Supplementary Materials for

Trimetaphosphate activates prebiotic peptide synthesis across a wide range of temperature and pH

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This file includes:

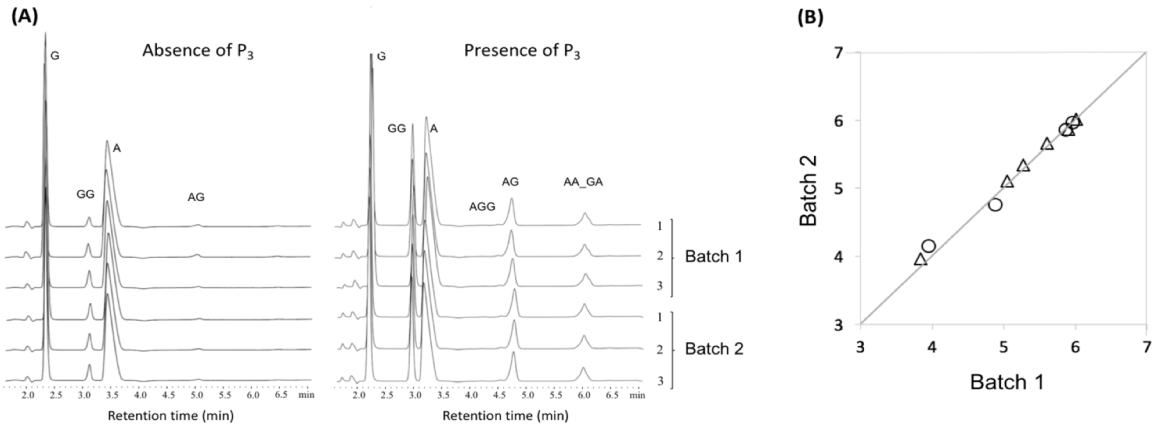

Figure S1. Reproducibility of experiments. Reactions were performed with three replicates per batch, with batches run on two different days. (**A**) HPLC product profiles are shown for reactions run in the absence and presence of trimetaphosphate (TP). The (**B**) concentrations for each peptide species were determined and plotted for batch 2 versus batch 1 in the absence (circles) and presence (triangles) of TP. Reactions of glycine and alanine were carried out at pH and 60°C, and concentrations are $\log_{10}(\mu M)$; for example, a value of 4 corresponds to 10^4 μM or 10 mM.

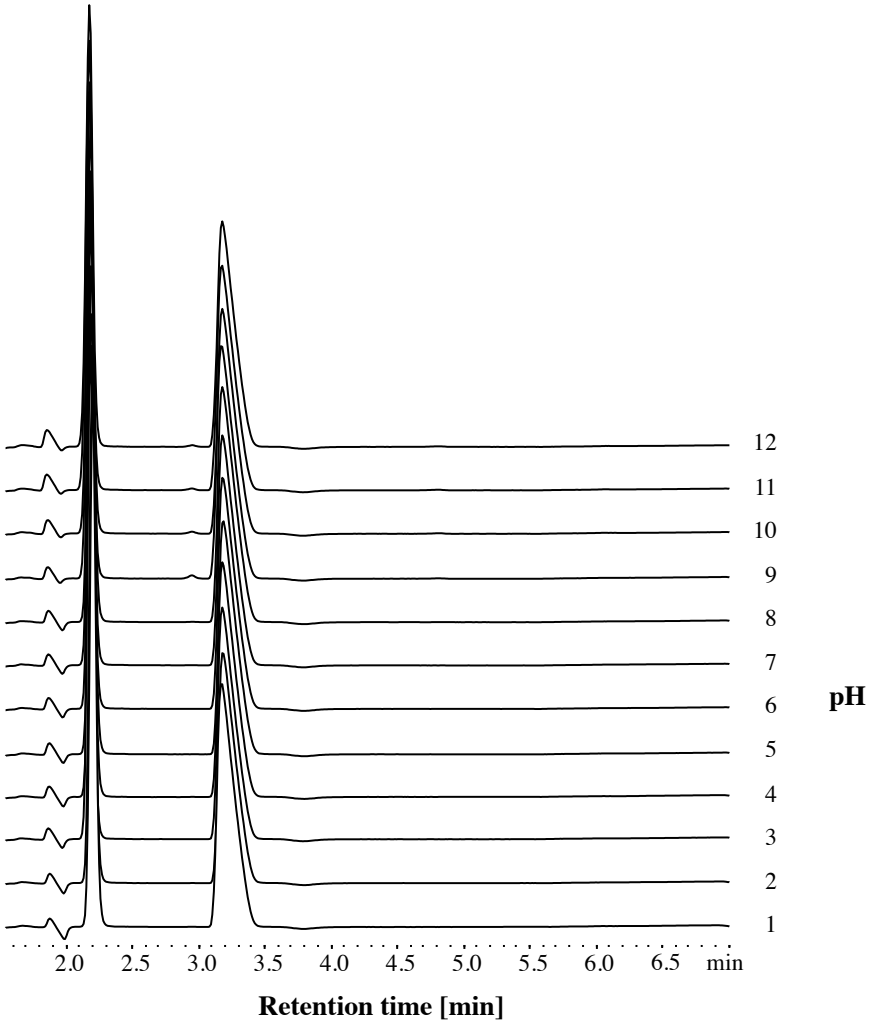

Fig. S2. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at 40^{o}C as a function of pH.

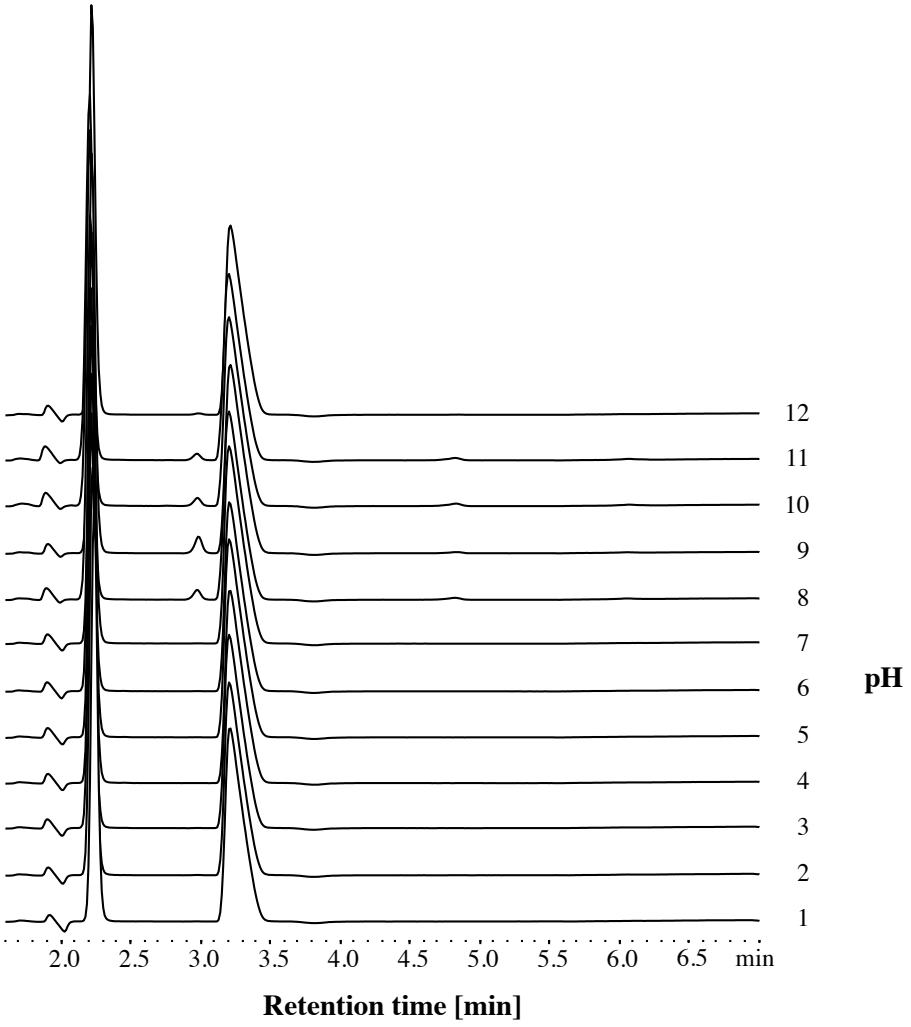

Fig. S3. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at 50^{o}C as a function of pH.

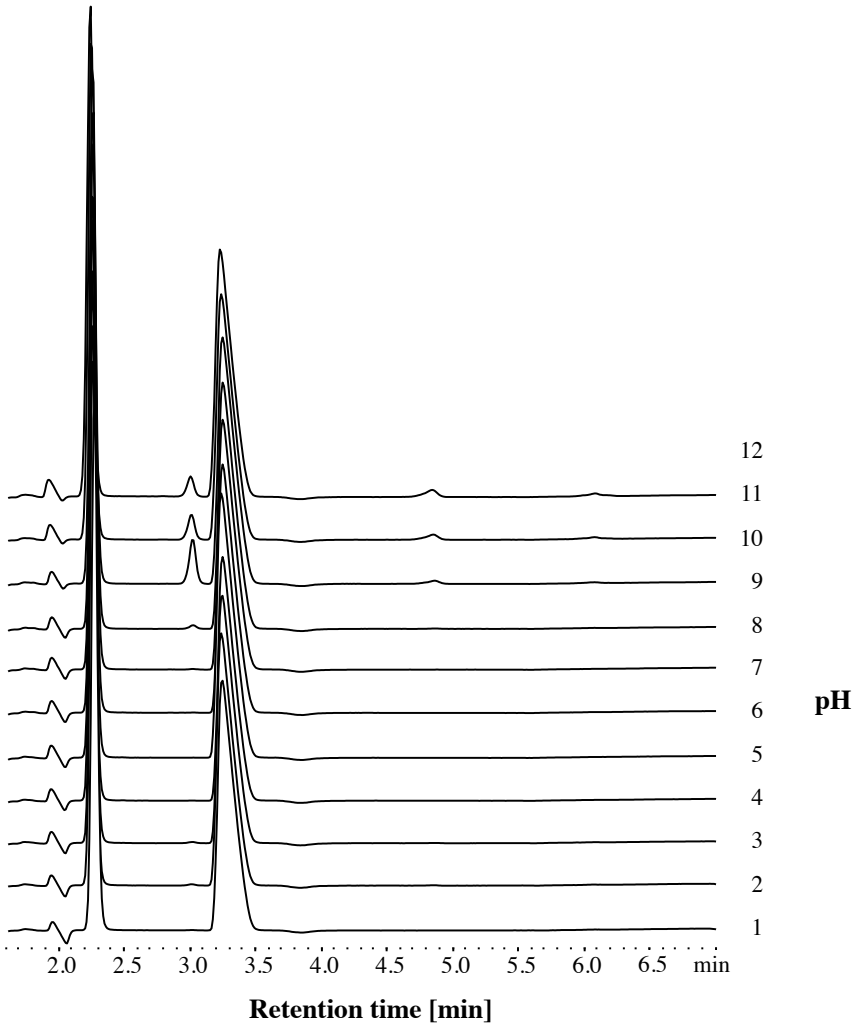

Fig. S4. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at 60^{o}C as a function of pH.

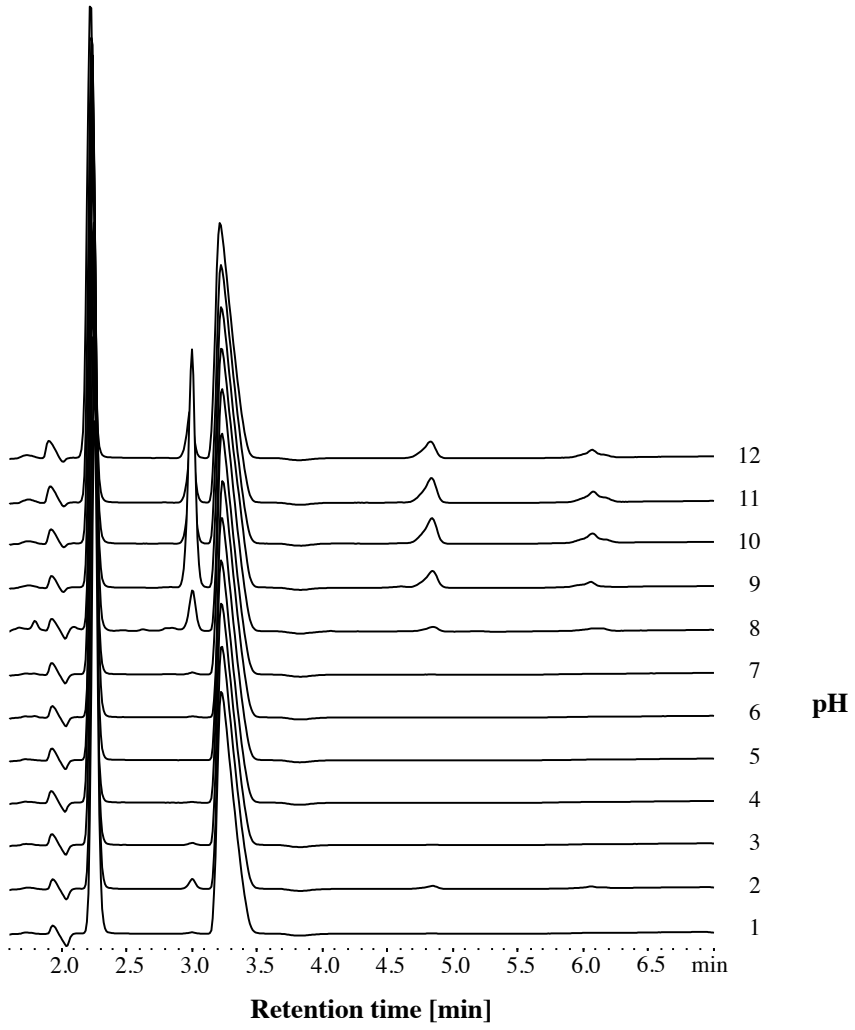

Fig. S5. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at 70^{o}C as a function of pH.

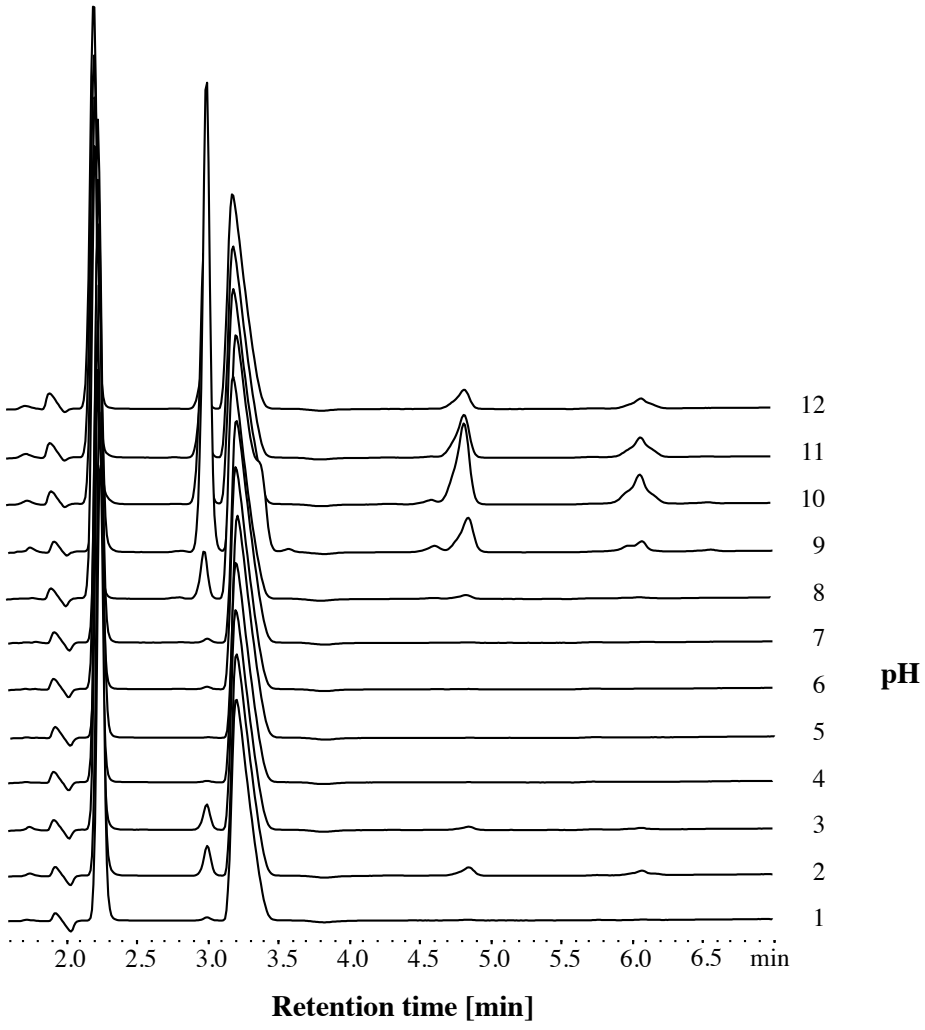

Fig. S6. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at 80^{o}C as a function of pH.

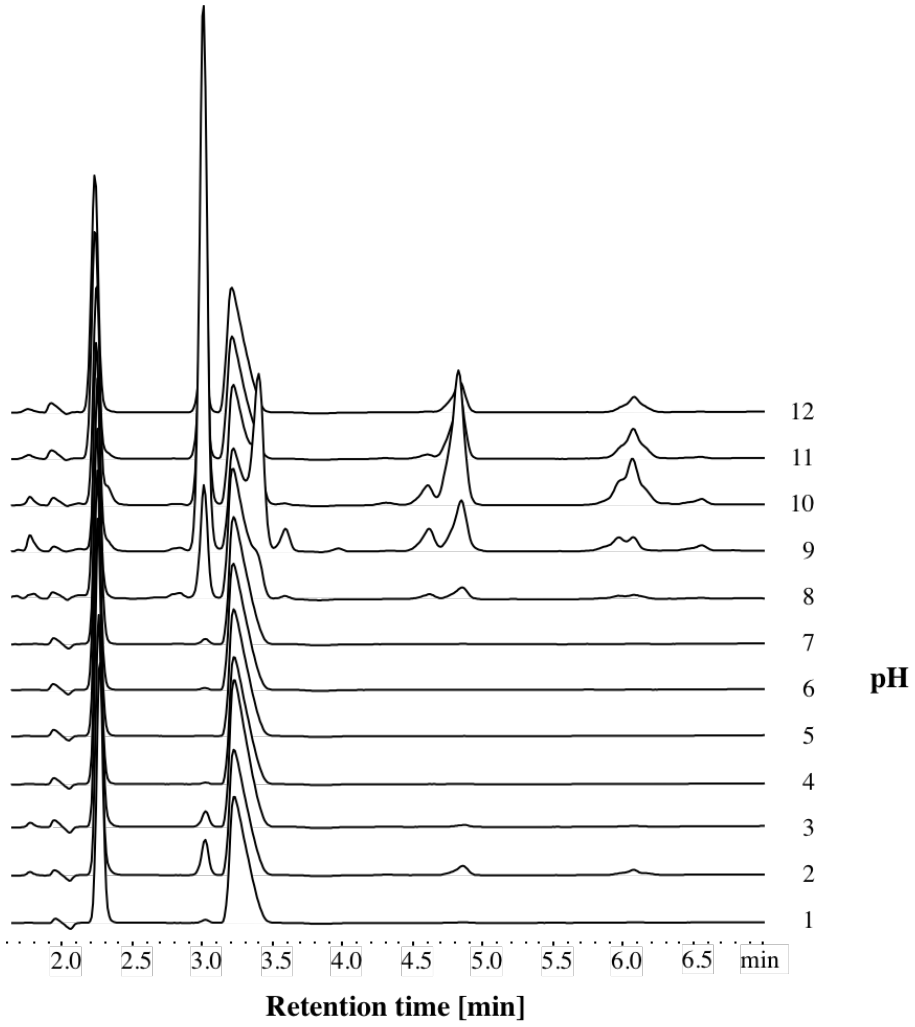

Fig. S7. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at 90^{o}C as a function of pH.

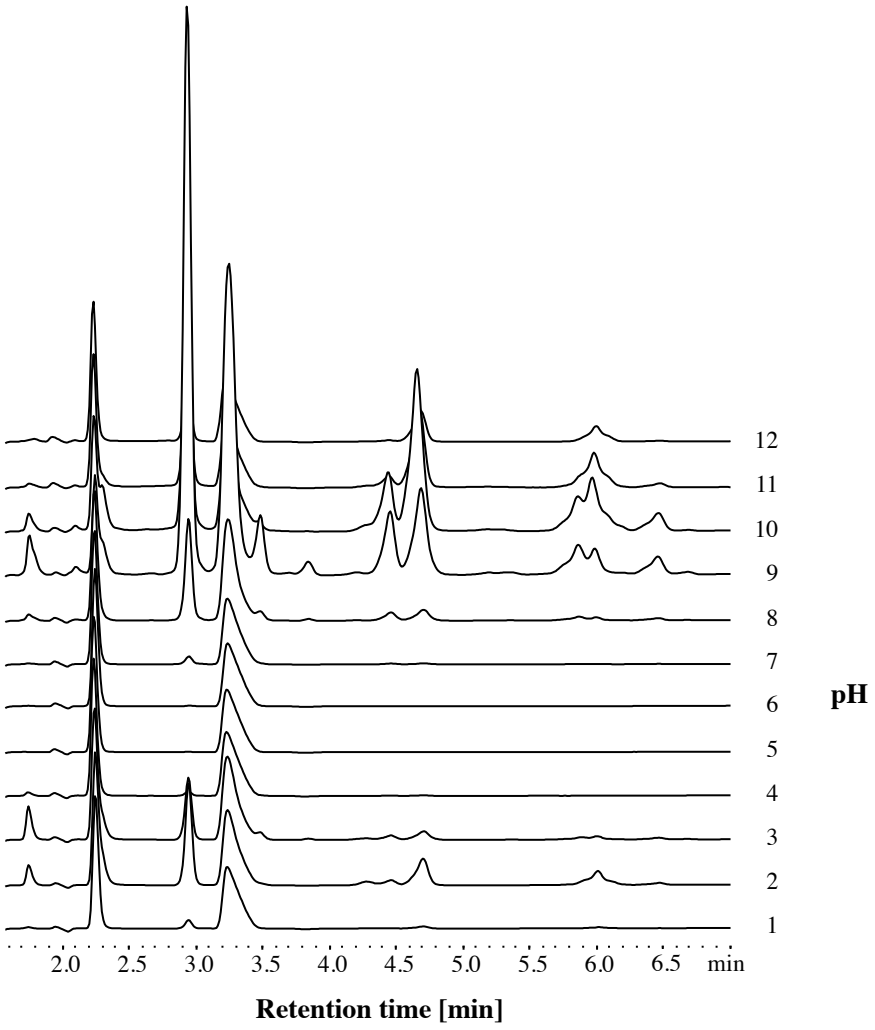

Fig. S8. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at 100^{o}C as a function of pH.

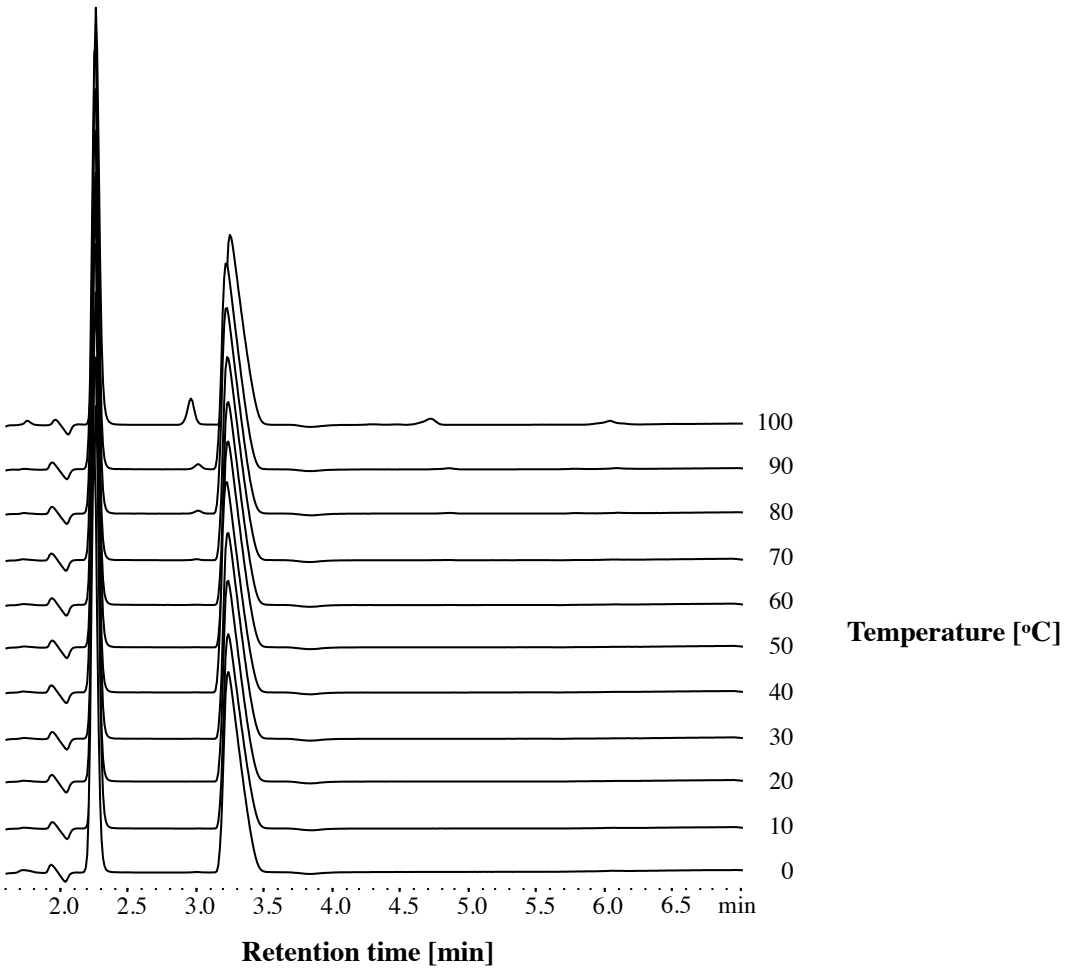

Fig. S9. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 1 as a function of temperature.

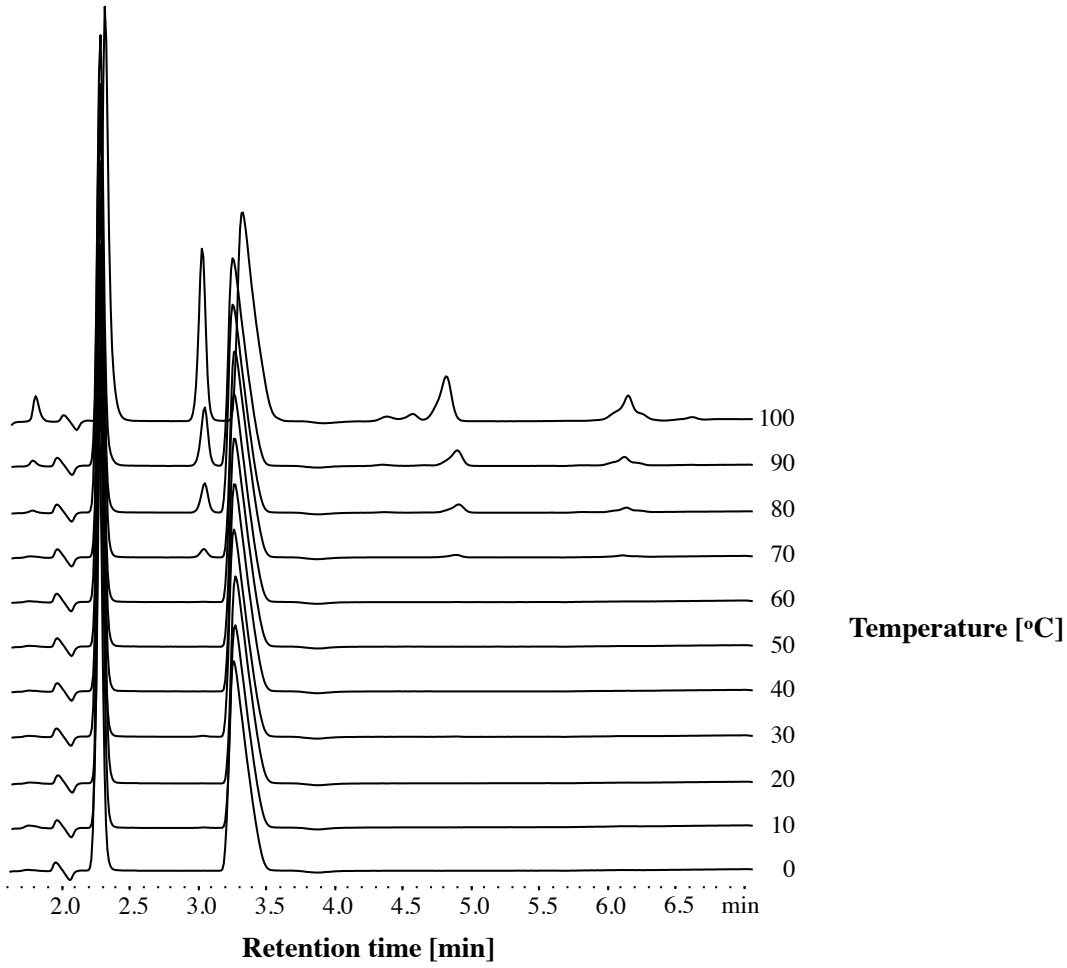

Fig. S10. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 2 as a function of temperature.

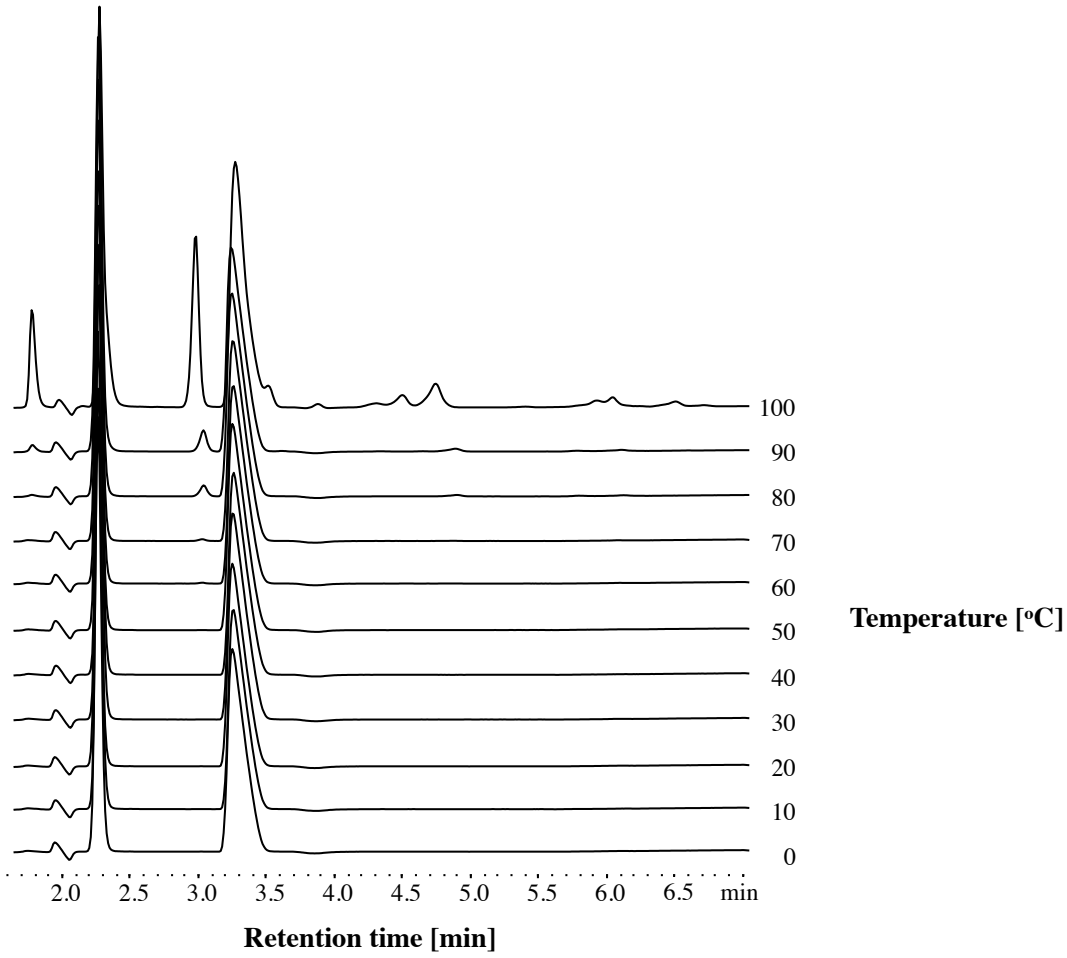

Fig. S11. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 3 as a function of temperature.

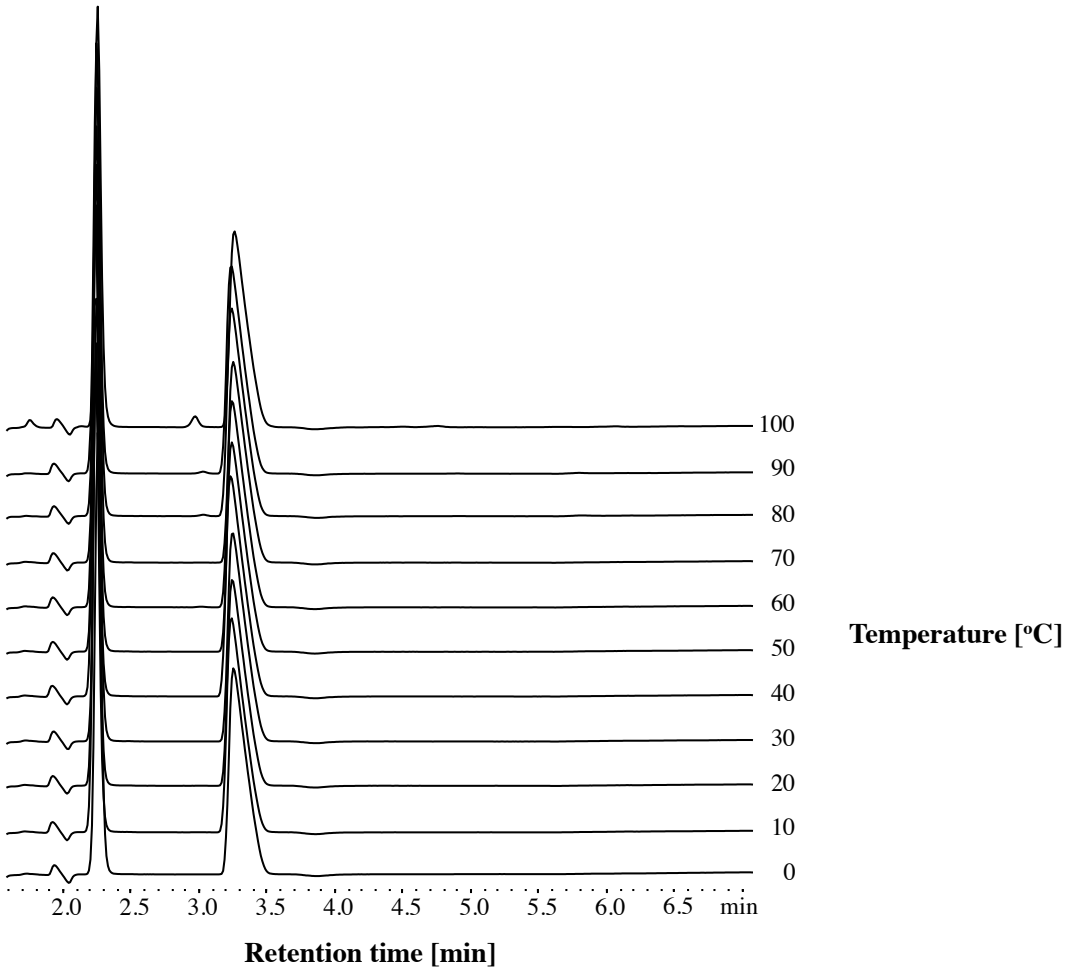

Fig. S12. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 4 as a function of temperature.

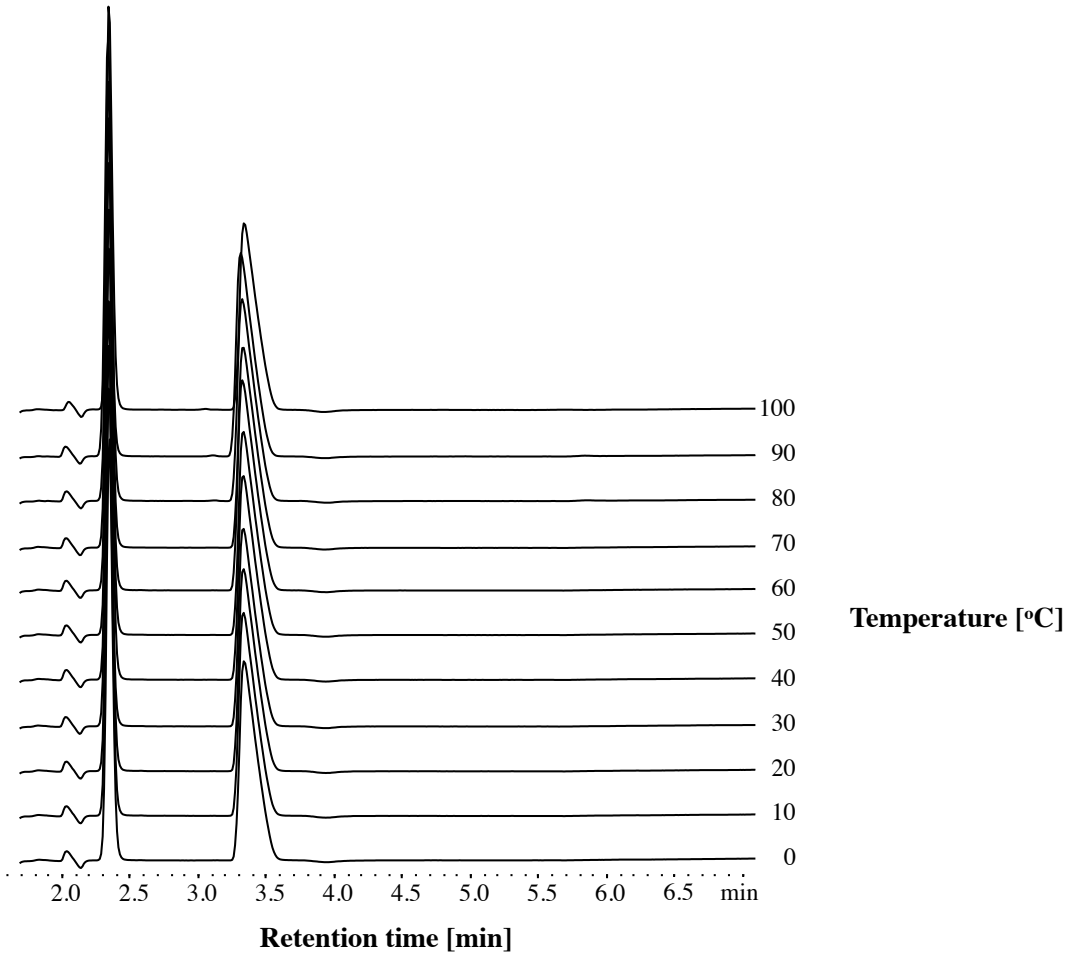

Fig. S13. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 5 as a function of temperature.

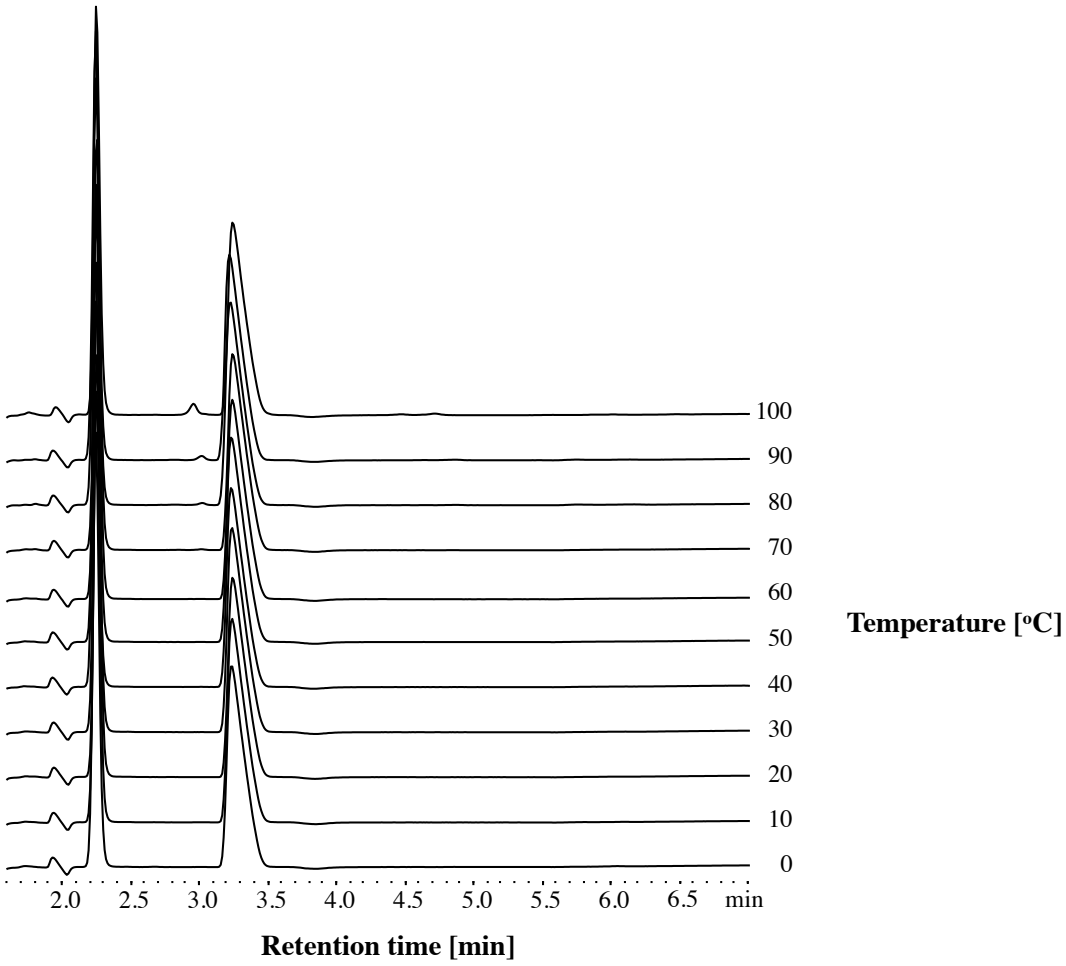

Fig. S14. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 6 as a function of temperature.

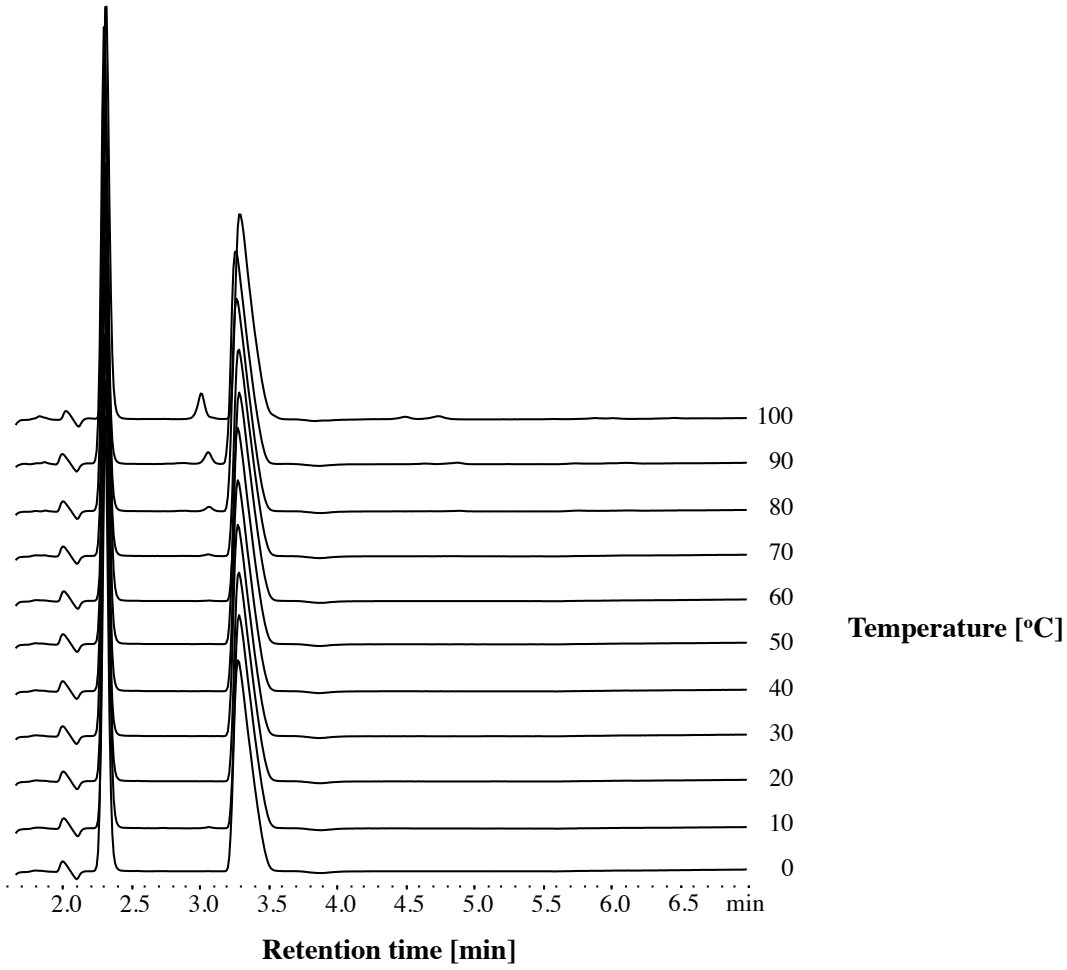

Fig. S15. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 7 as a function of temperature.

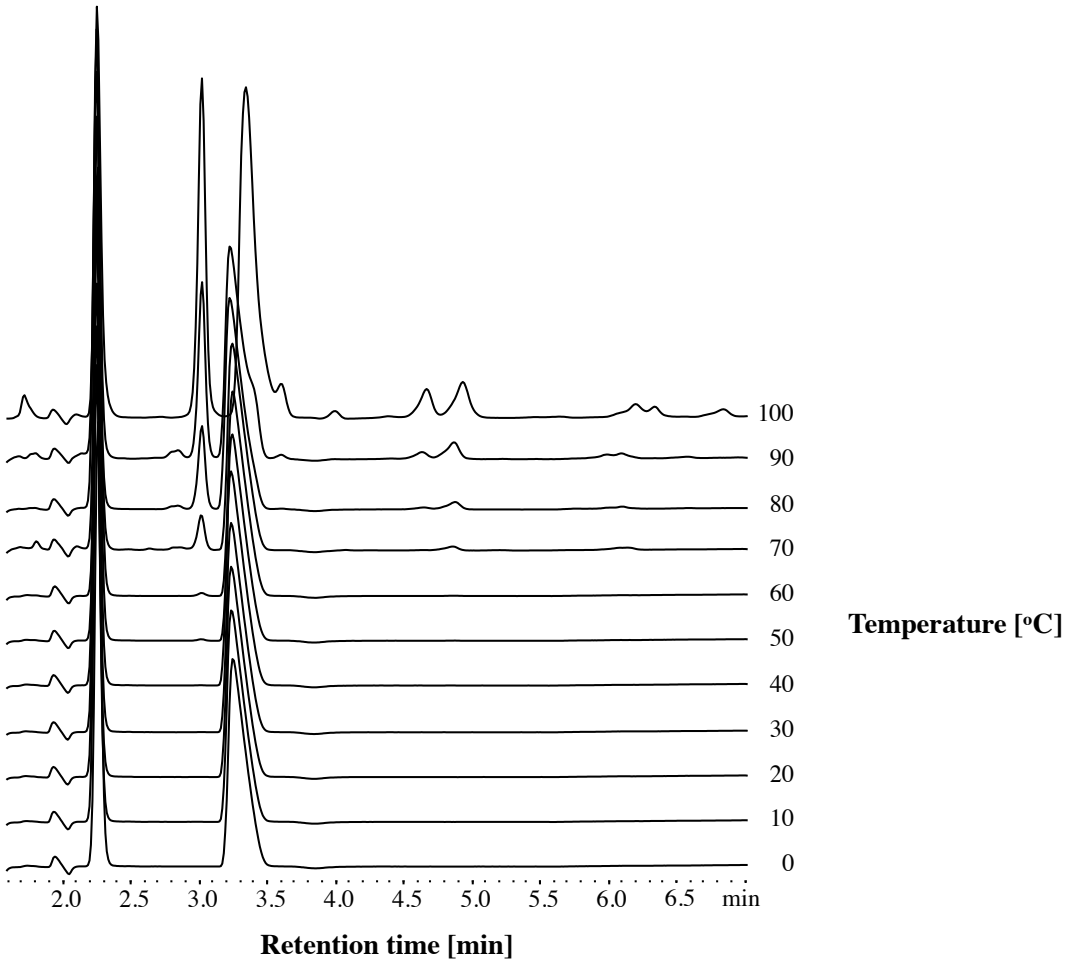

Fig. S16. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 8 as a function of temperature.

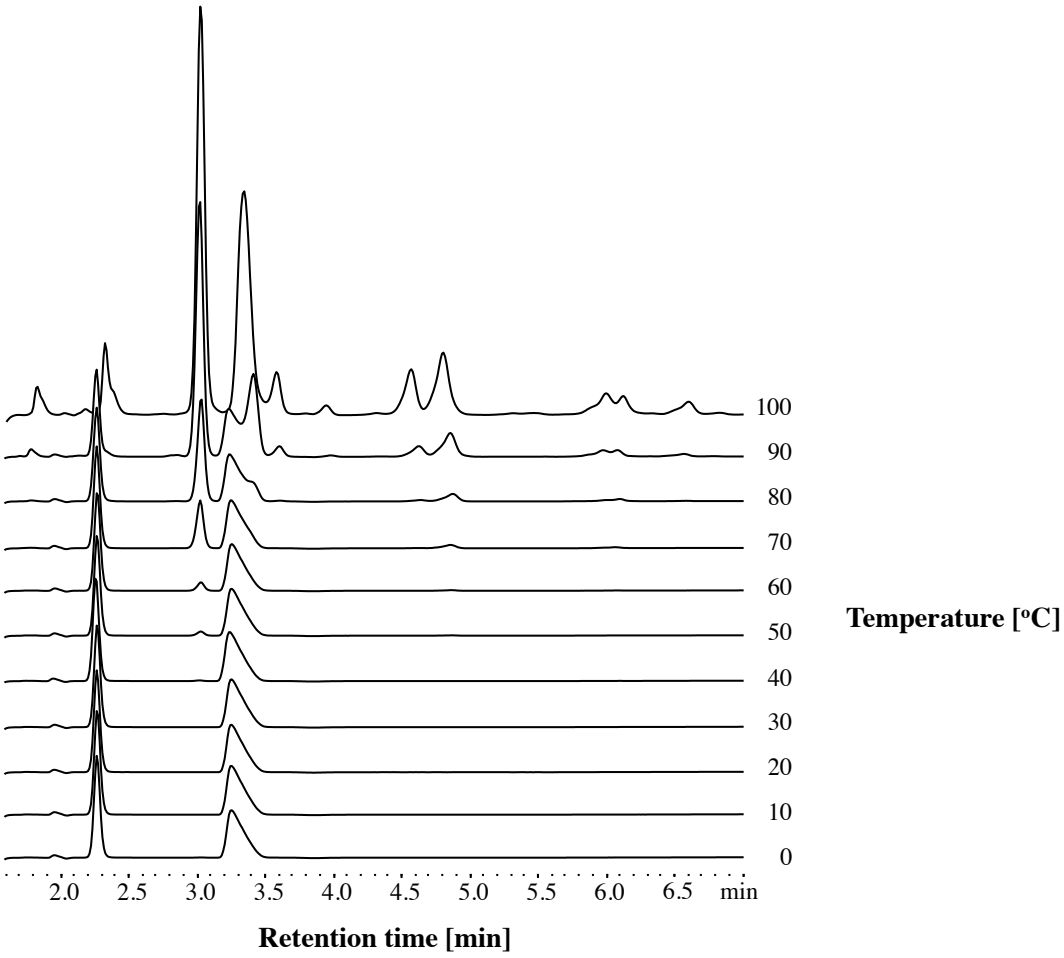

Fig. S17. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 9 as a function of temperature.

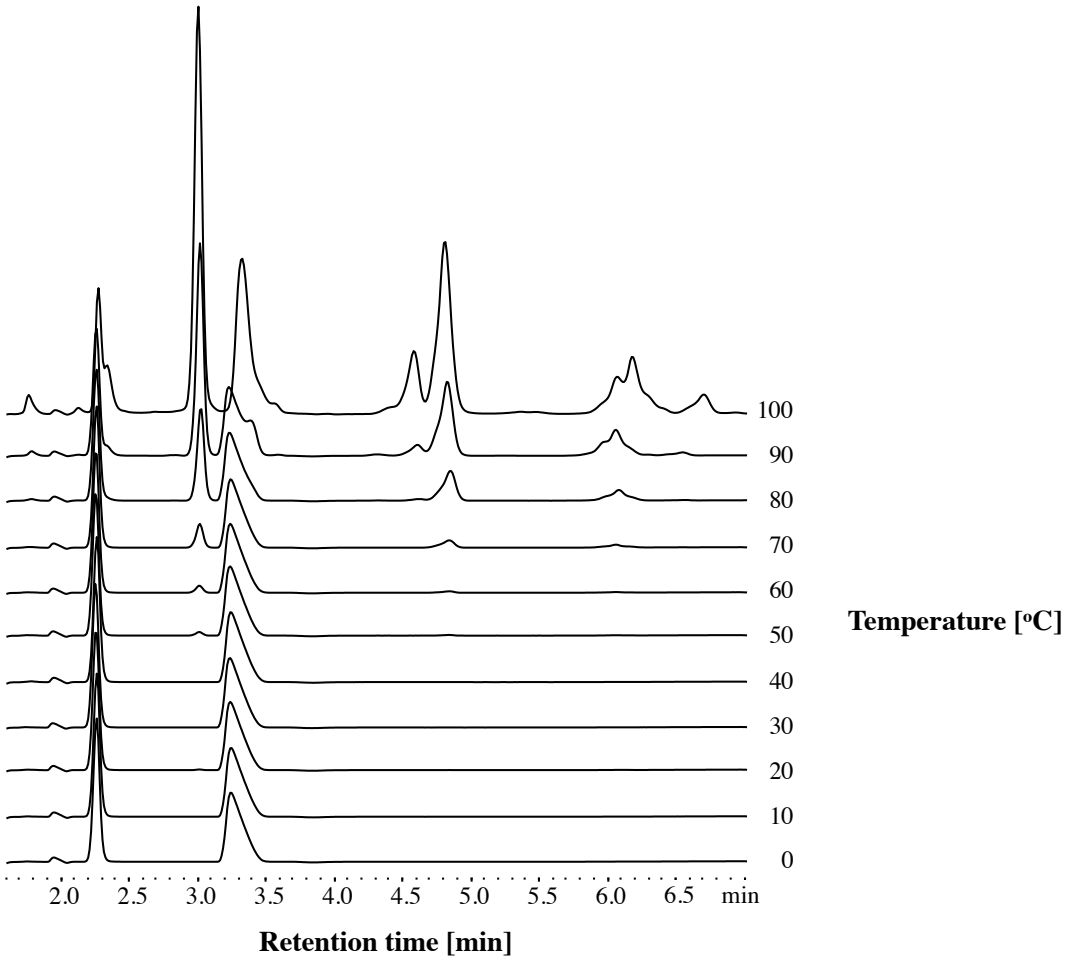

Fig. S18. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 10 as a function of temperature.

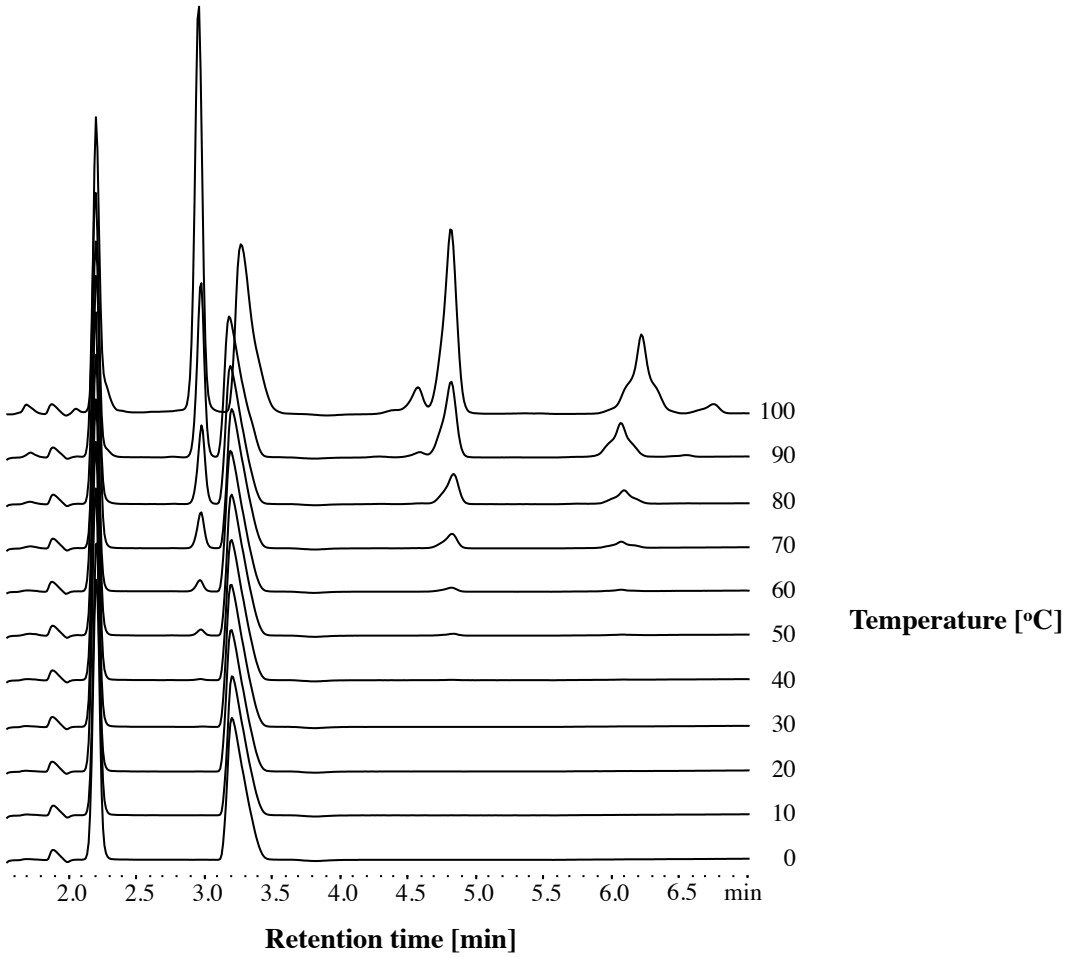

Fig. S19. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 11 as a function of temperature.

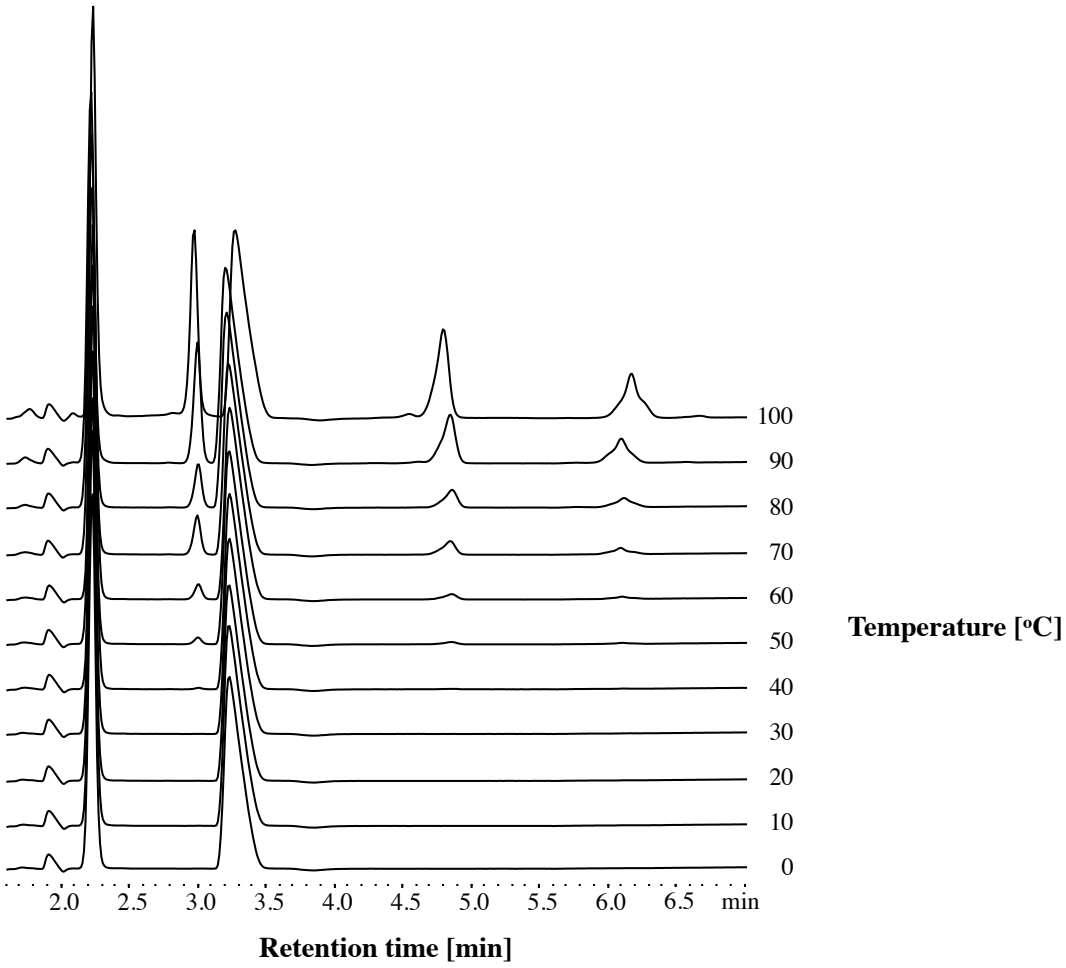

Fig. S20. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the absence of TP at pH 12 as a function of temperature.

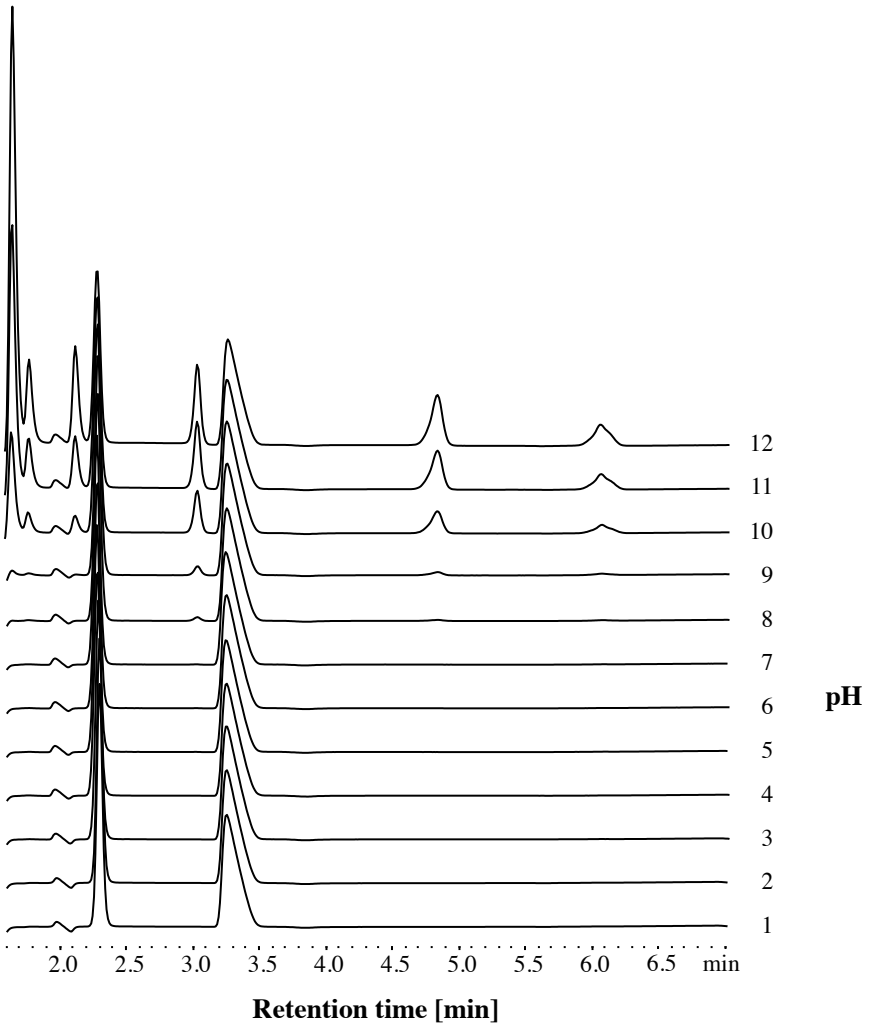

Fig. S21. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 0^{o}C as a function of pH.

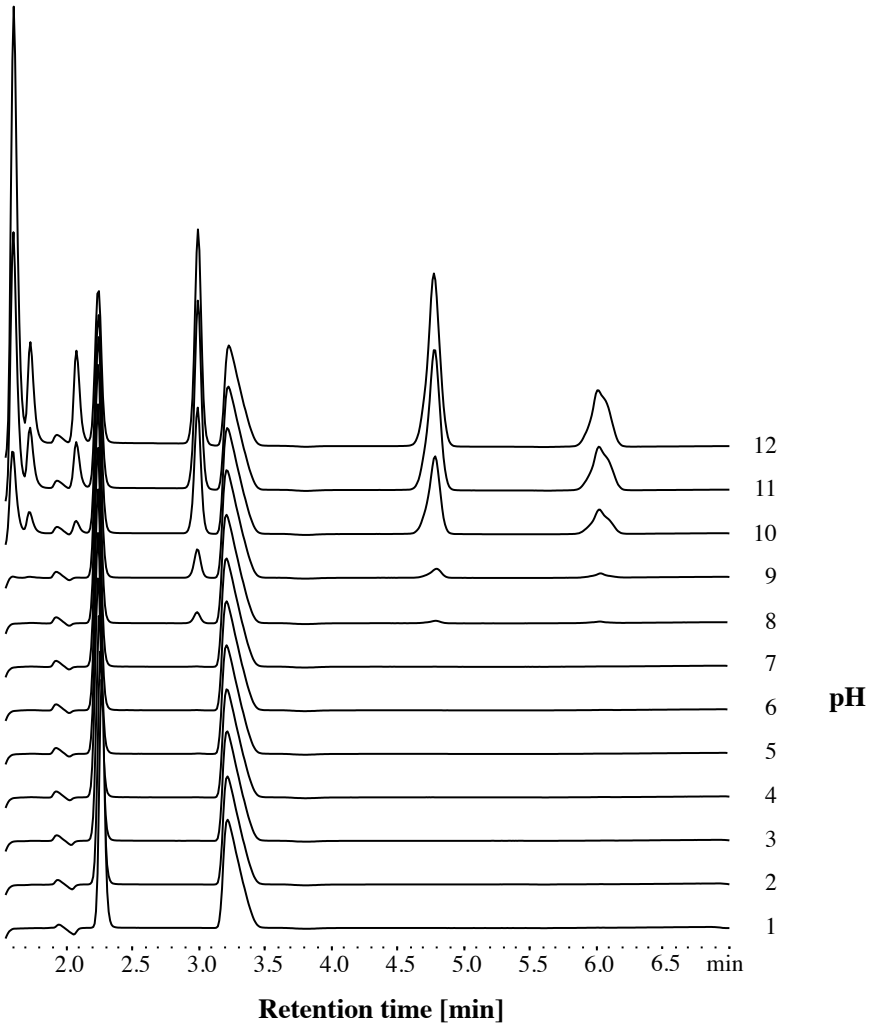

Fig. S22. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 10^{o}C as a function of pH.

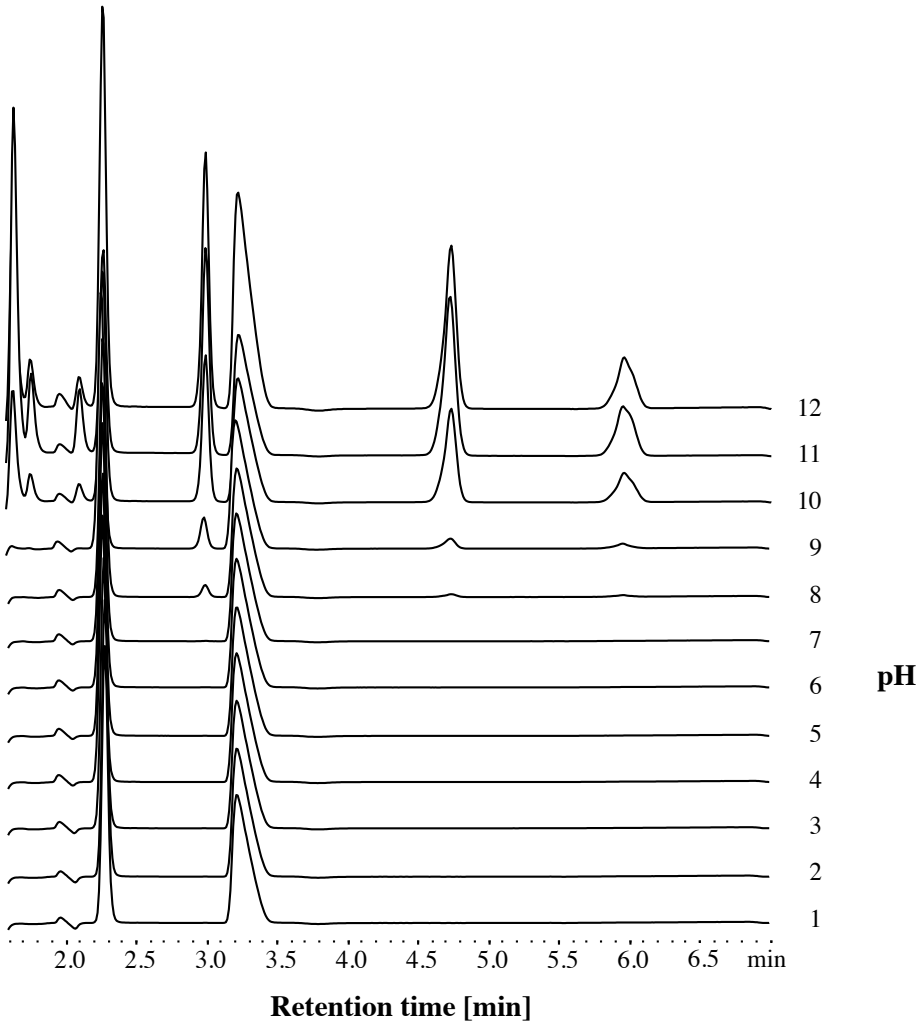

Fig. S23. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 20^{o}C as a function of pH.

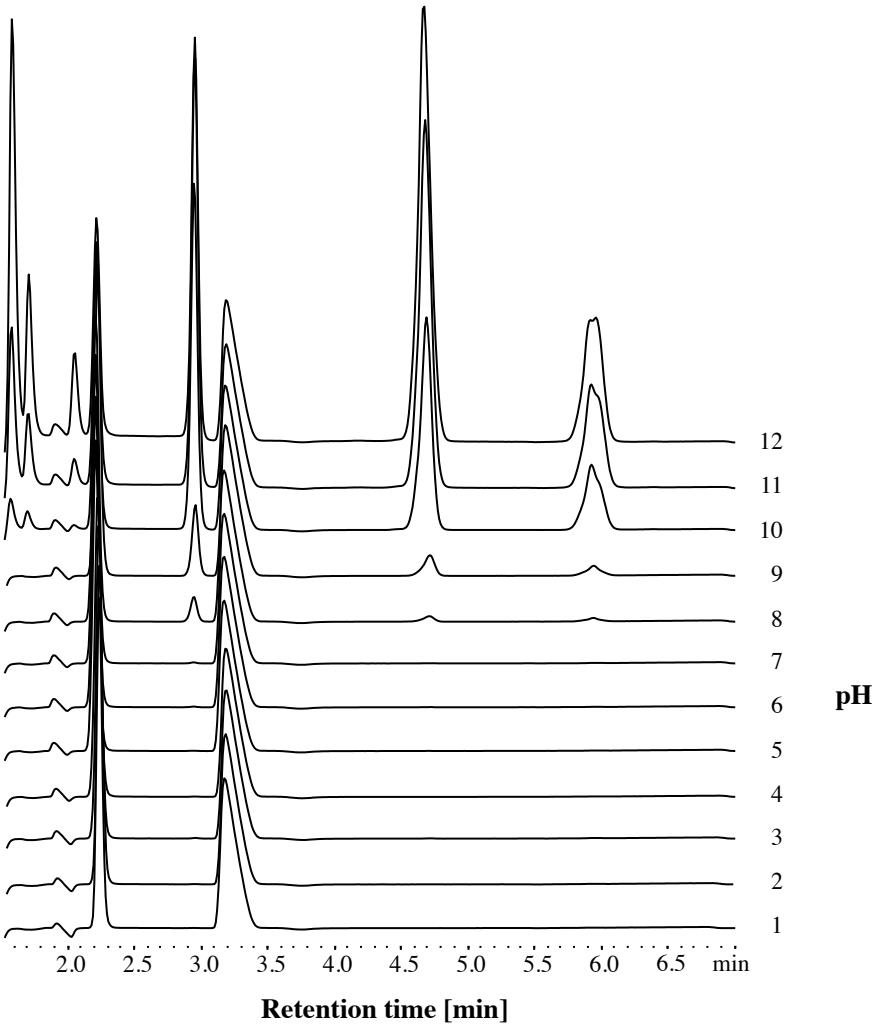

Fig. S24. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 30^{o}C as a function of pH.

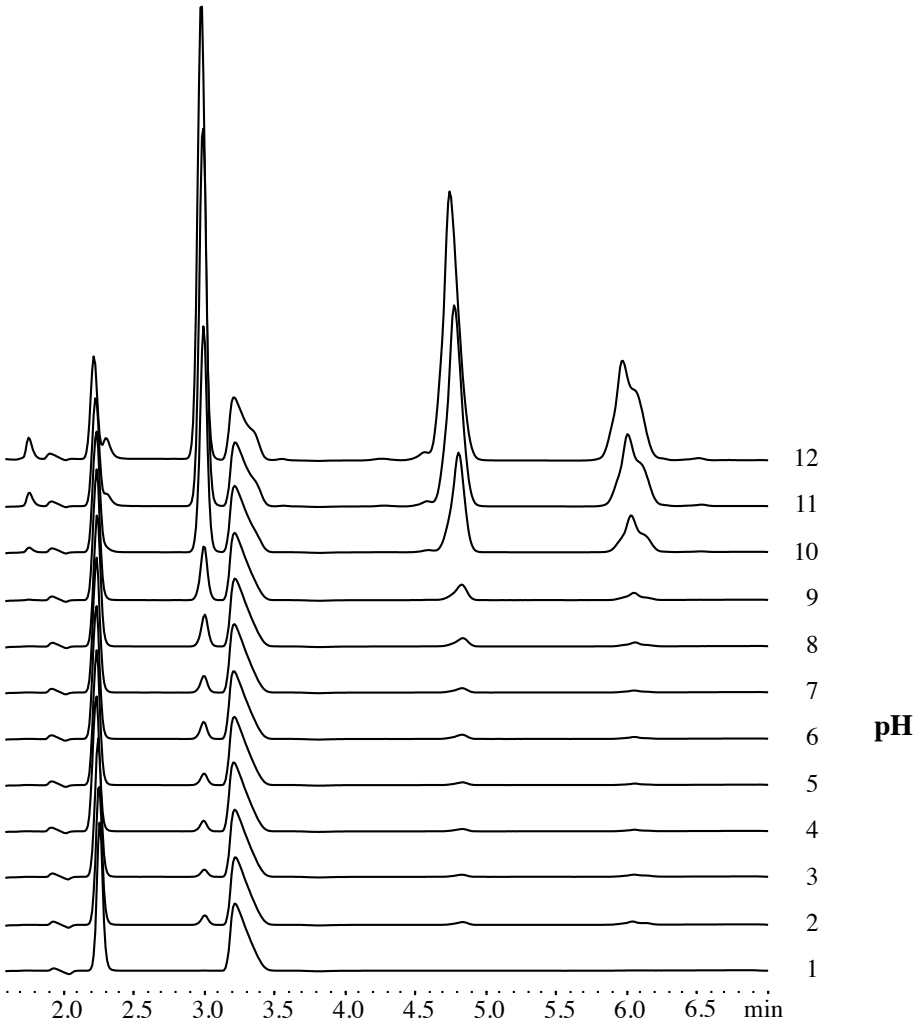

Fig. S25. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 40^{o}C as a function of pH.

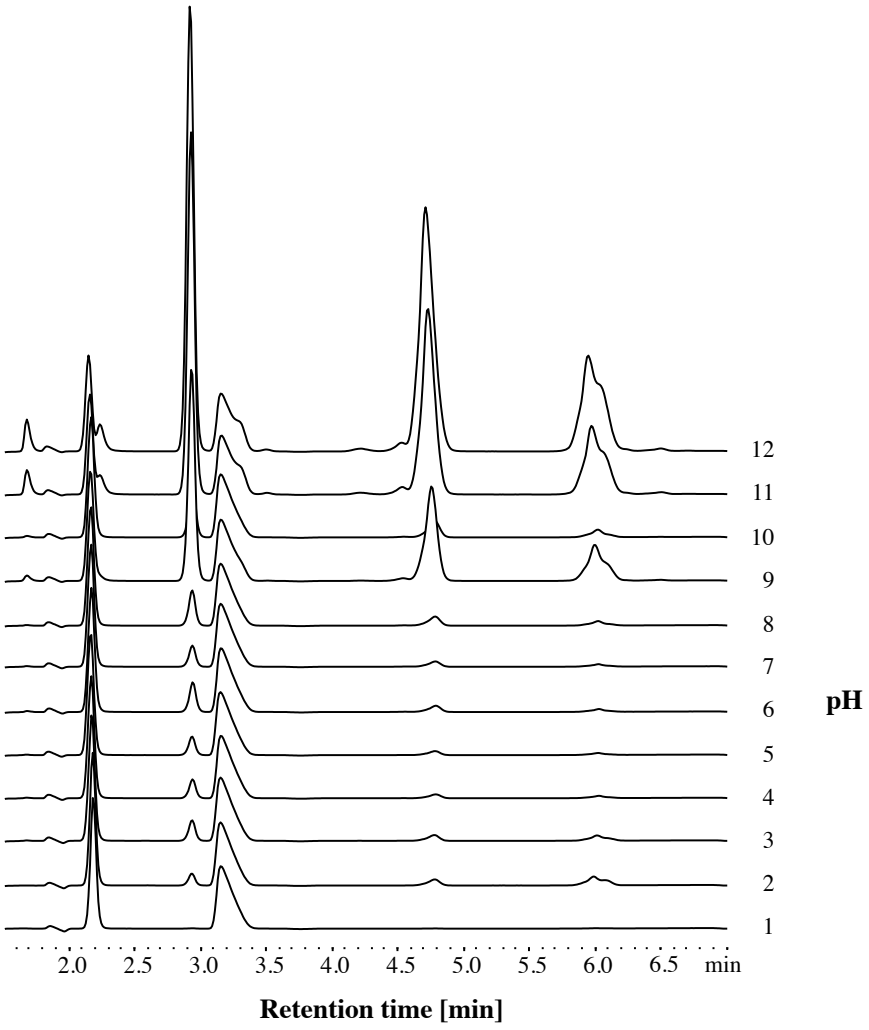

Fig. S26. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 50^{o}C as a function of pH.

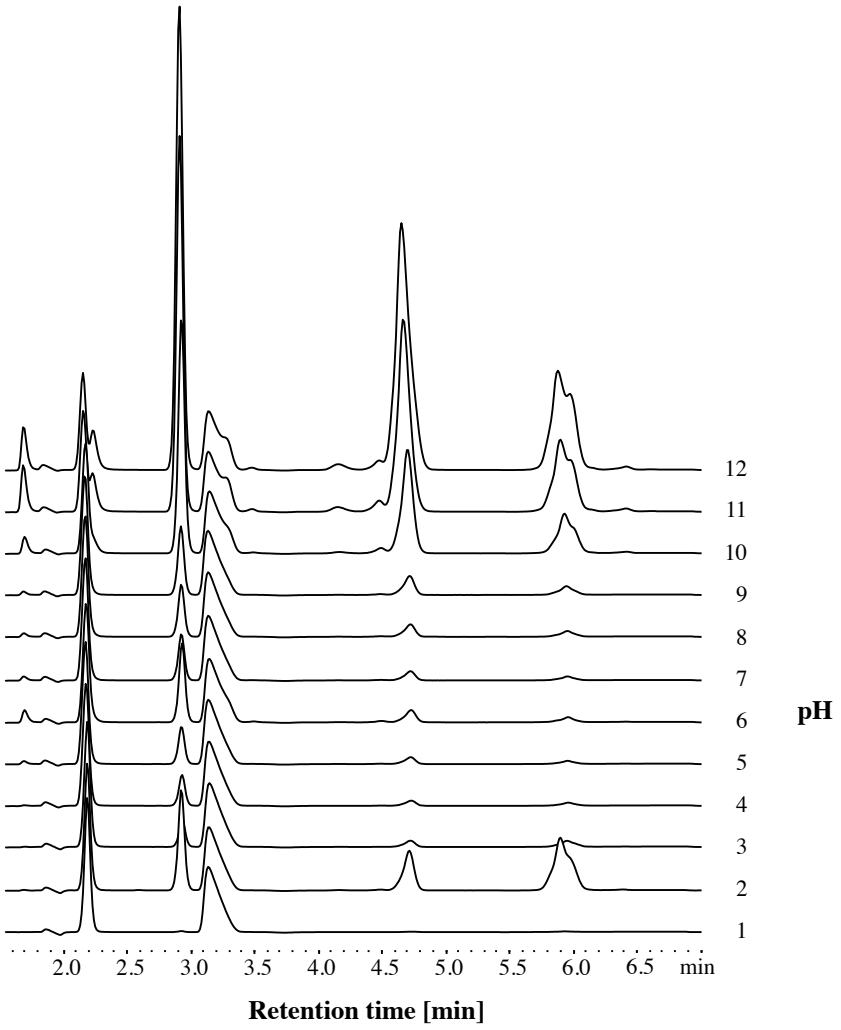

Fig. S27. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 60^{o}C as a function of pH.

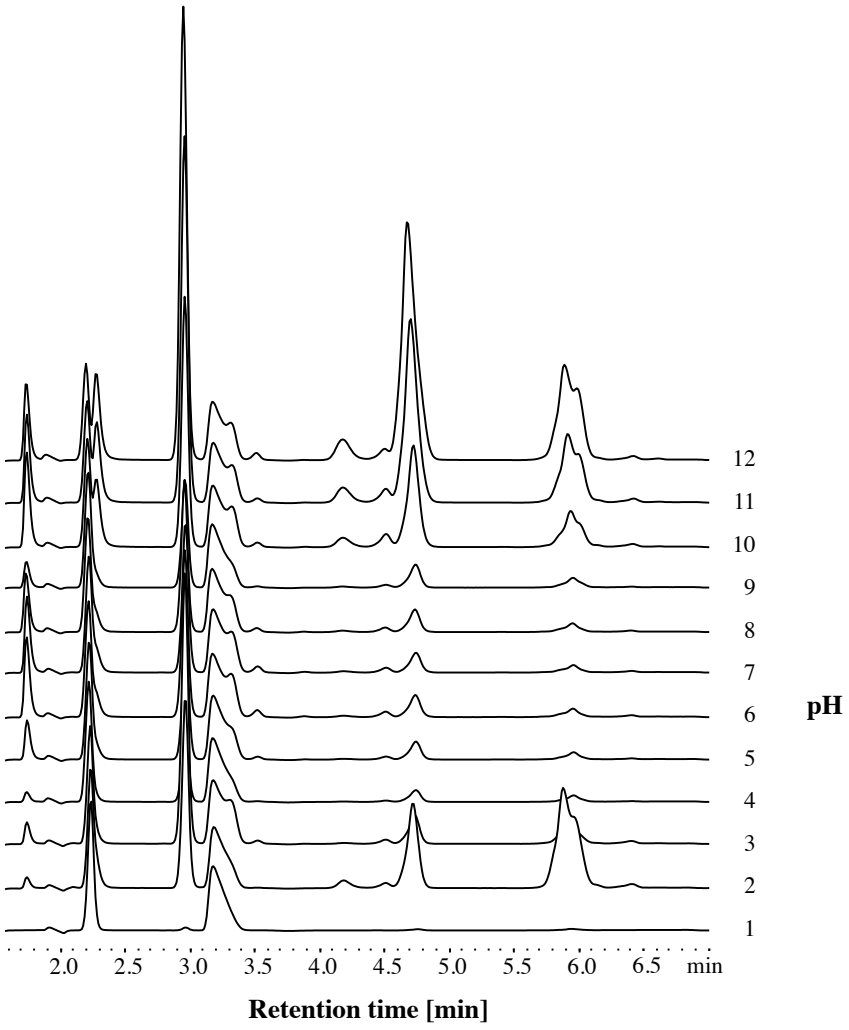

Fig. S28. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 70^{o}C as a function of pH.

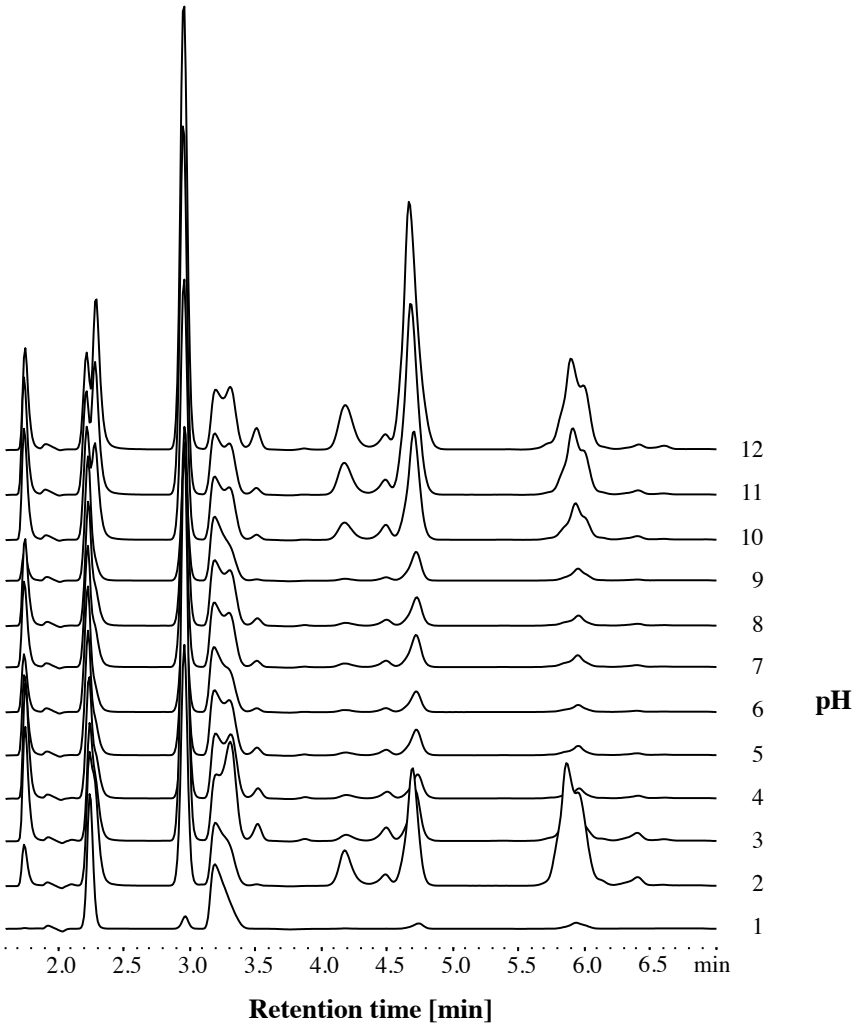

Fig. S29. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 80^{o}C as a function of pH.

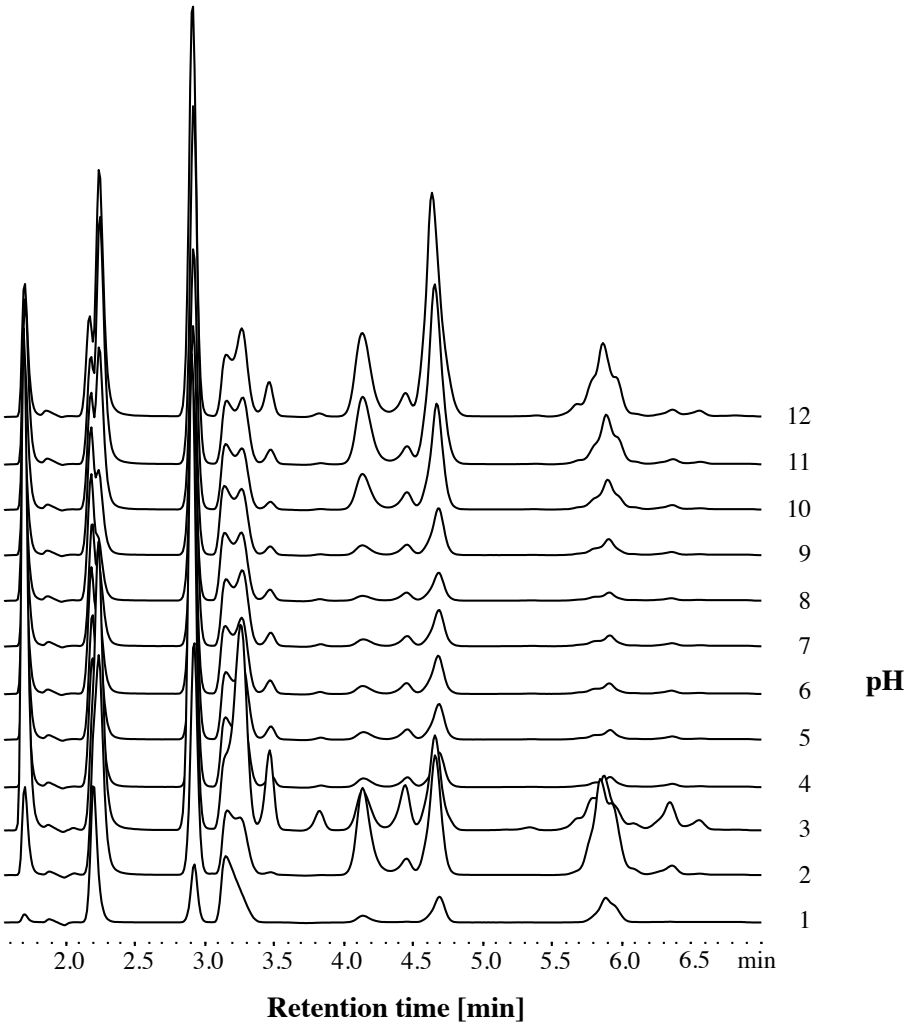

Fig. S30. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 90^{o}C as a function of pH.

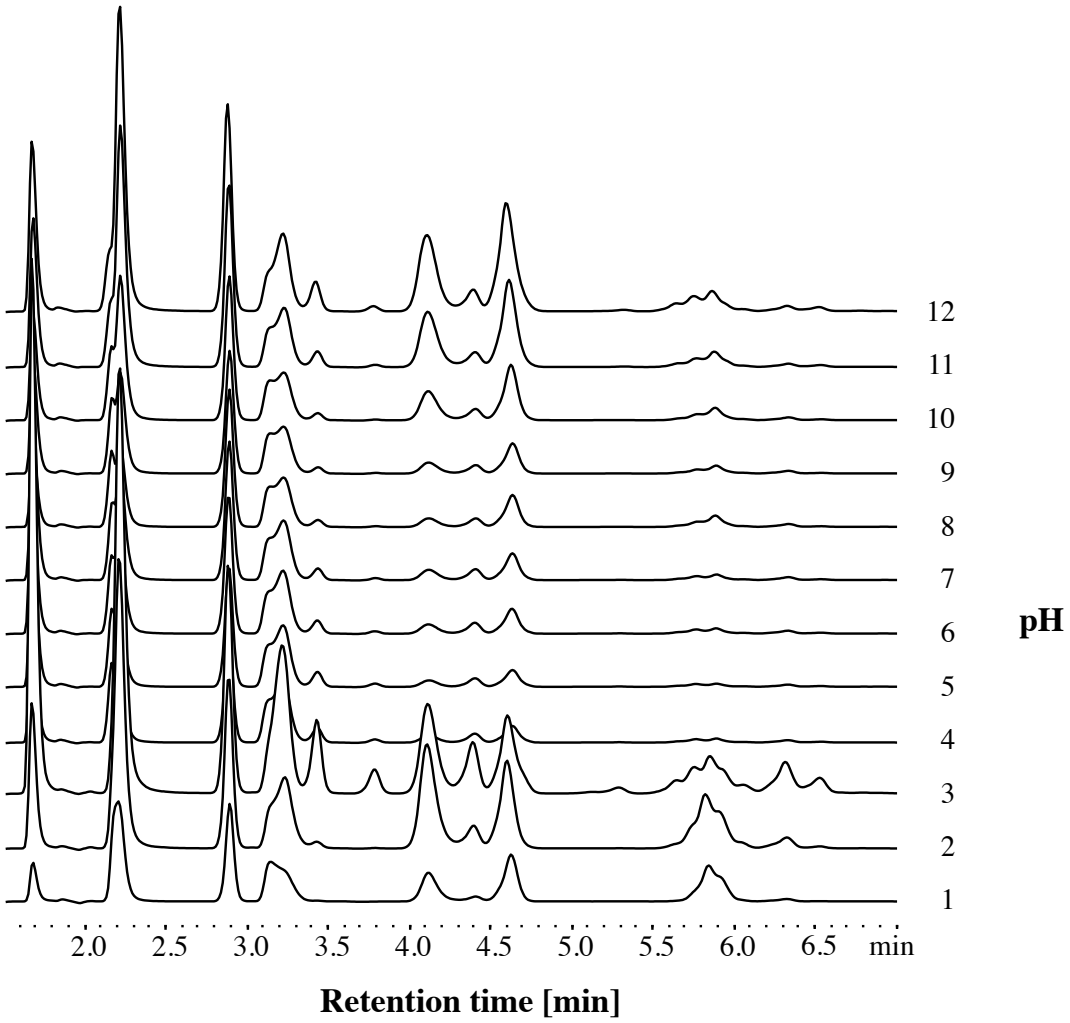

Fig. S31. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at 100^{o}C as a function of pH.

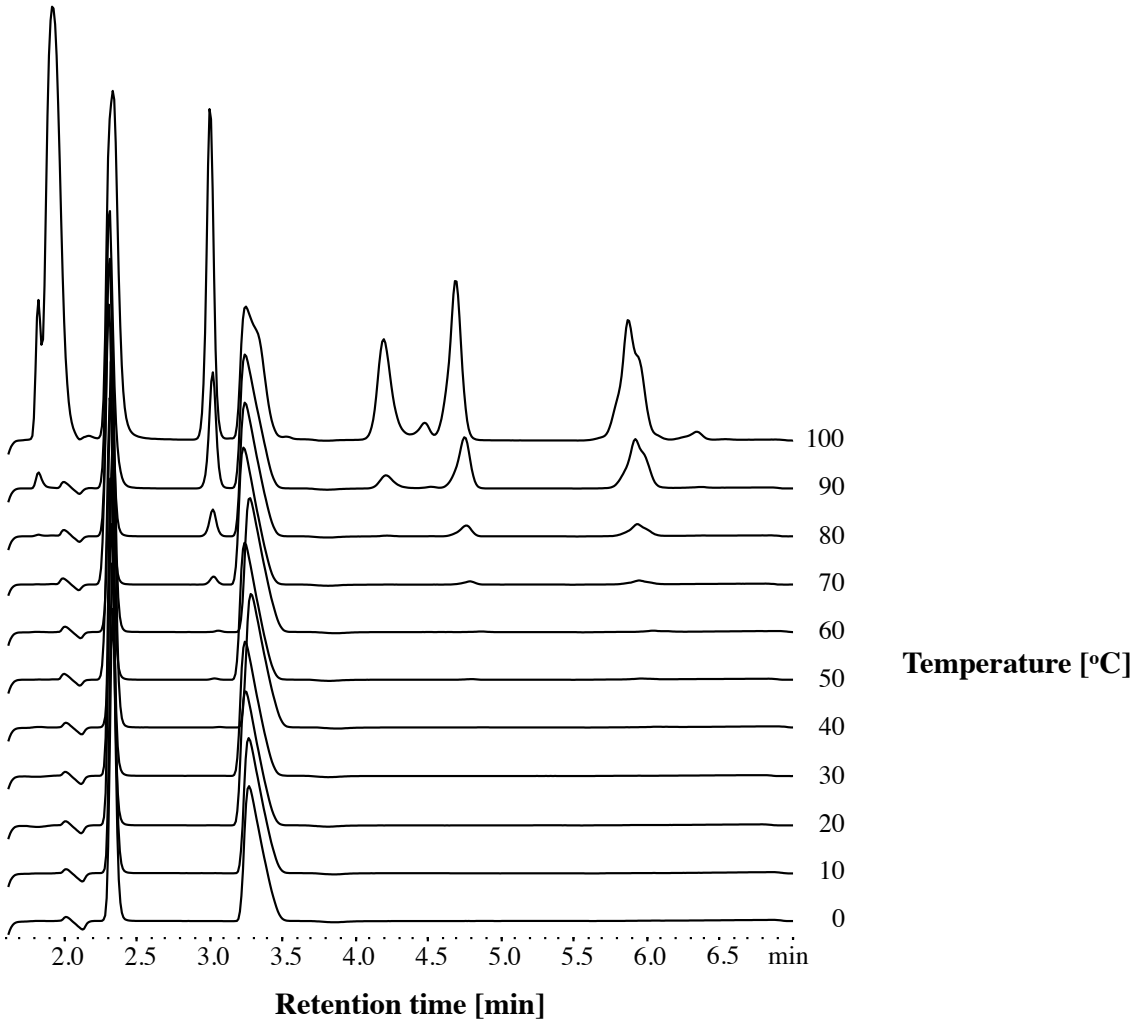

Fig. S32. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 1 as a function of temperature.

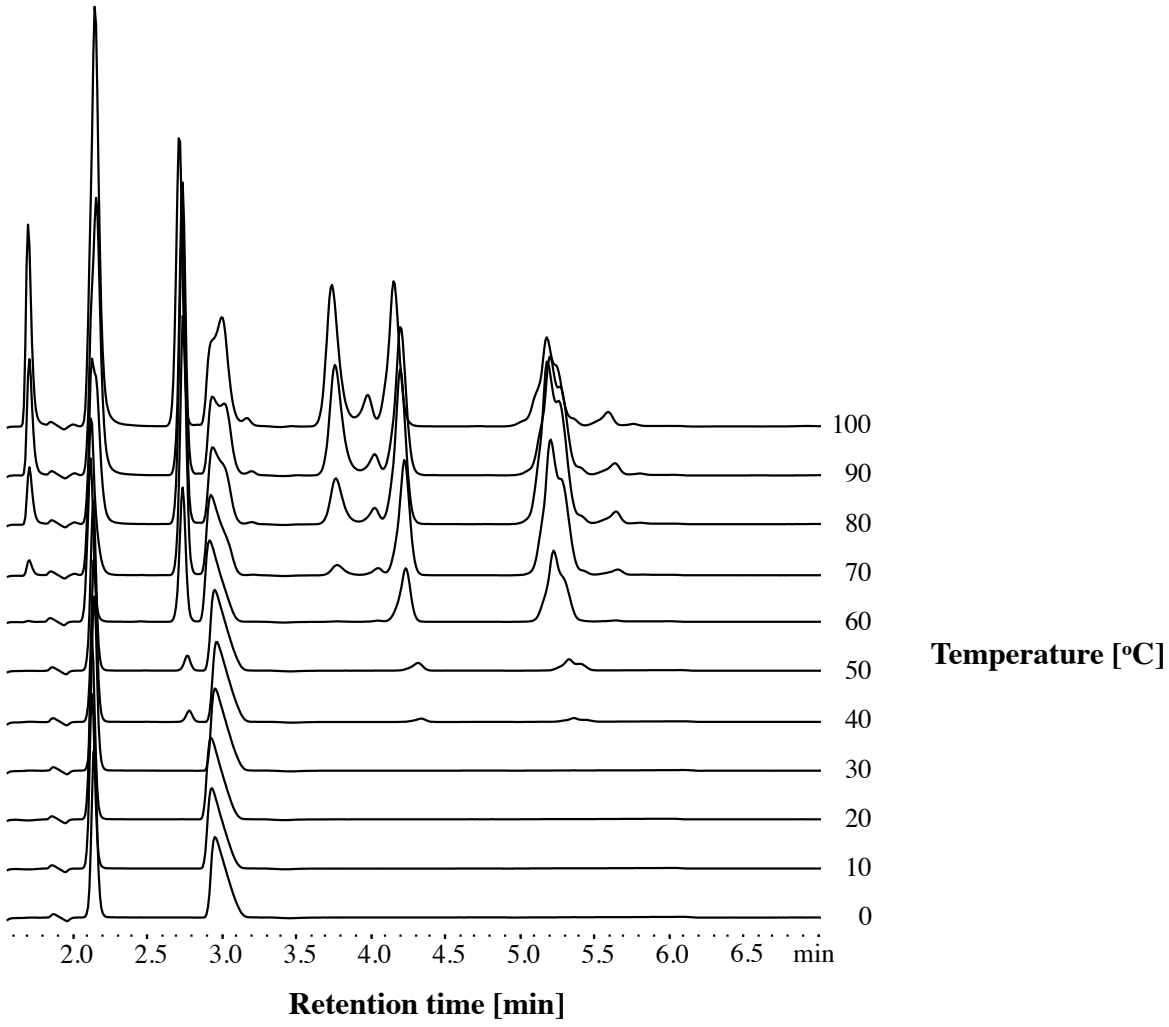

Fig. S33. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 2 as a function of temperature.

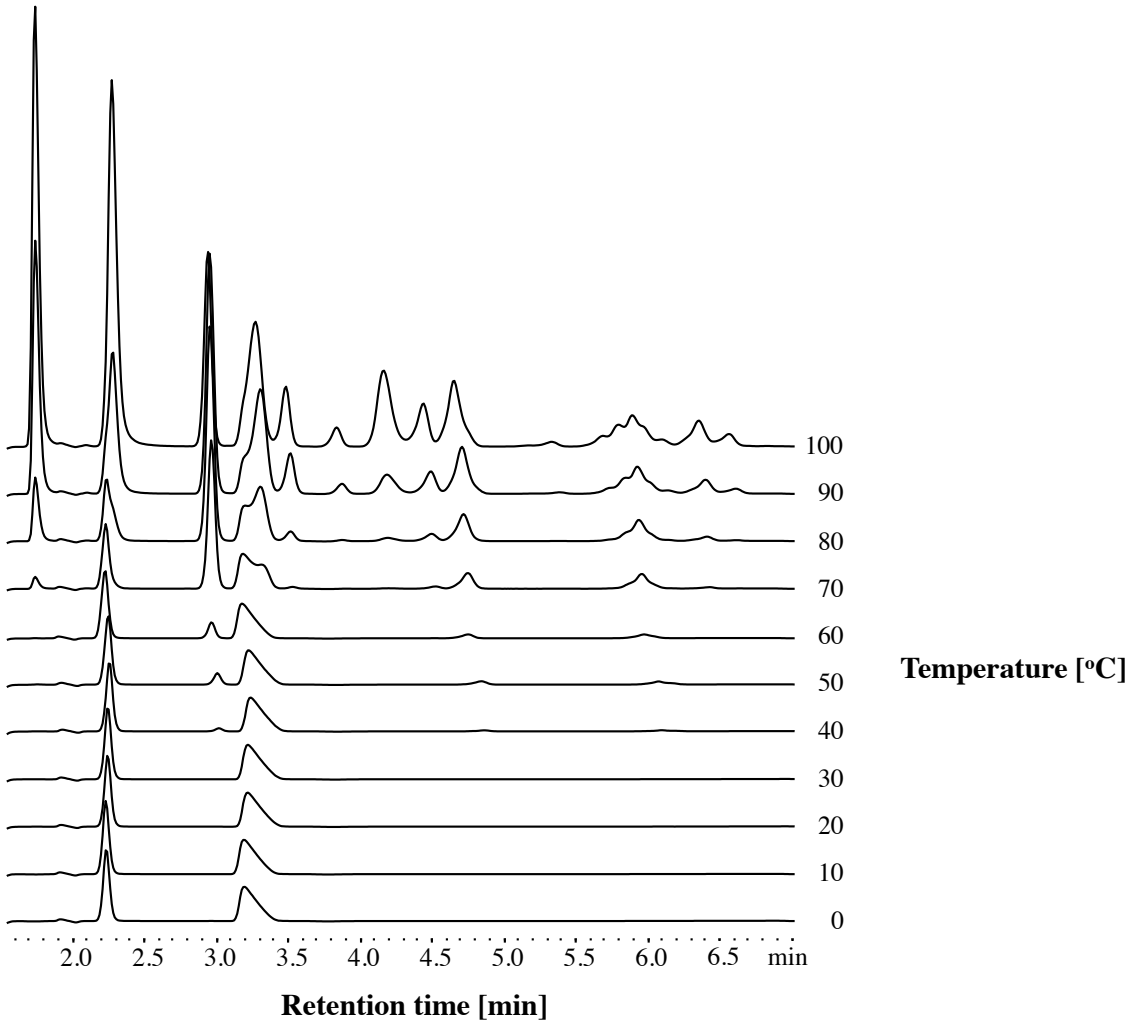

Fig. S34. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 3 as a function of temperature.

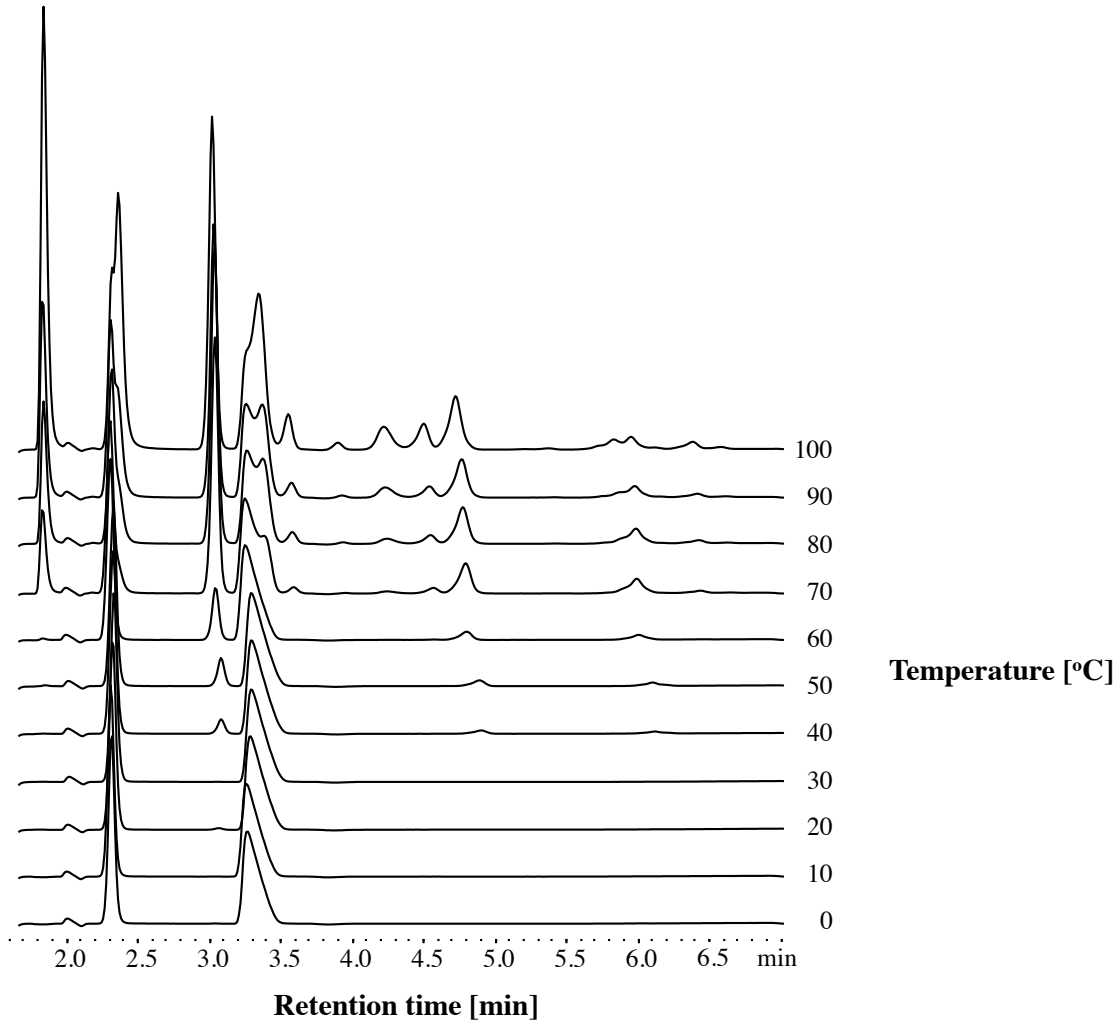

Fig. S35. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 4 as a function of temperature.

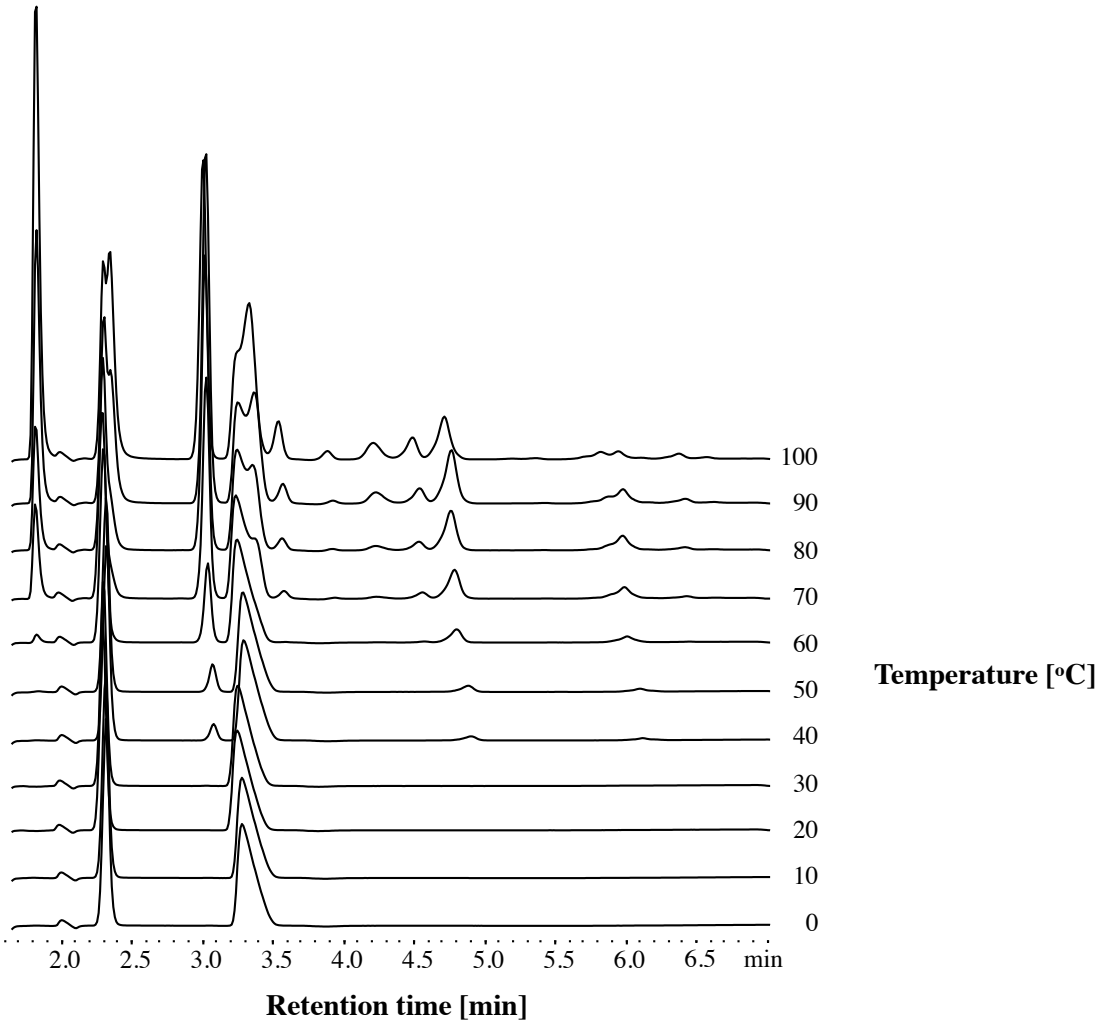

Fig. S36. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 5 as a function of temperature.

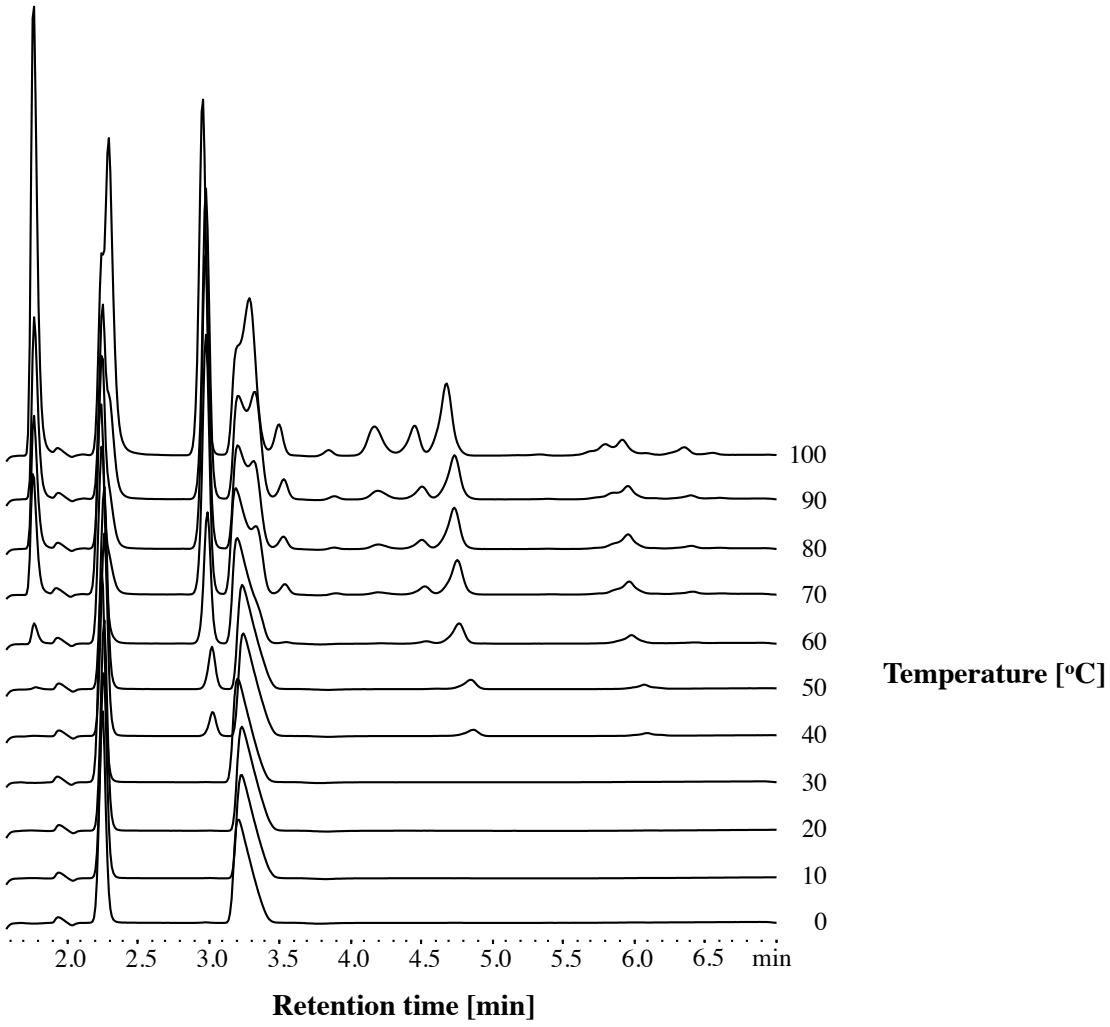

Fig. S37. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 6 as a function of temperature.

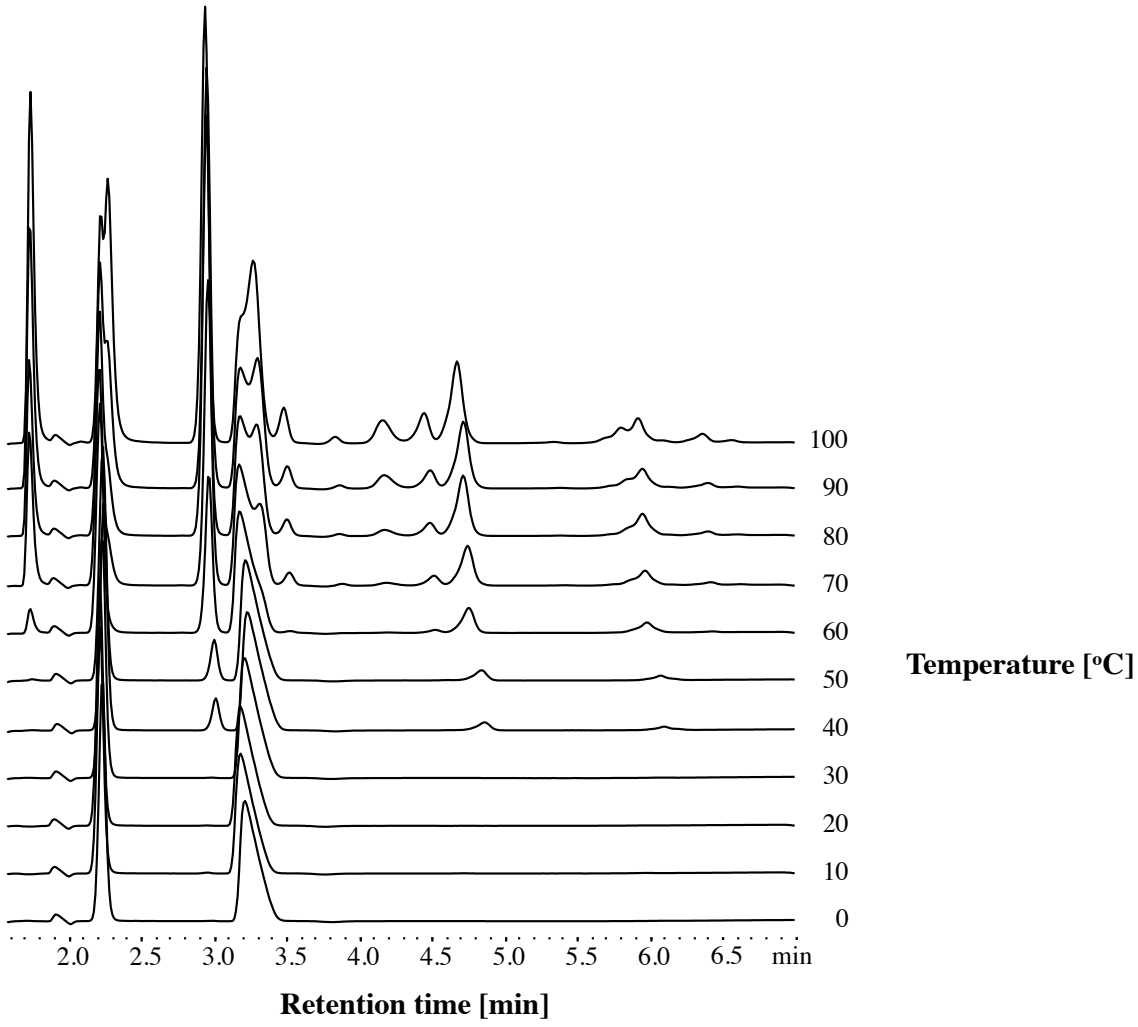

Fig. S38. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 7 as a function of temperature.

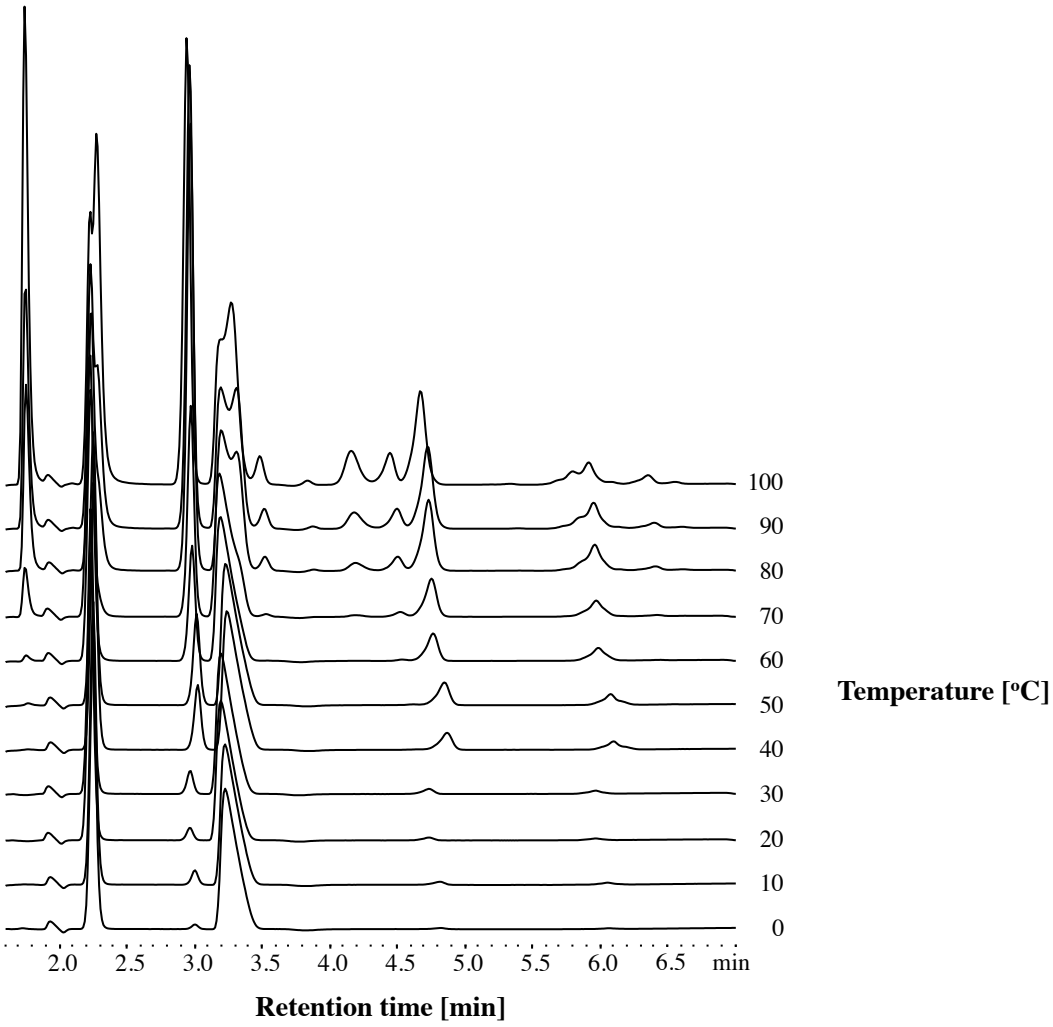

Fig. S39. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 8 as a function of temperature.

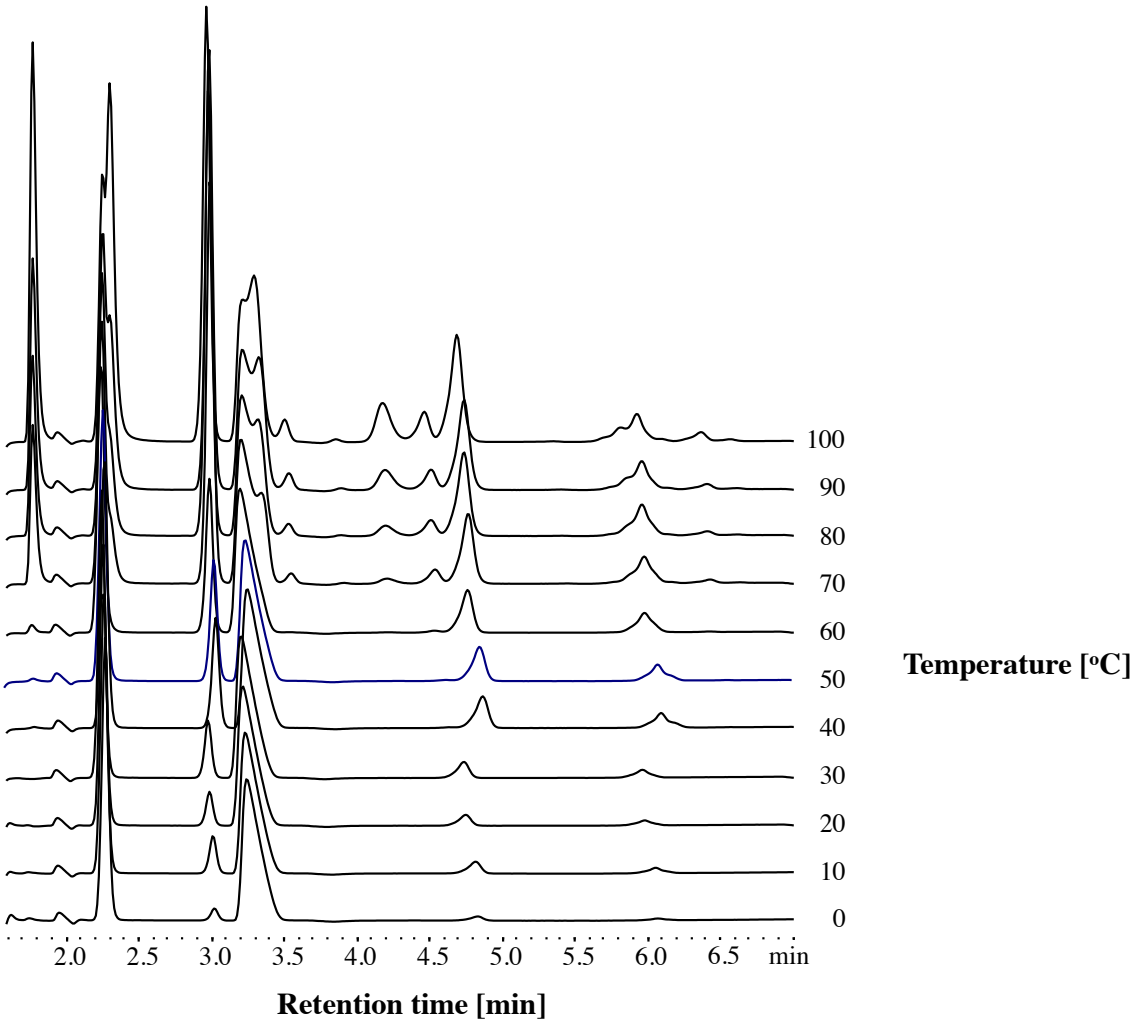

Fig. S40. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 9 as a function of temperature.

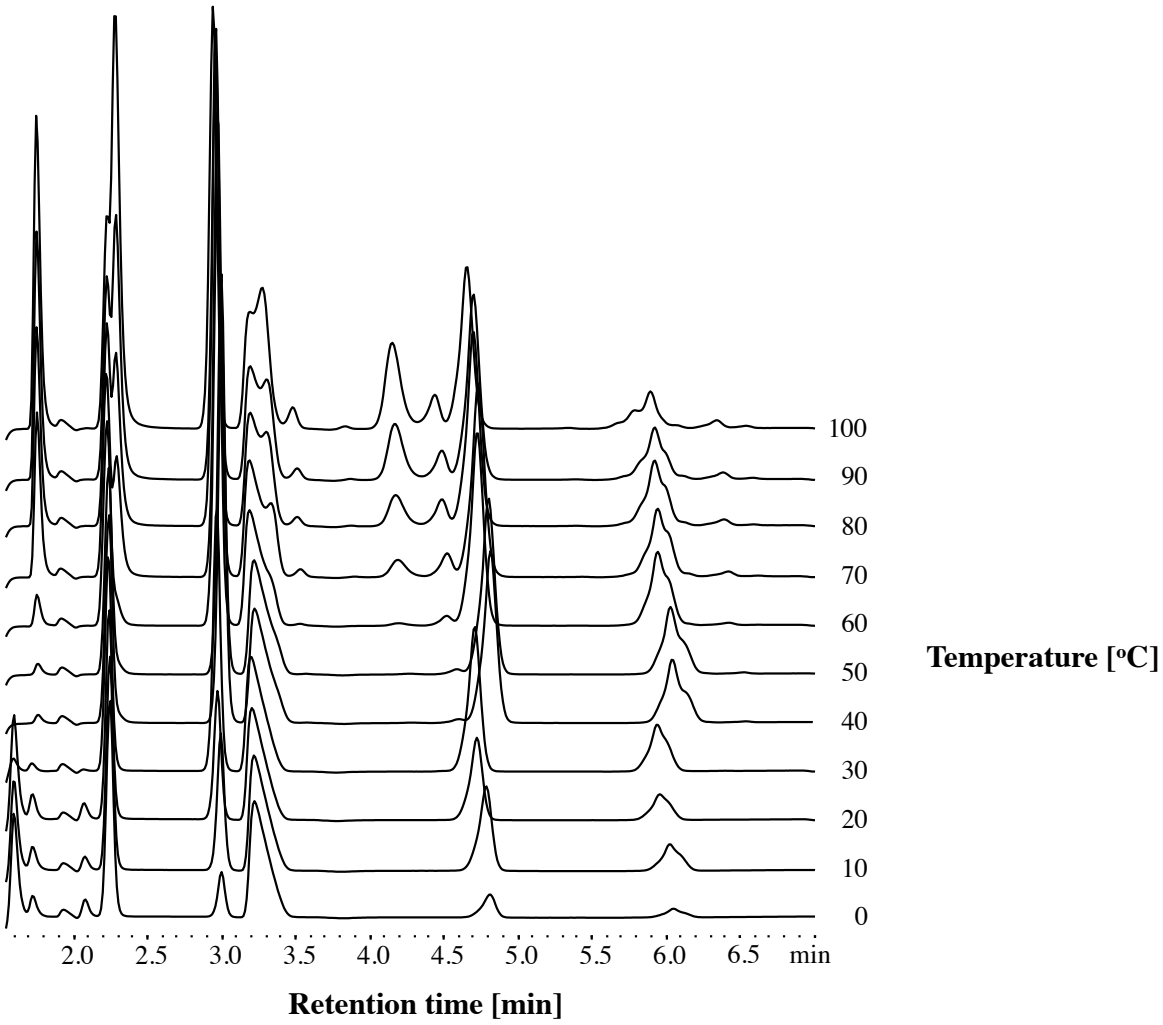

Fig. S41. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 10 as a function of temperature.

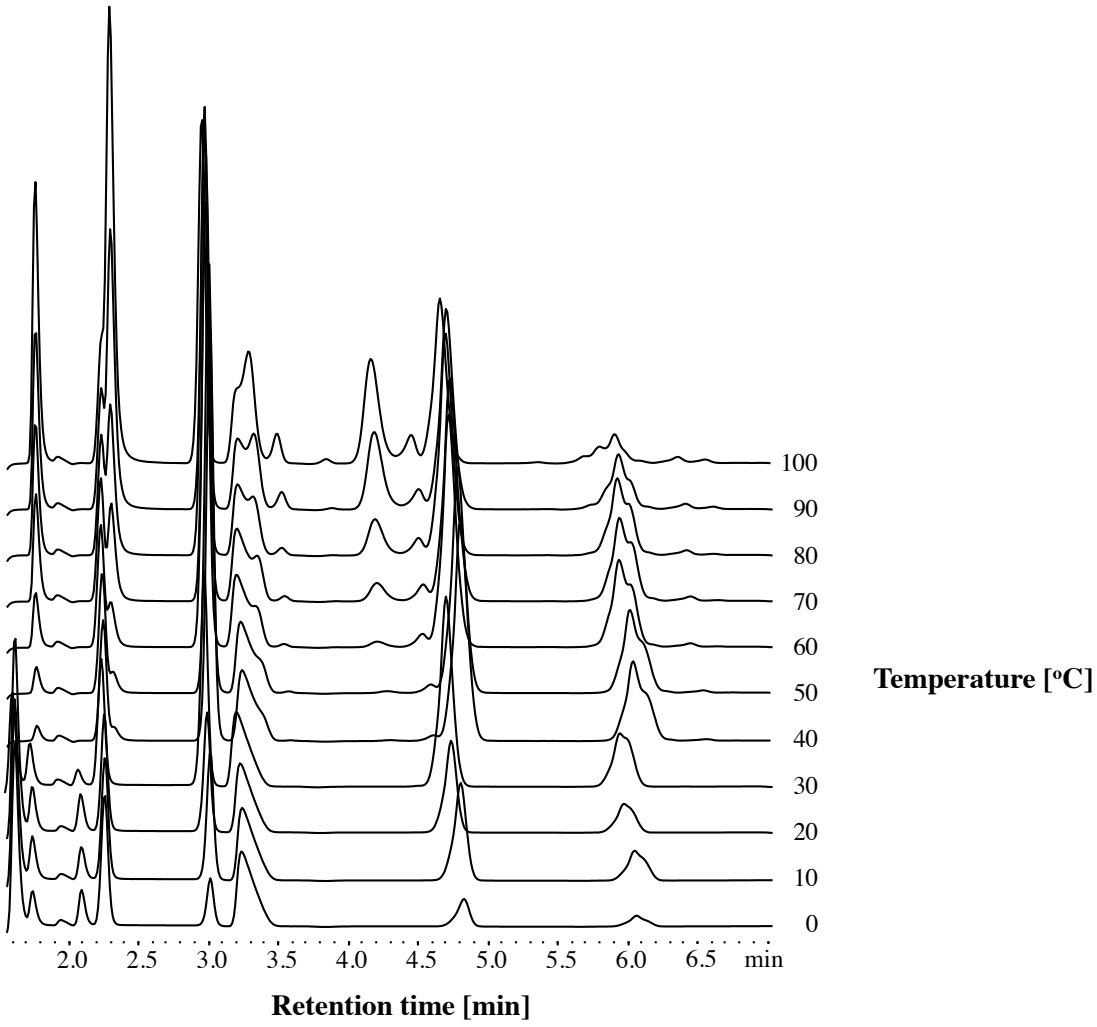

Fig. S42. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 11 as a function of temperature.

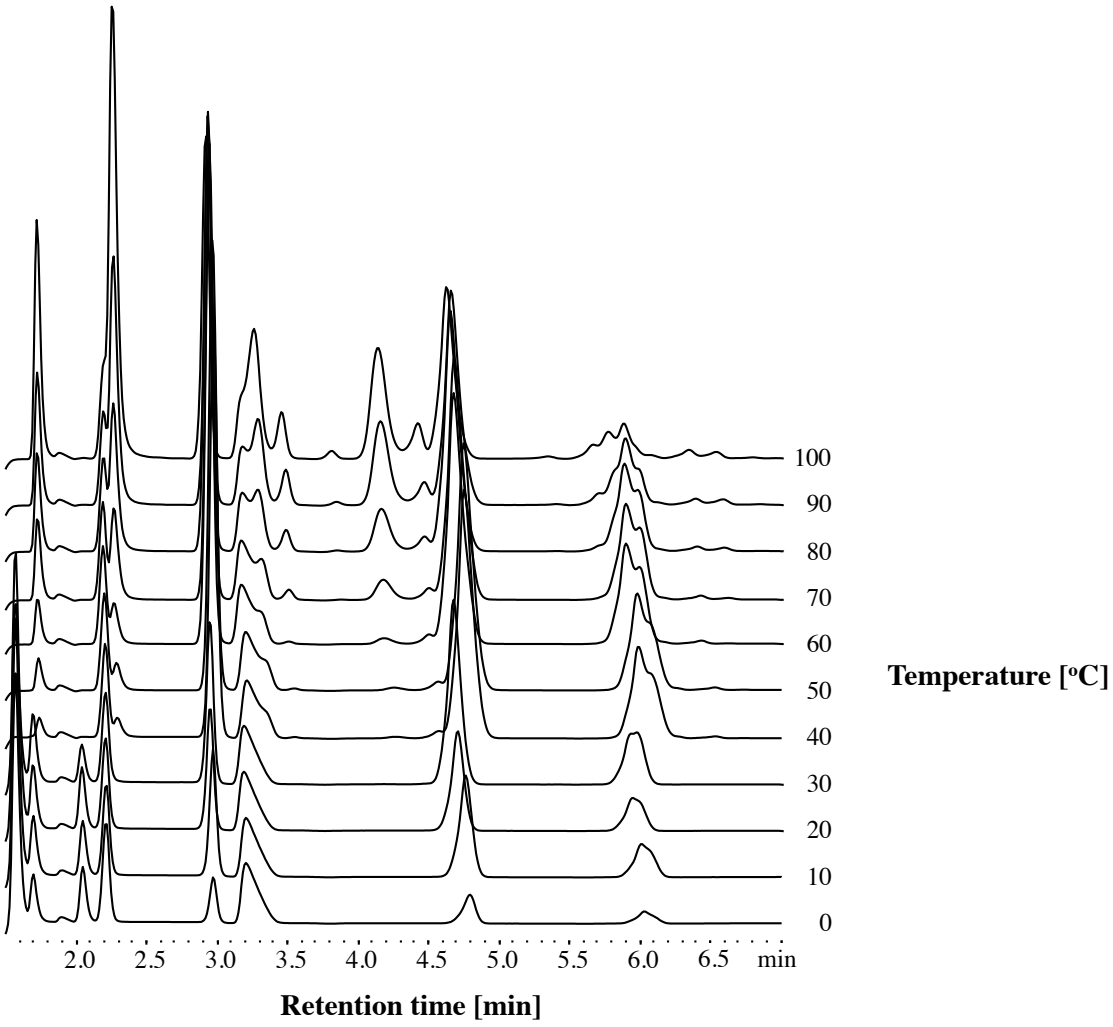

Fig. S43. Ion pairing HPLC chromatograms of an alanine and glycine condensation reaction in the presence of TP at pH 12 as a function of temperature.

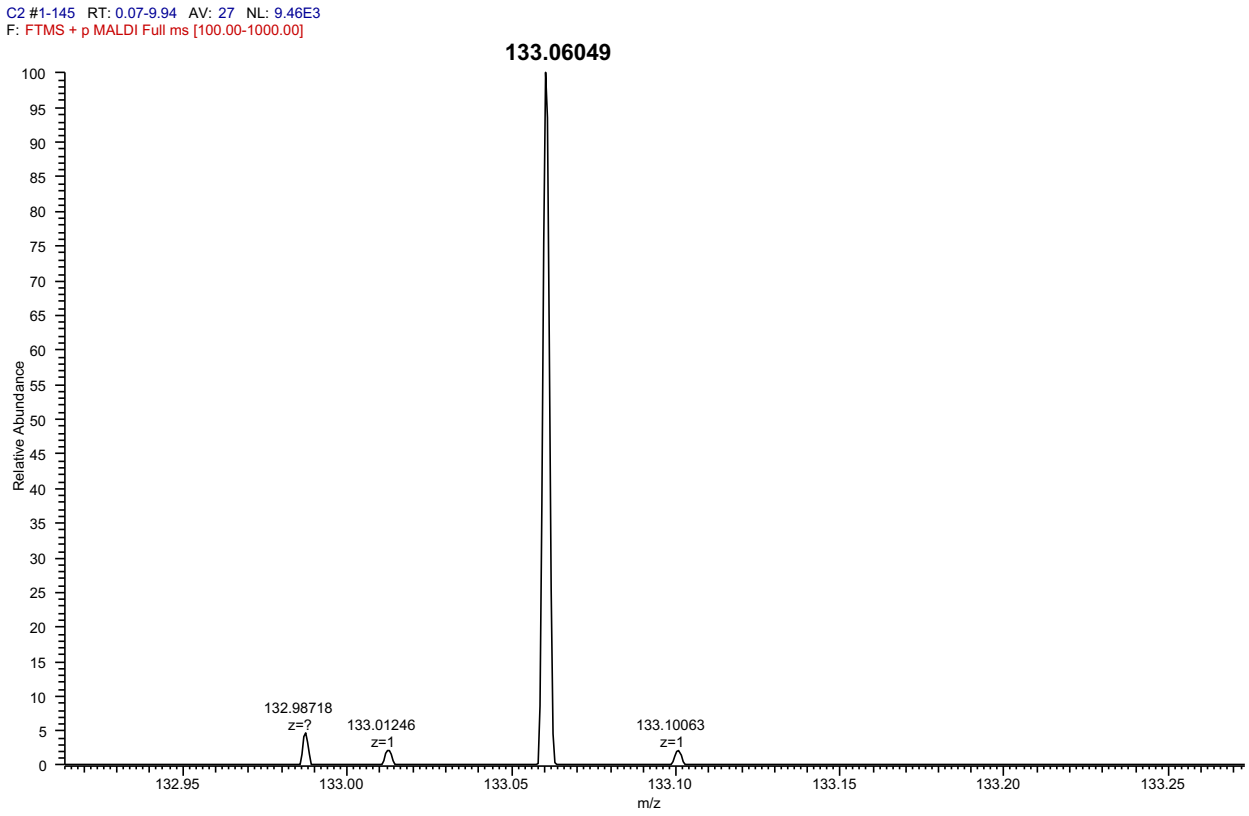

Fig. S44. MS spectra for 2G $[M+H]^+$ oligopeptide.

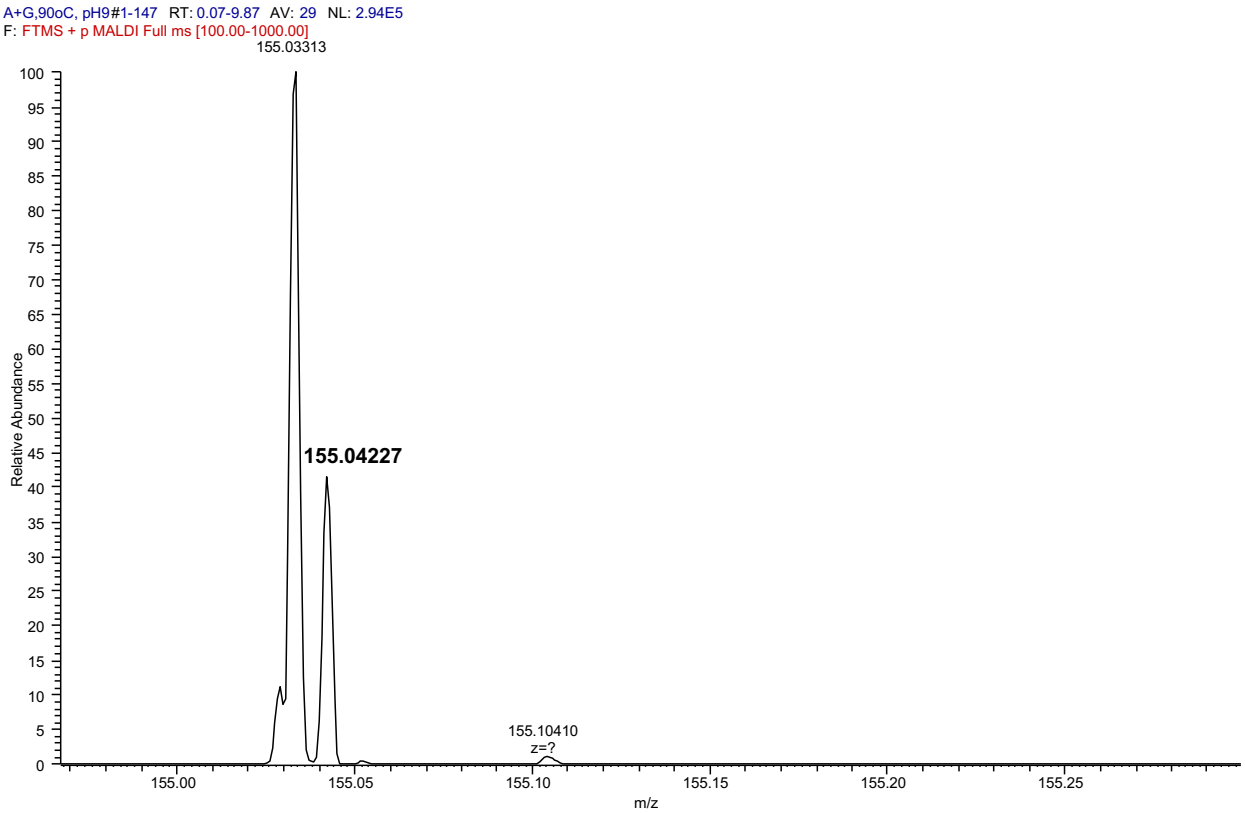

Fig. S45. MS spectra for 2G $[M+Na]^+$ oligopeptide.

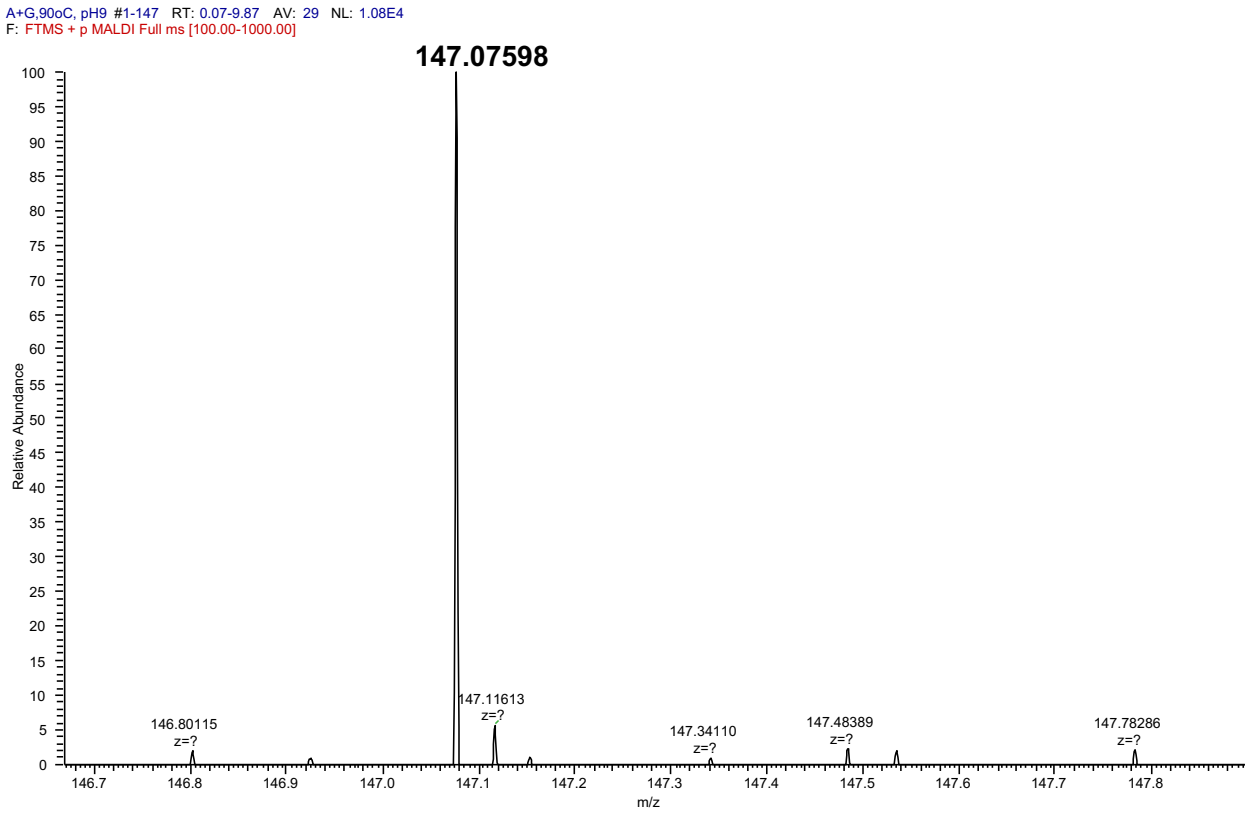

Fig. S46. MS spectra for AG $[M+H]^+$ oligopeptide.

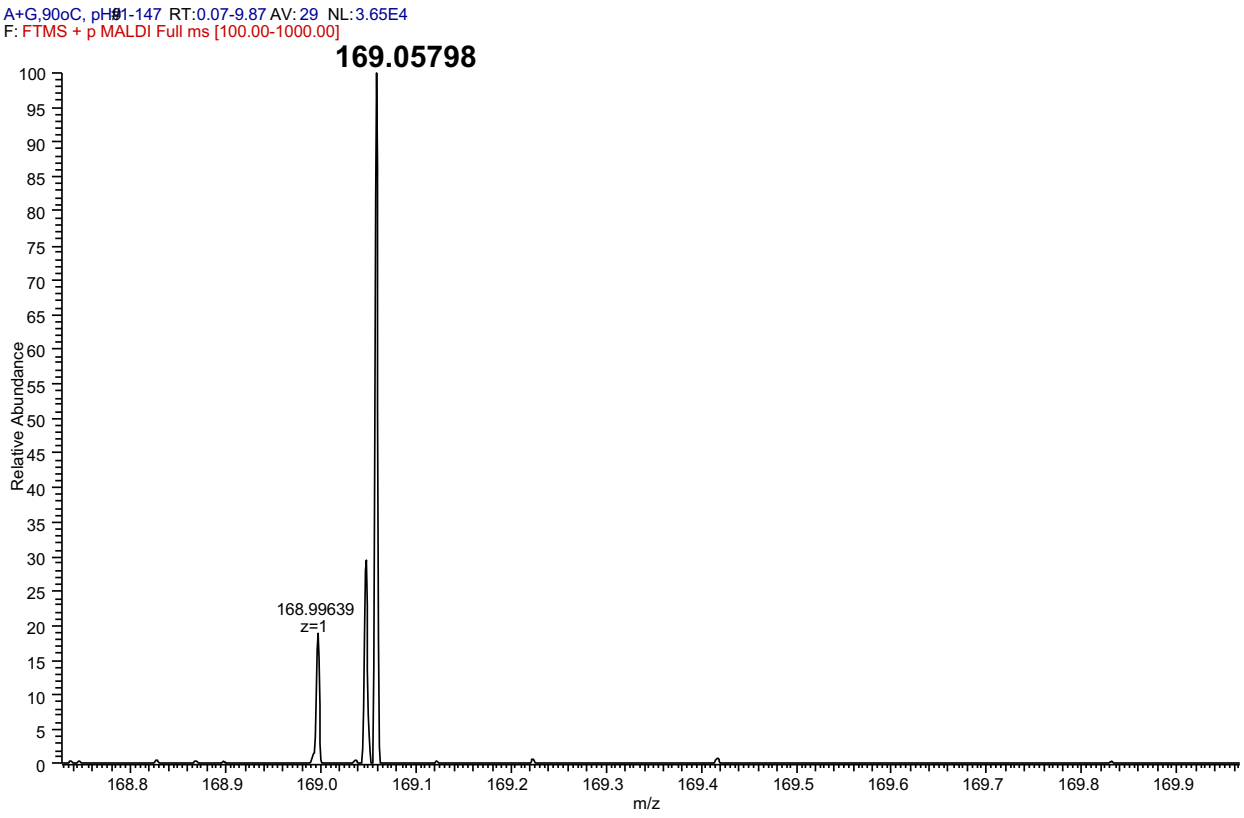

Fig. S47. MS spectra for AG $[M+Na]^+$ oligopeptide.

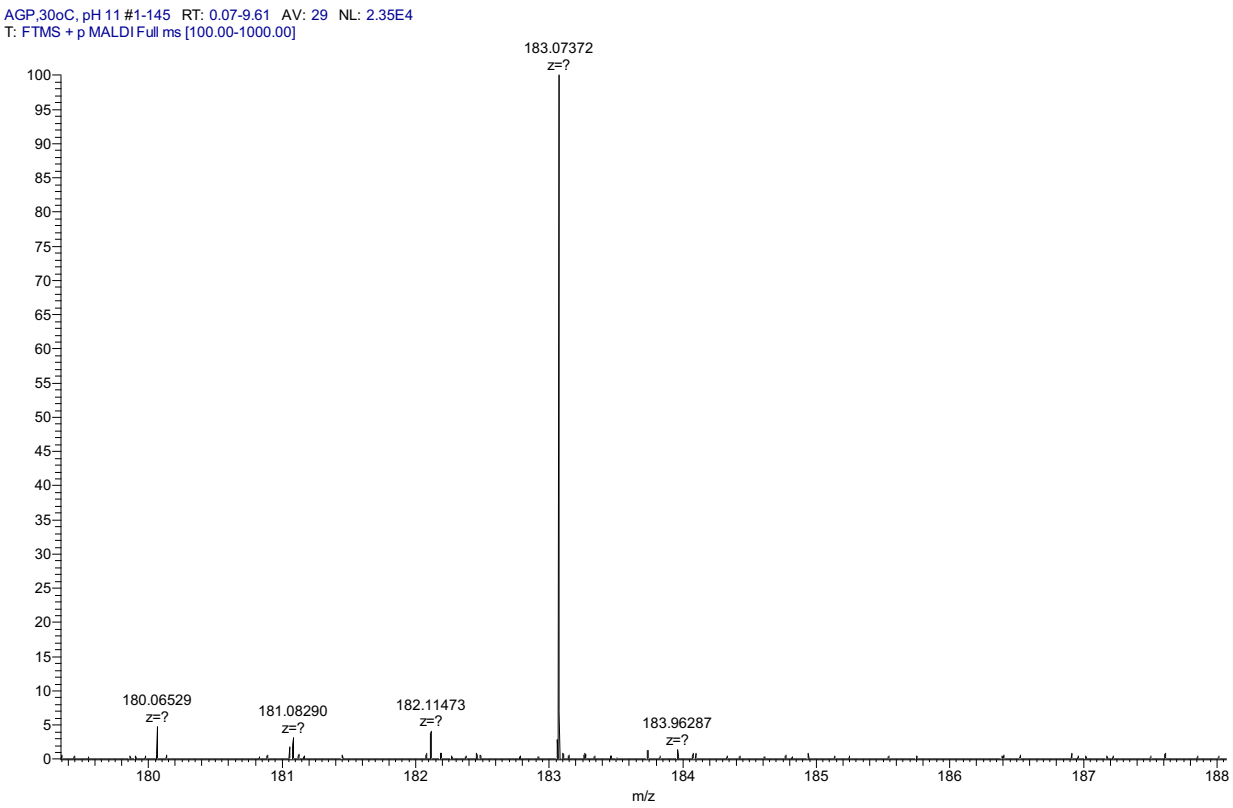

Fig. S48. MS spectra for 2A $[M+Na]^+$ oligopeptide.

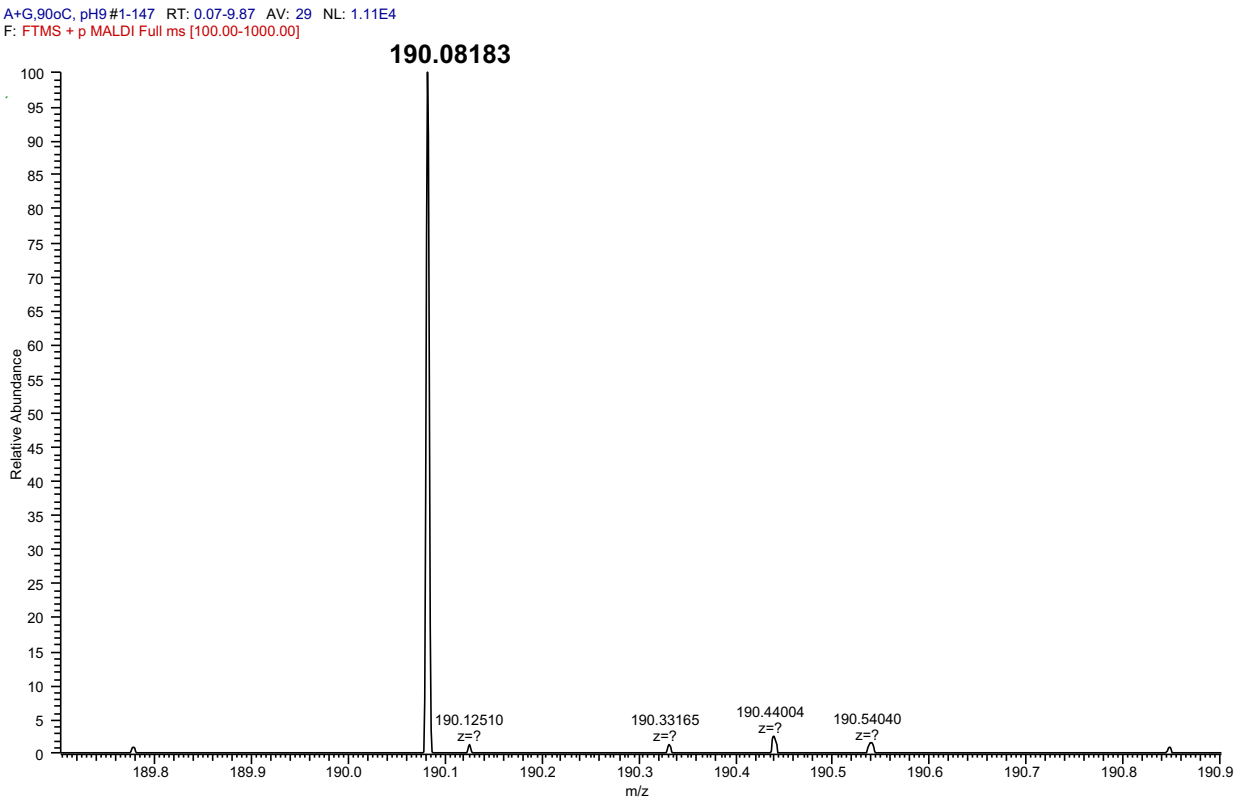

Fig. S49. MS spectra for 3G $[M+H]^+$ oligopeptide.

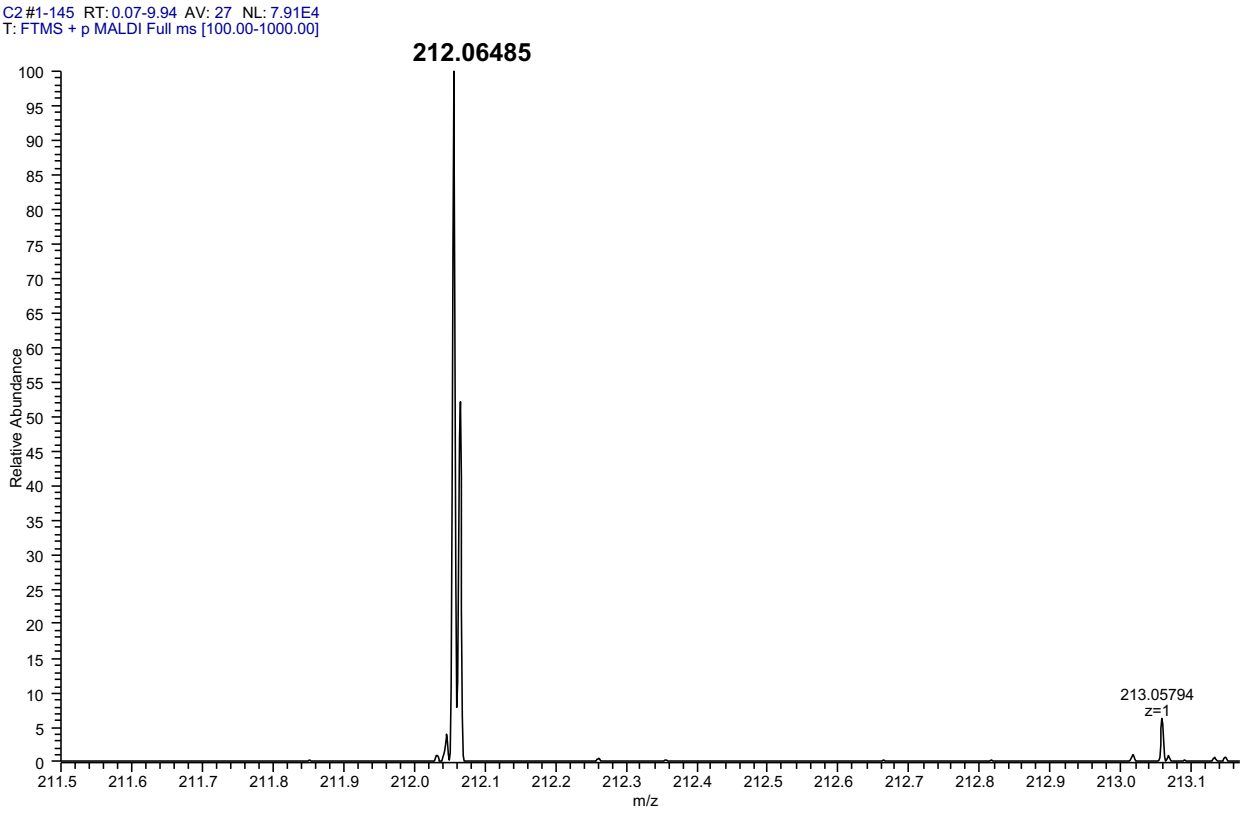

Fig. S50. MS spectra for 3G $[M+Na]^+$ oligopeptide.

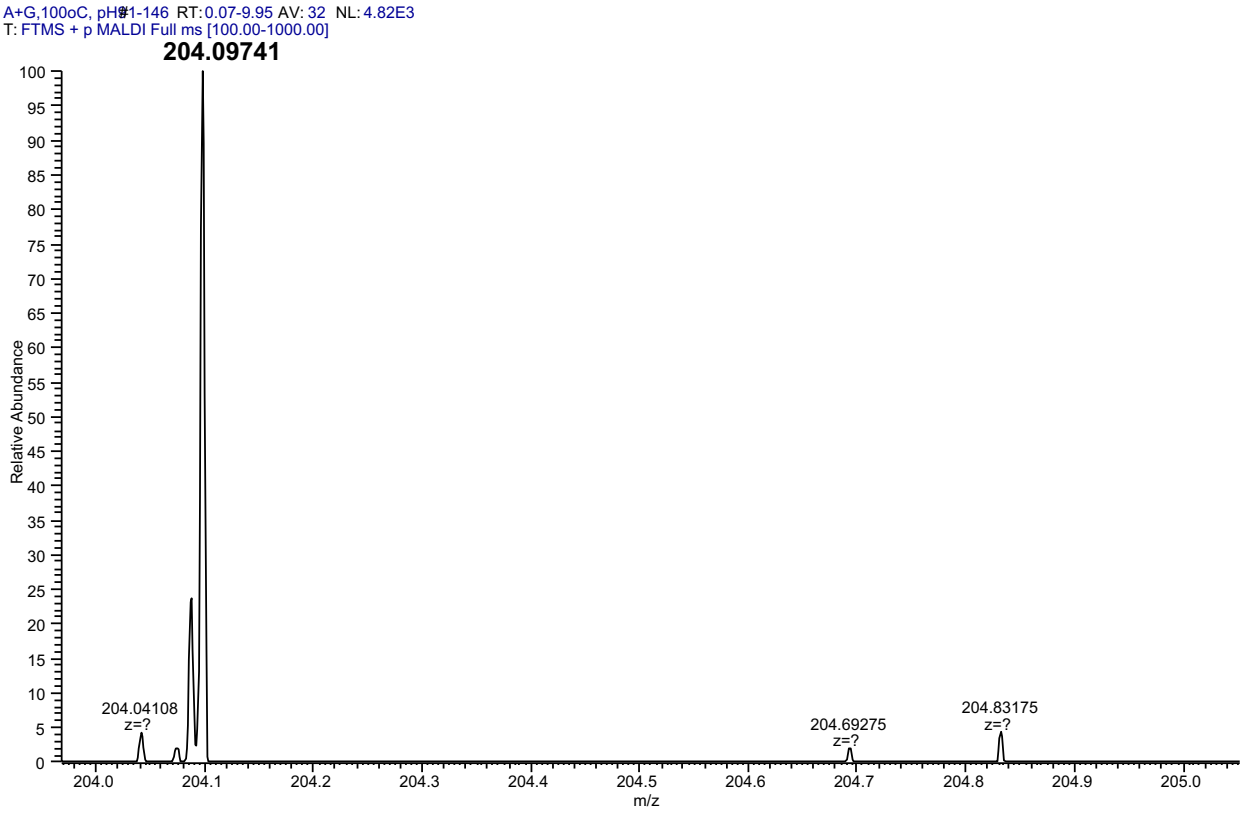

Fig. S51. MS spectra for 2GA $[M+H]^+$ oligopeptide.

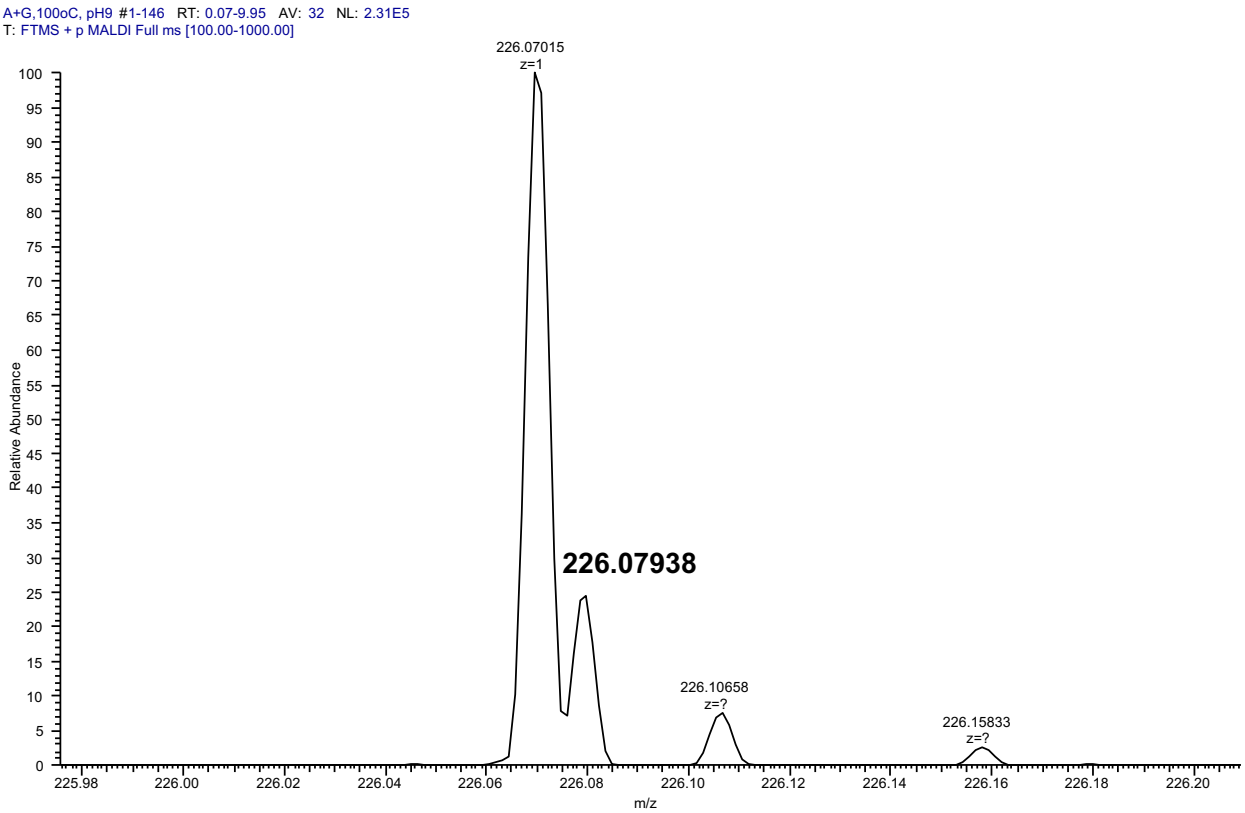

Fig. S52. MS spectra for 2GA $[M+Na]^+$ oligopeptide.

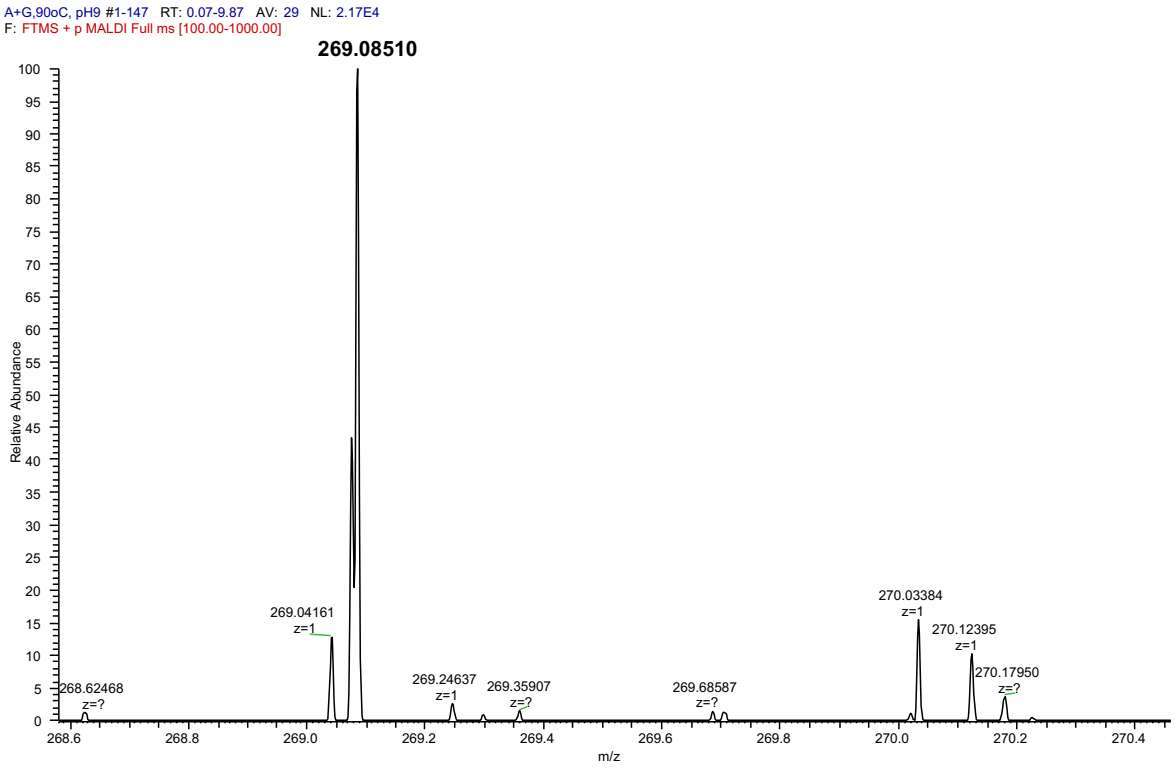

Fig. S53. MS spectra for 4G $[M+Na]^+$ oligopeptide.

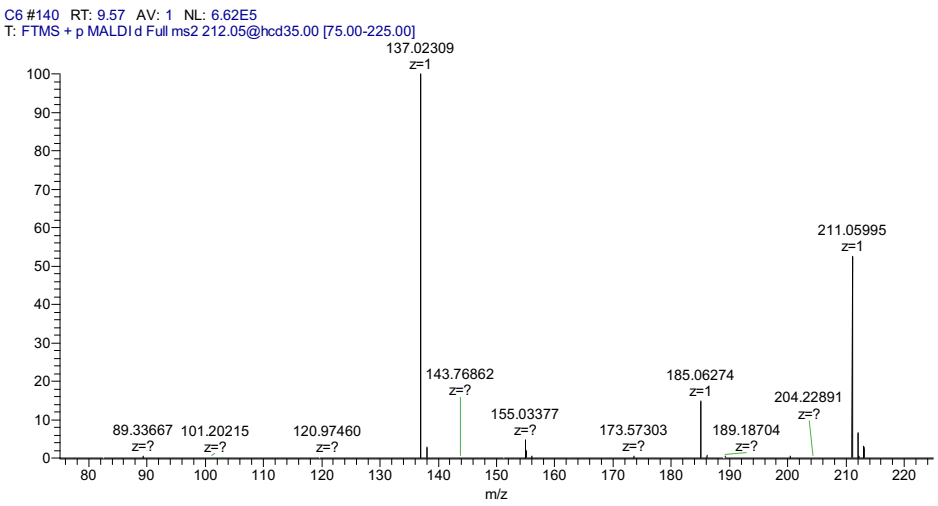

Fig. S54. MS/MS spectra for 3G $[M+Na]^+$ oligopeptide.

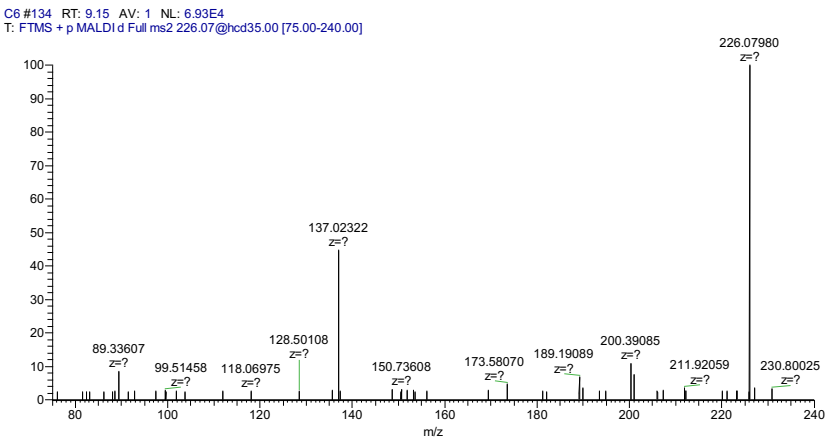

Fig. S55. MS/MS spectra for GGA $[M+Na]^+$ oligopeptide.

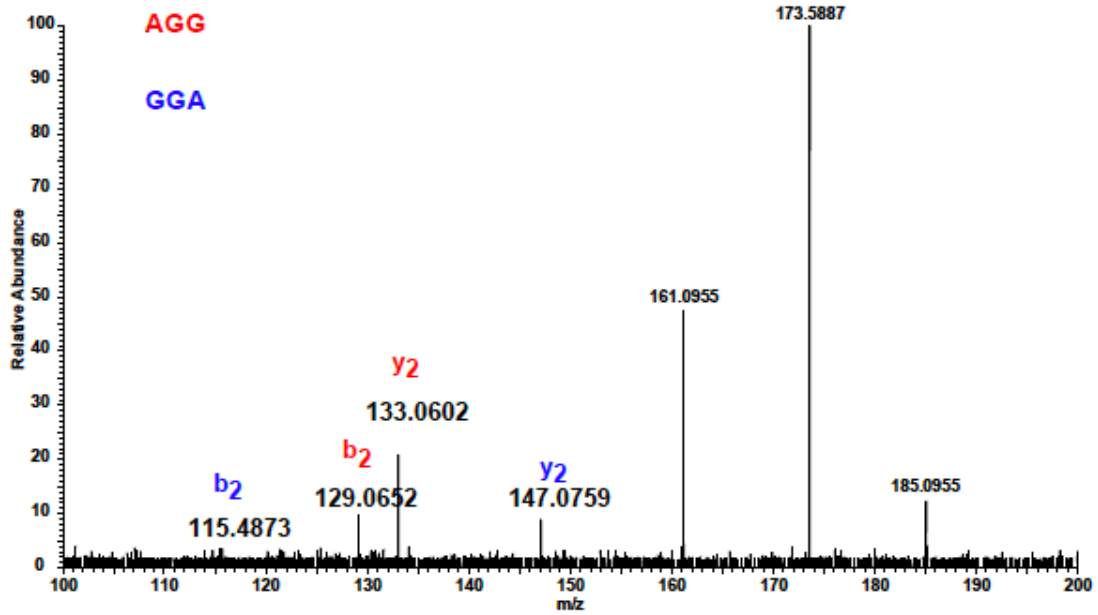

Fig. S56. MS/MS spectra for AGG and GGA $[M+H]^+$ oligopeptide mix.