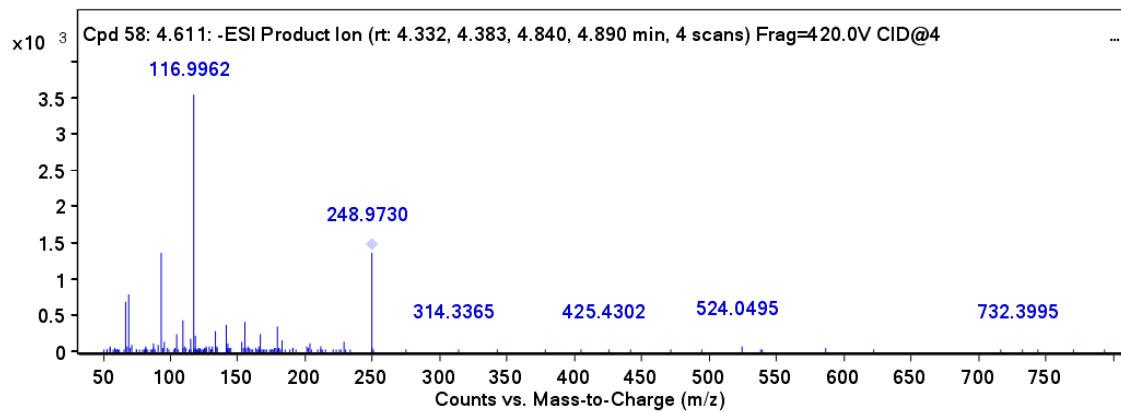
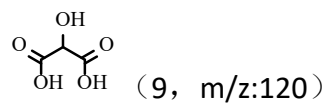


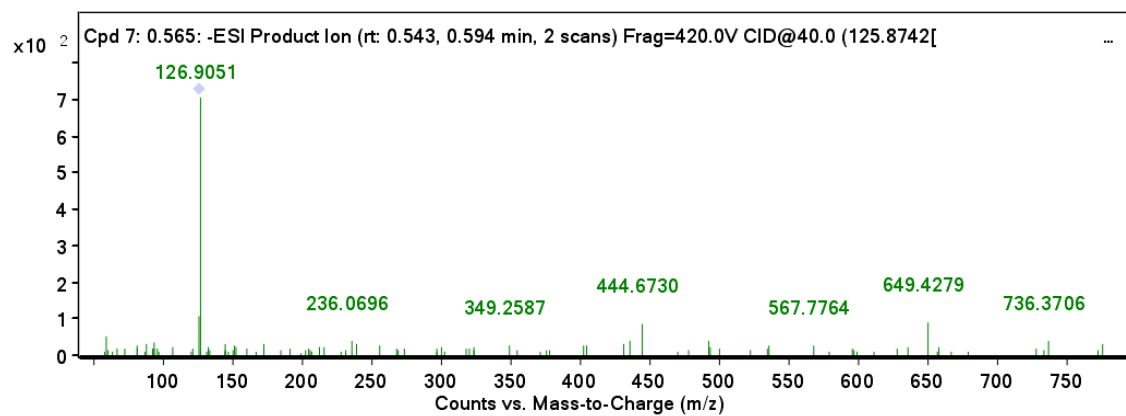
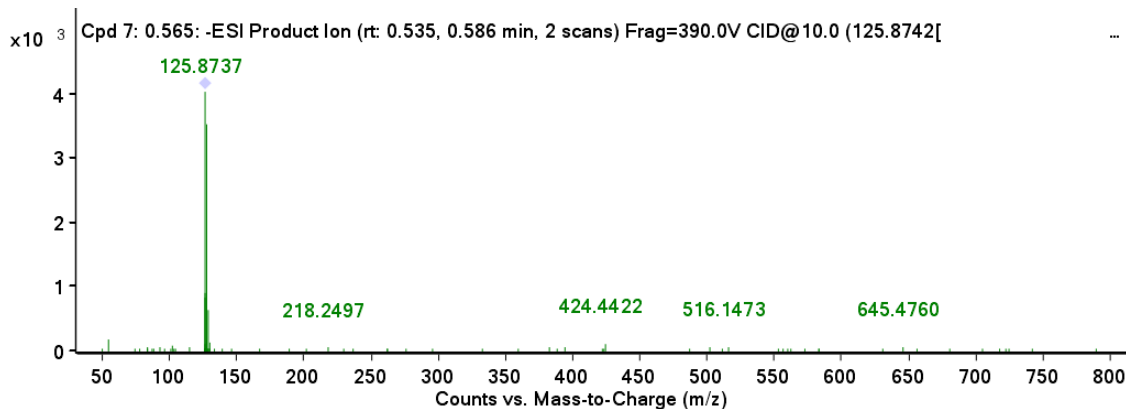
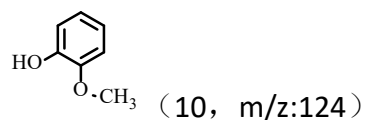
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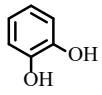




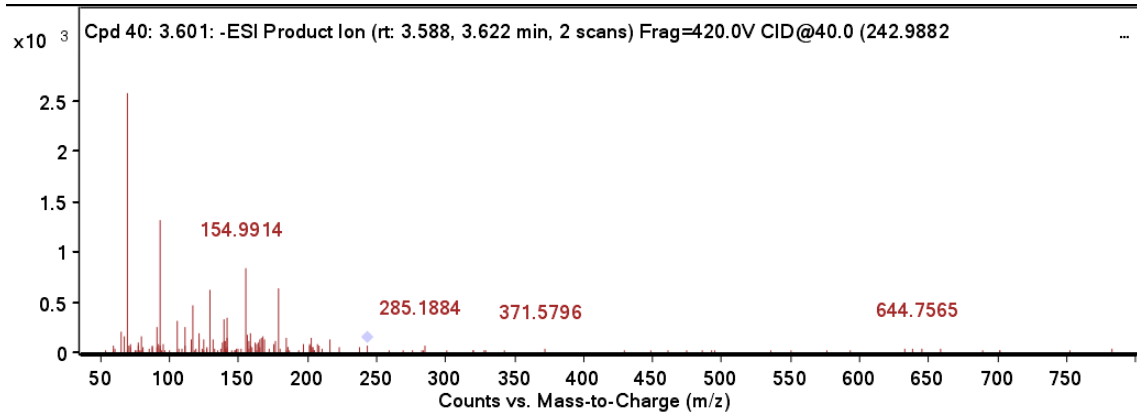
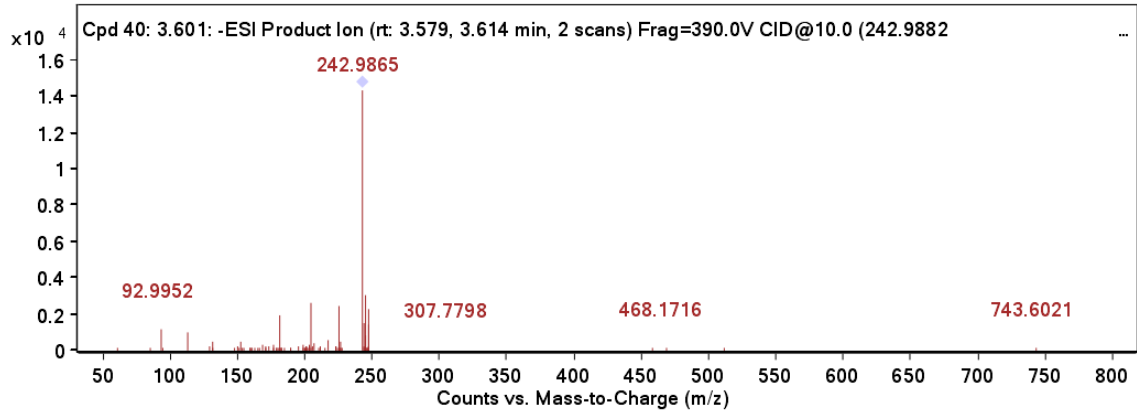








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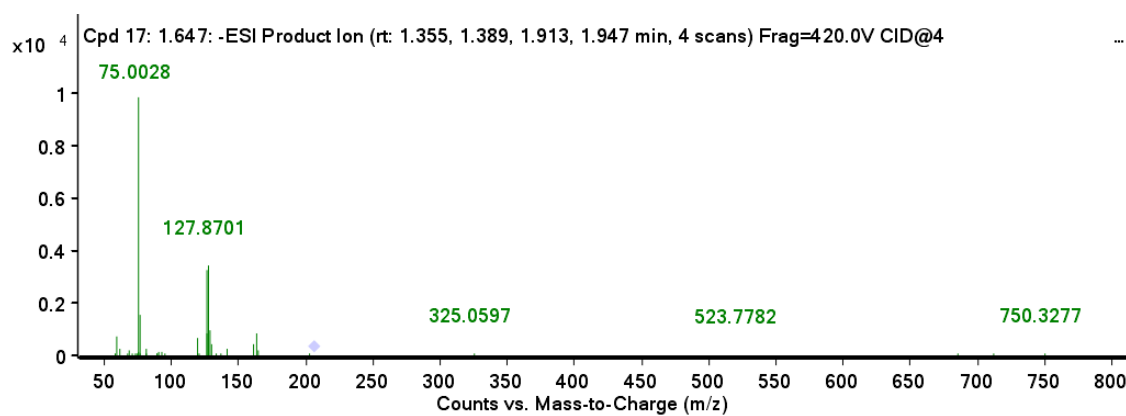
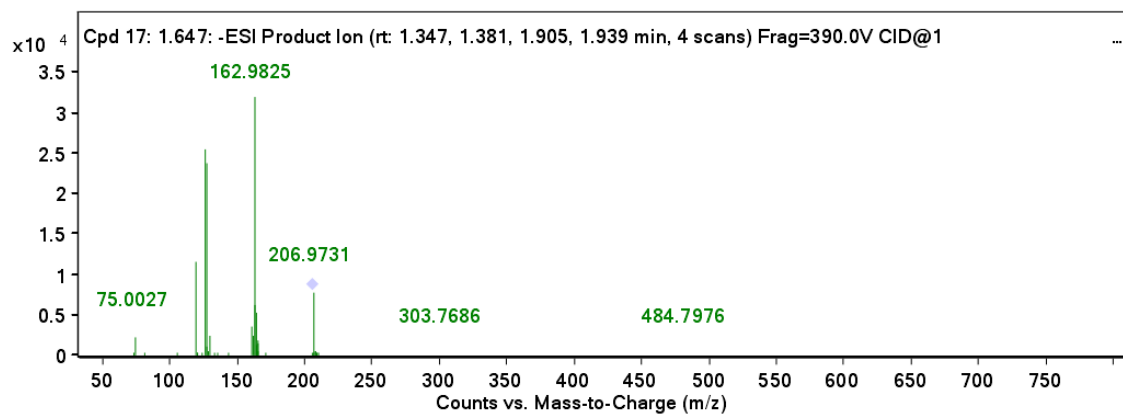
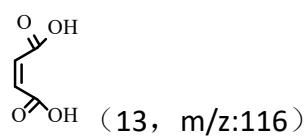
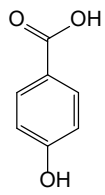
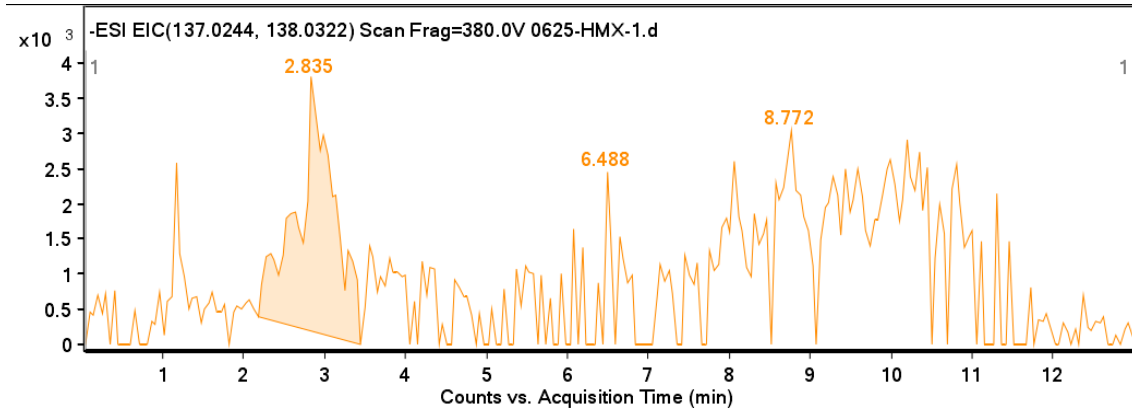
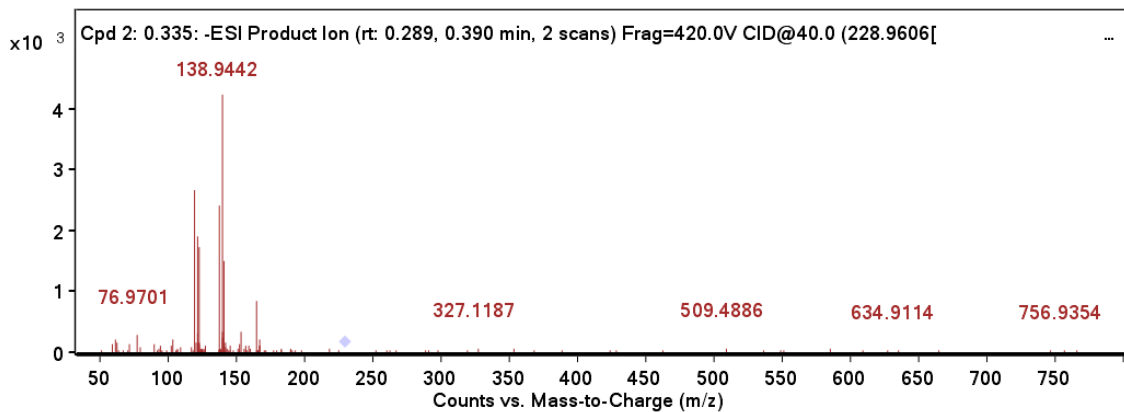
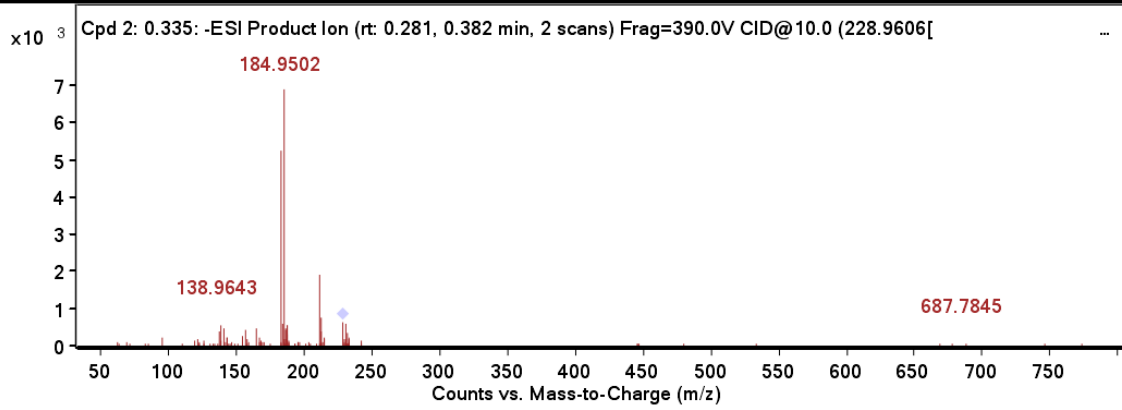
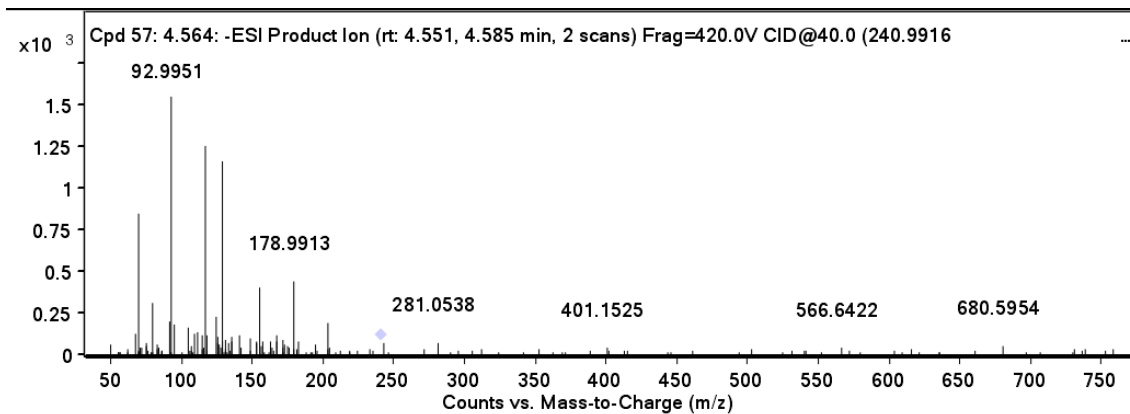
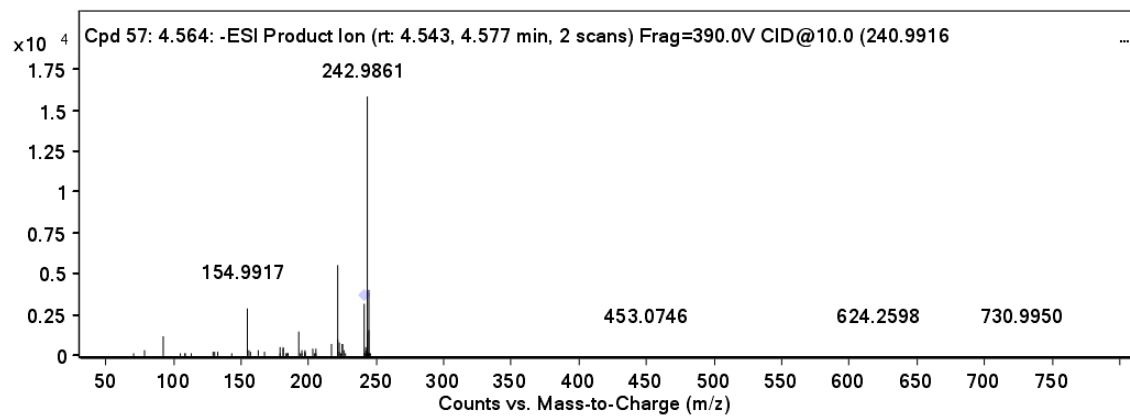
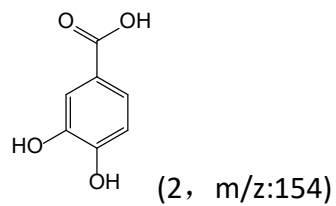


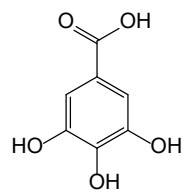
Fig. S6 MS spectra of vanillic acid and its degradation intermediates



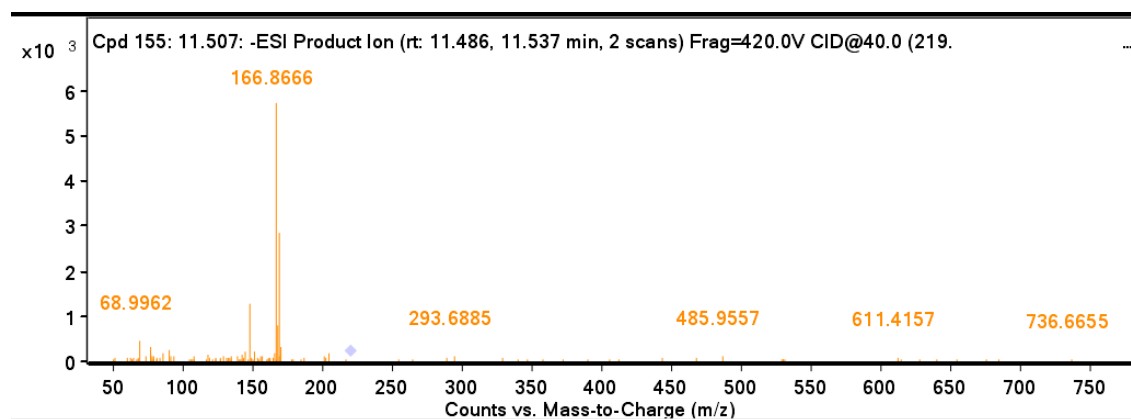
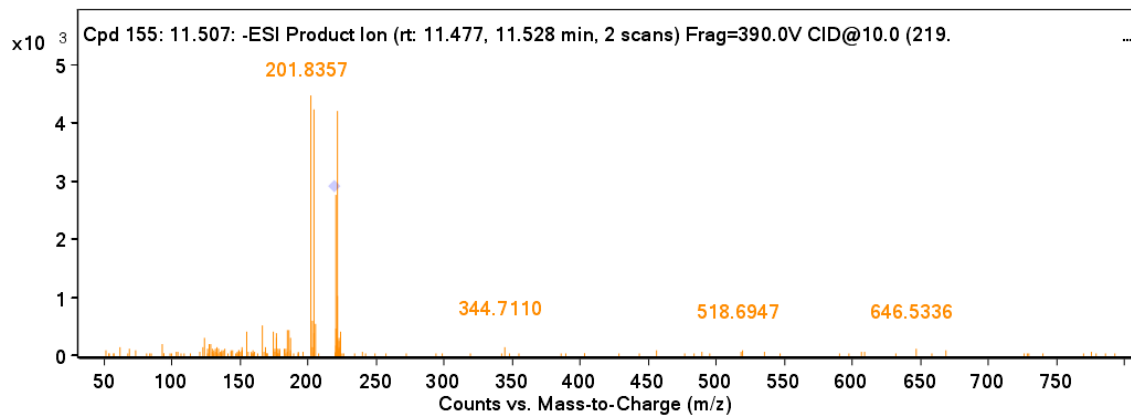
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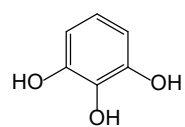




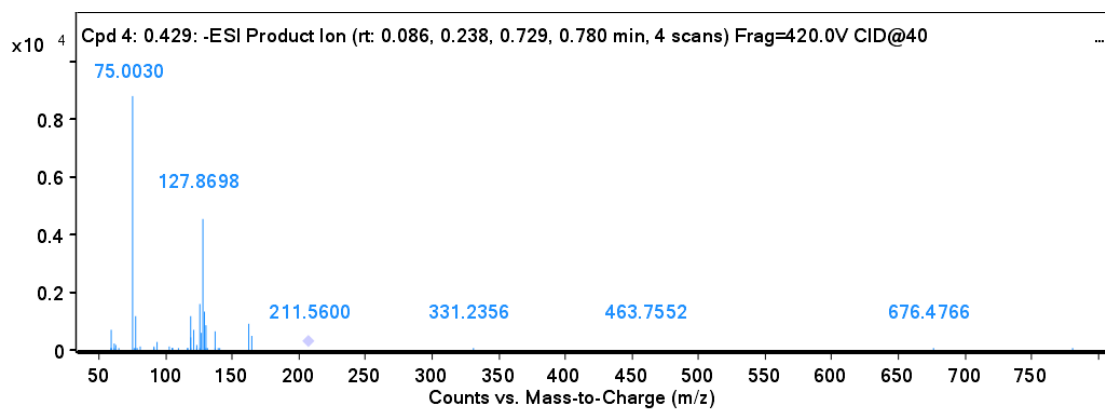
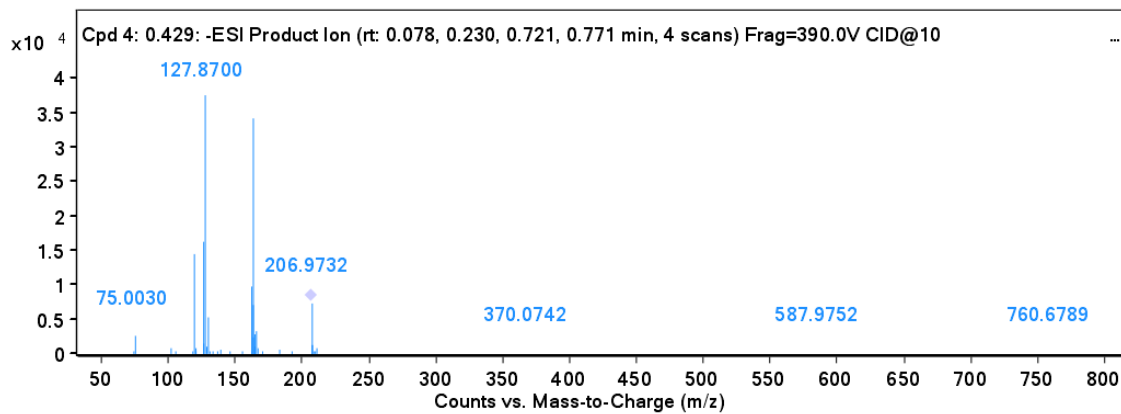


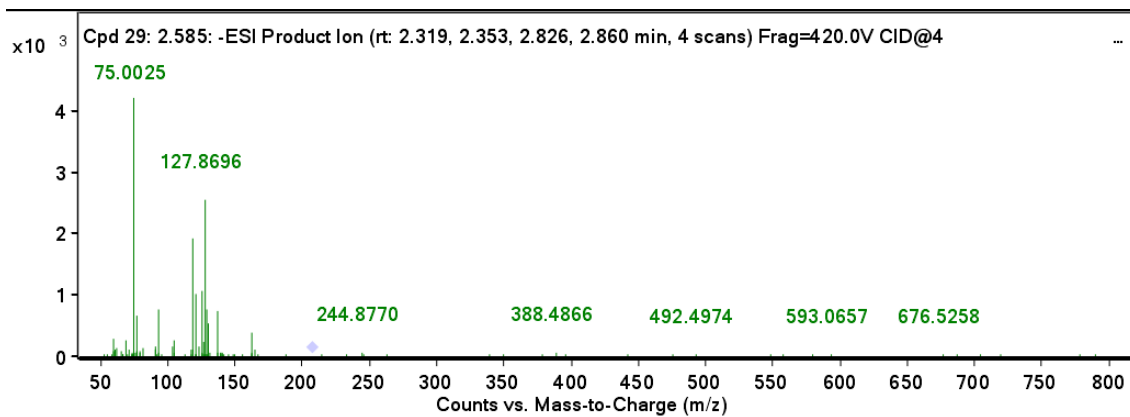
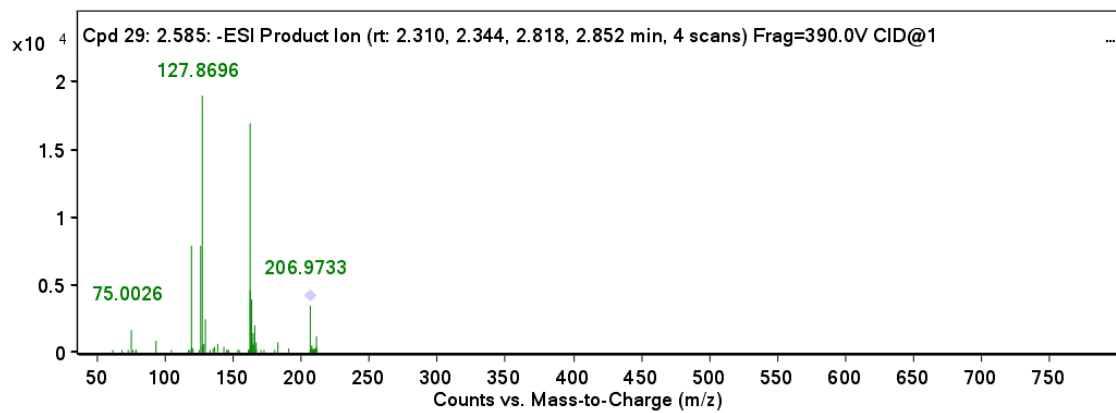
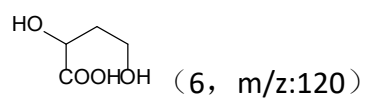
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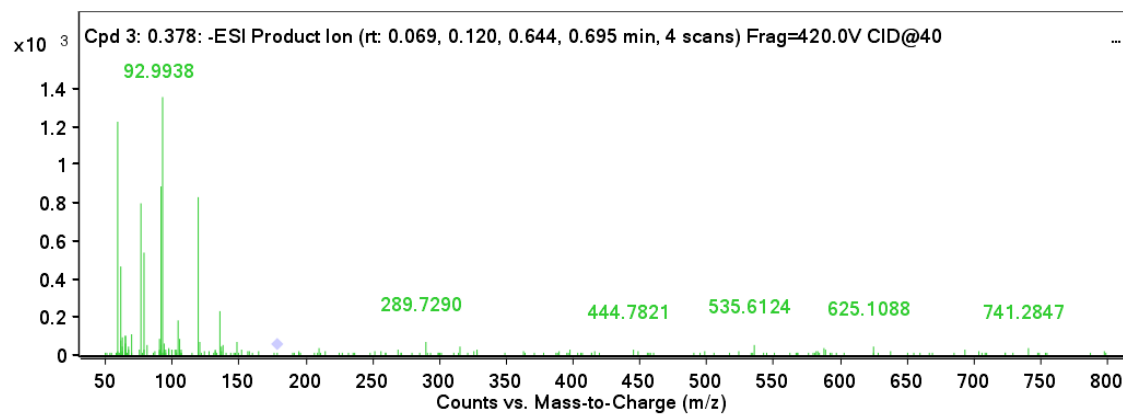
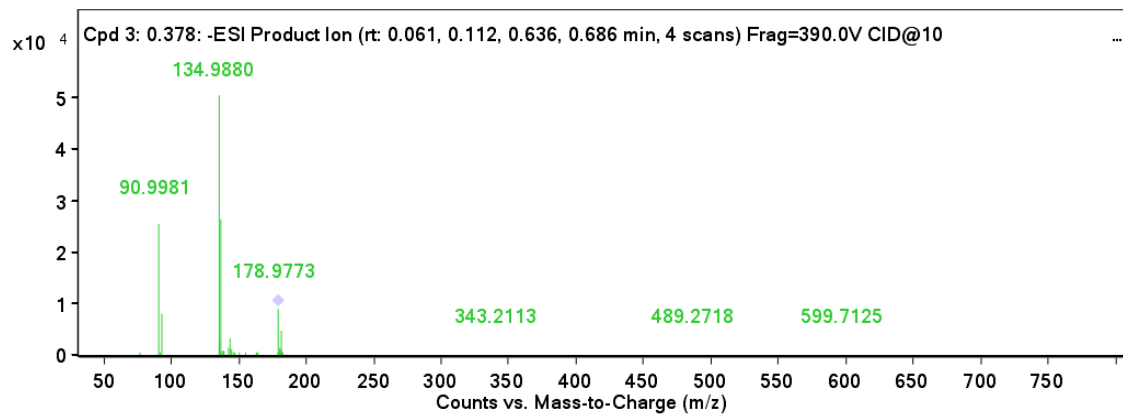
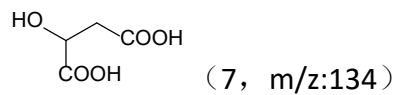


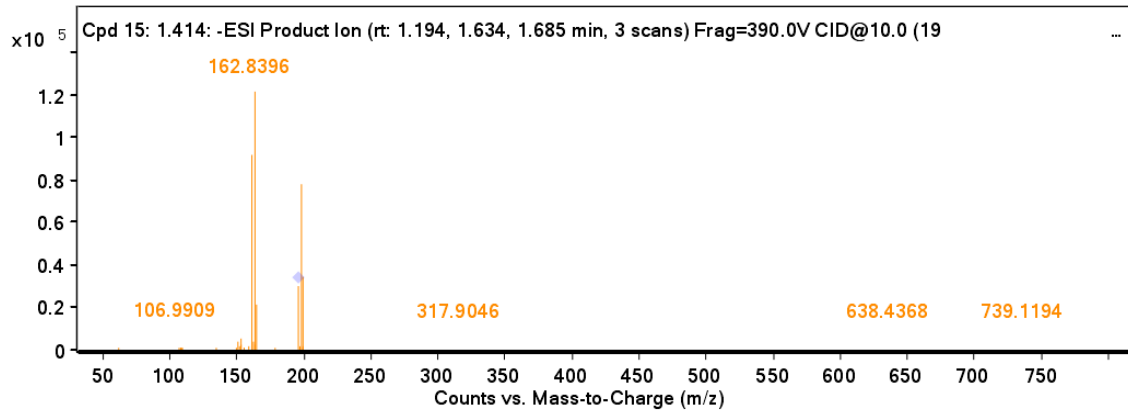
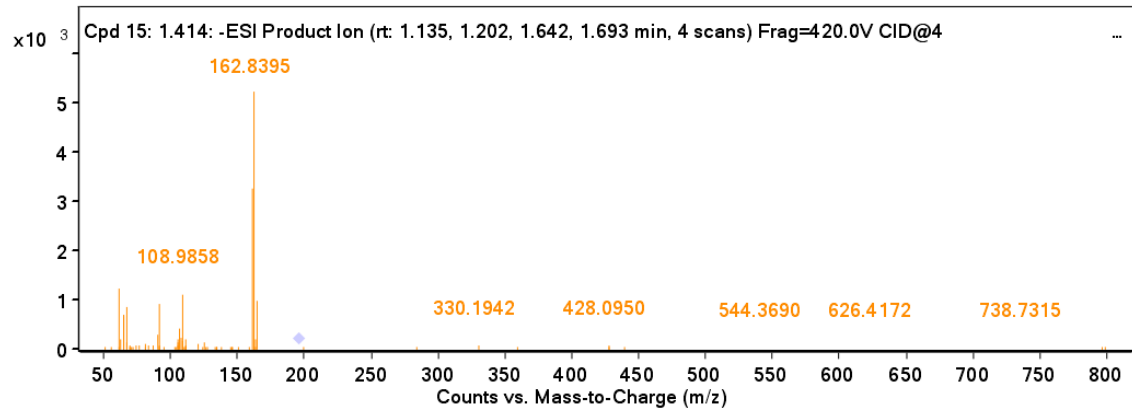
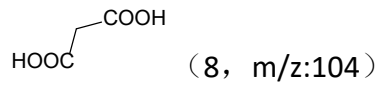


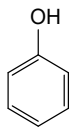
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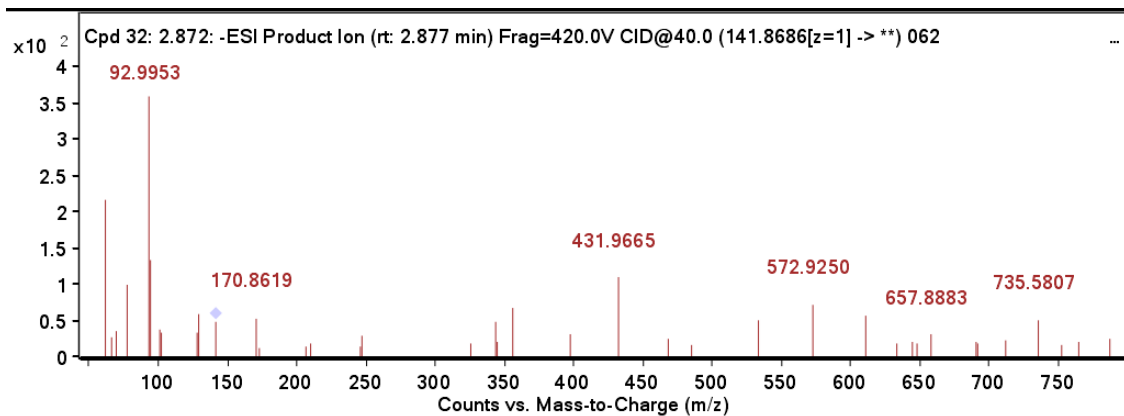
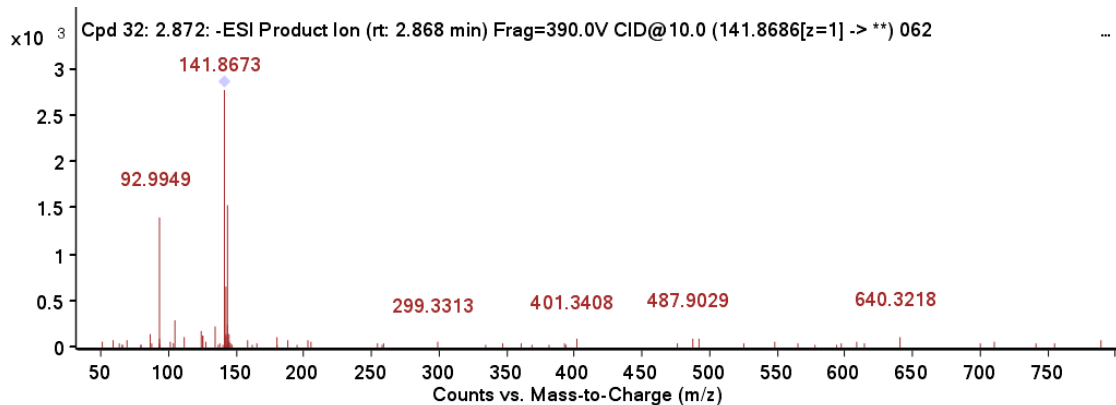


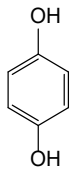




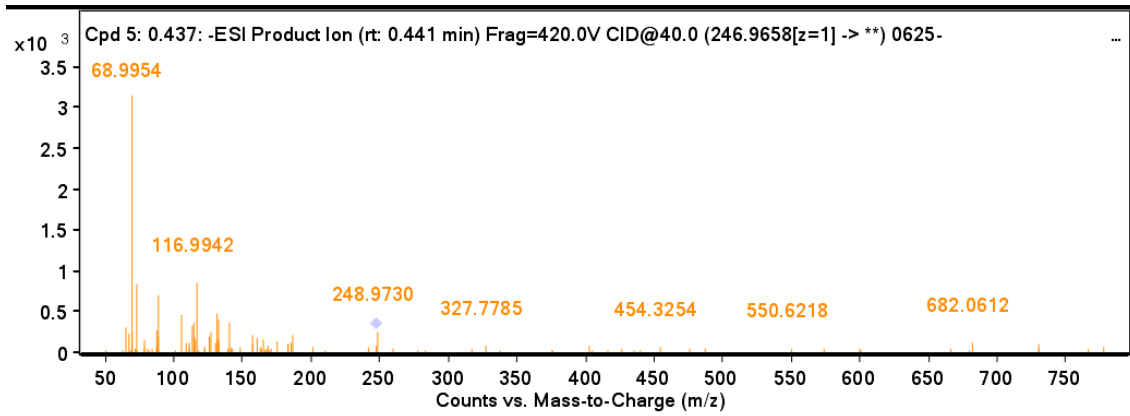
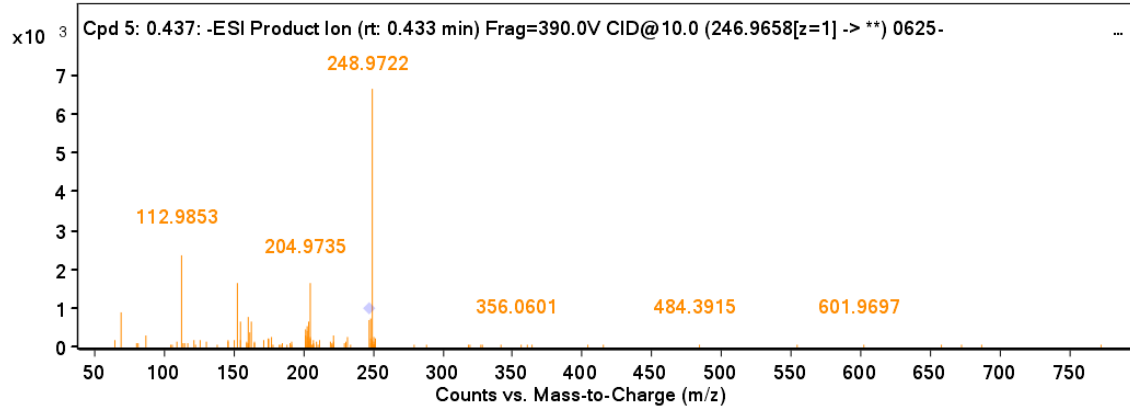


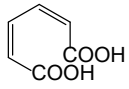
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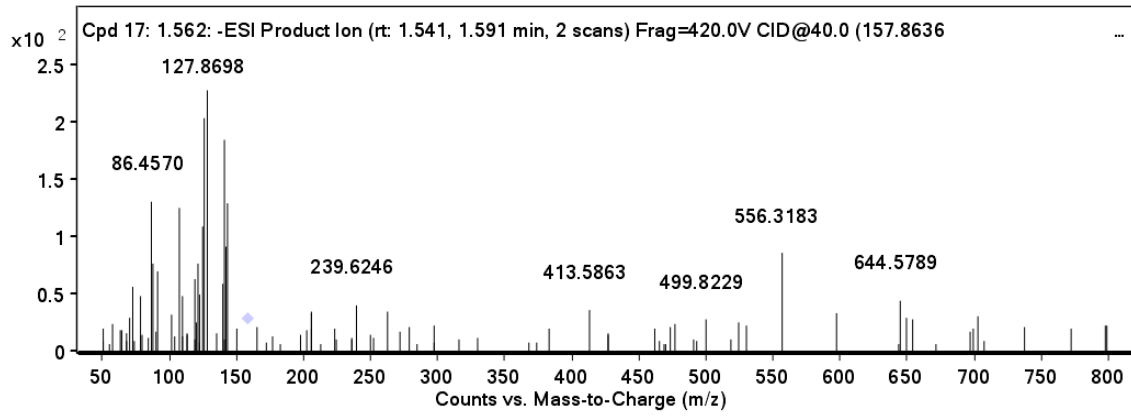
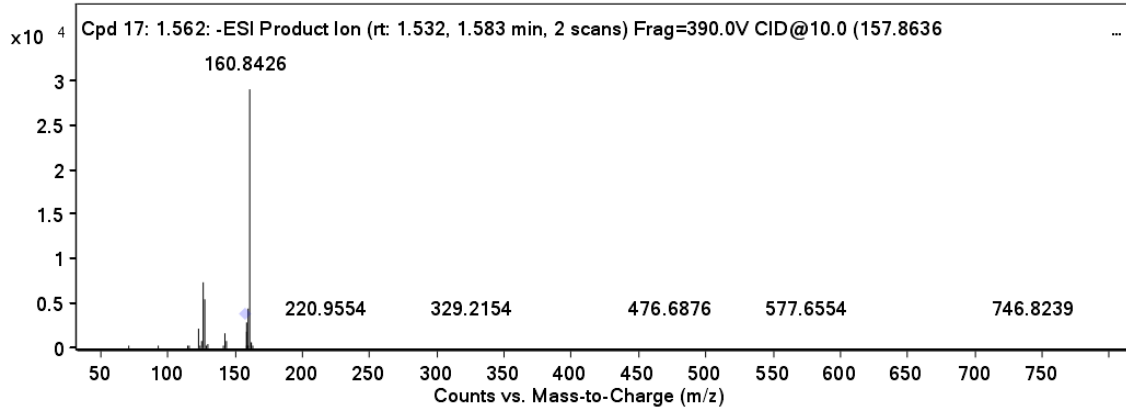


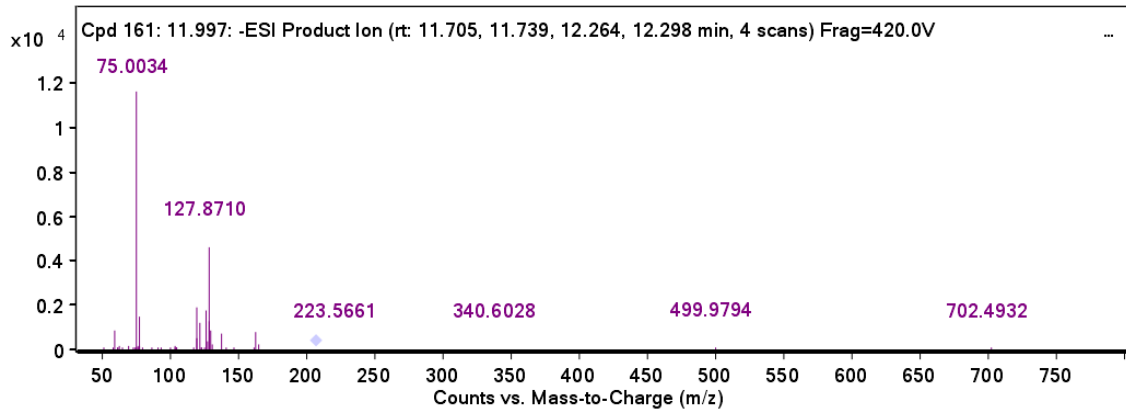
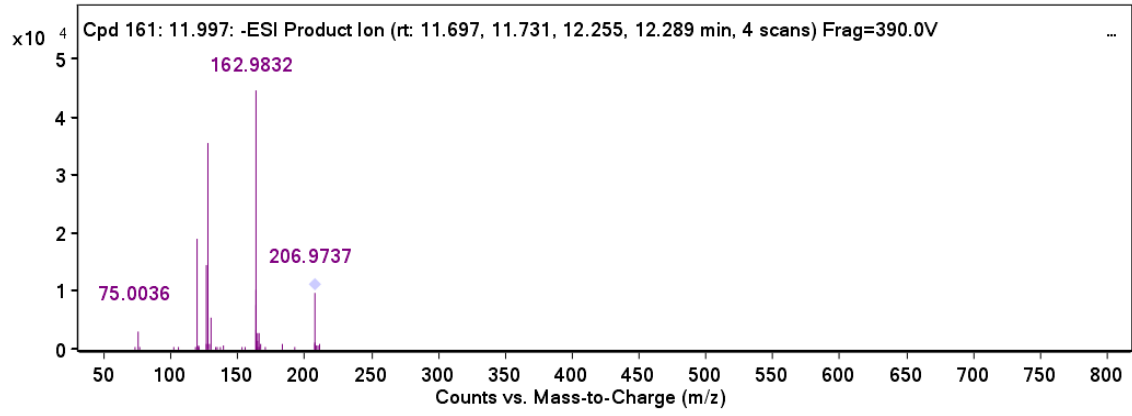
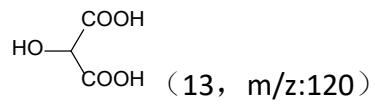
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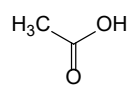




(11, m/z:142)







(14, m/z:60)

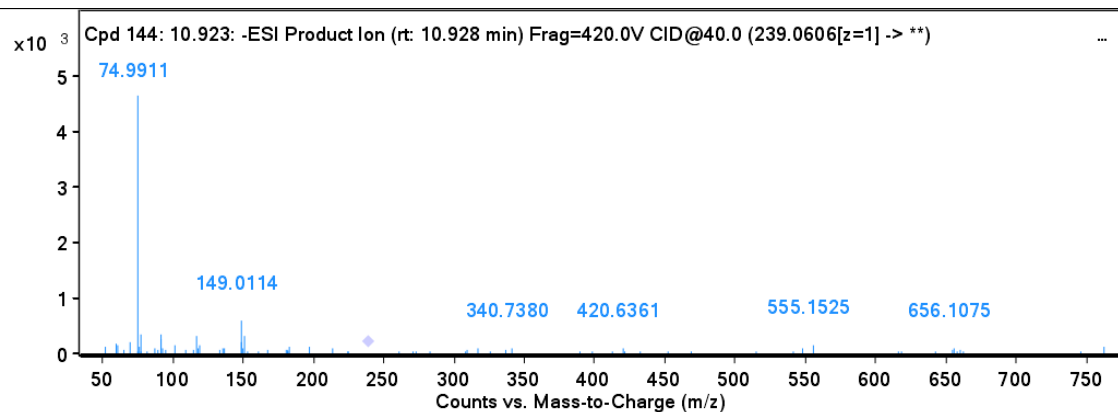
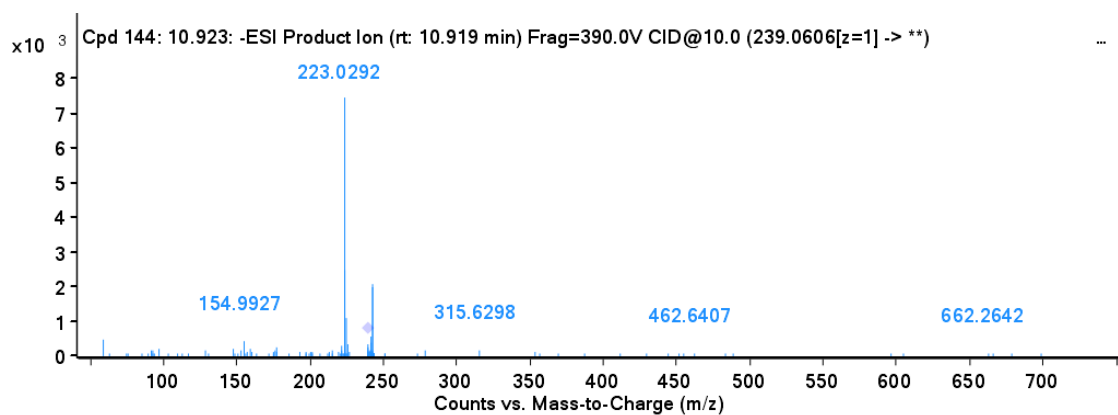


Fig. S7 MS spectra of PHBA and its degradation intermediates

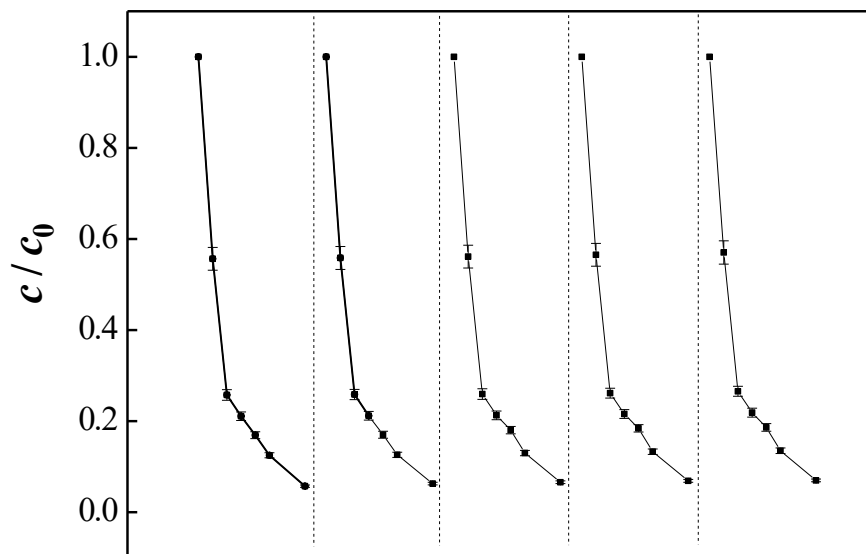


Fig. S8 Degradation of vanillic acid with the recycled GO-Fe₃S₄ composite

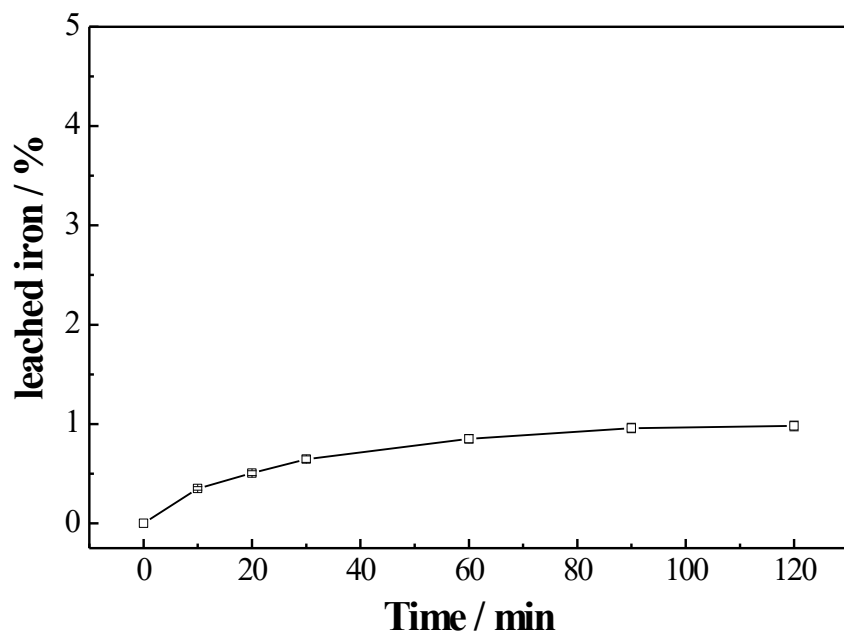


Fig. S9 Percentage of total dissolved iron during the degradation in the GO-Fe₃S₄-H₂O₂ systems.

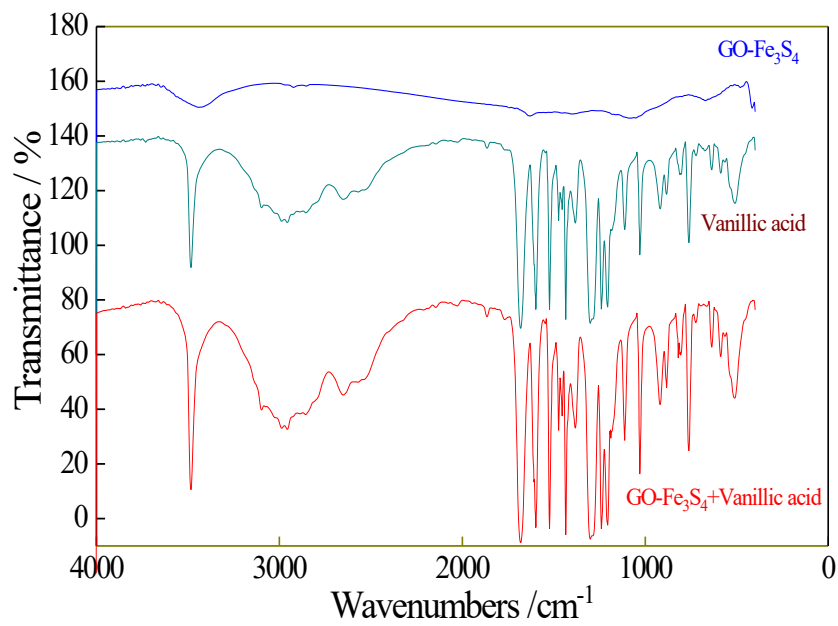


Fig. S10 FT-IR spectra of GO-Fe₃S₄, vanillic acid and GO-Fe₃S₄ after the adsorption of vanillic acid.