

Thermal Studies of L, D and β -Alanine

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Introduction

α -Amino acids are generally studied by spectroscopic techniques, to determine their structure and distinguish between L and D forms (Caroline et al., 2009). Their study via thermal analysis is usually combined with other analytical techniques such as FT-IR, MS, HPLC, GC or NMR to identify the products of thermal decomposition (Kumar et al., 2006, Rodante and Marrosu, 1990). It is intriguing to ascertain whether thermal analytical techniques alone can provide useful information about amino acids, in terms of their physicochemical properties, and their techniques ability to distinguish between L and D forms.

Results

TGA experiments were performed with a TGA2950 (TA Instruments), DSC experiments were performed using a DSCQ2000 (TA Instruments). Samples were subjected to various TGA and DSC experiments using different heating rates (2, 5 and 20 °C/min) under a nitrogen atmosphere. A heating rate of 2 °C/min was found to be the most reproducible, and thus, was used for studies of 1:1 mixtures of L/D-Alanine and L/D/ β -Alanine.

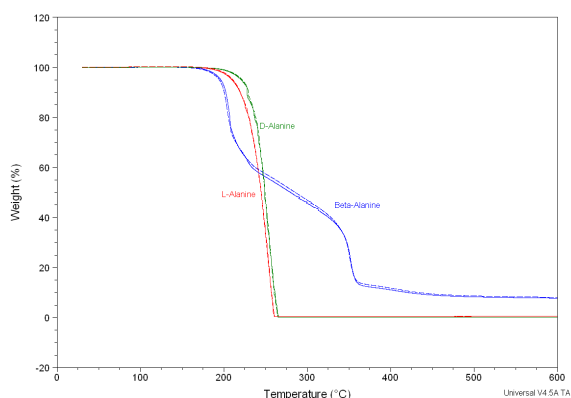


Figure 1. TG of D (Green)/L (Red)/ β (Blue) - Alanine at 2 °C/min

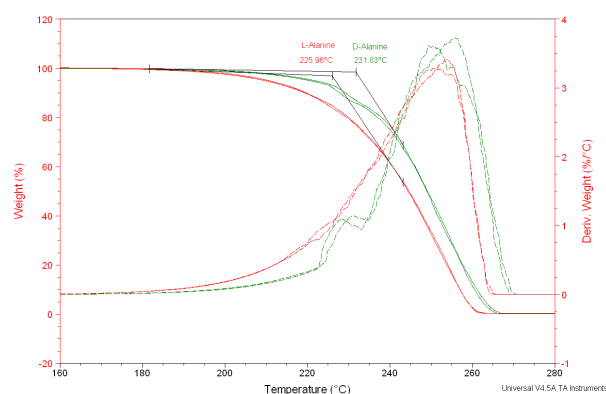


Figure 2. TG/dTG of L (Red)/D (Green)-Alanine at 2 °C/min

Figure 1 shows the TG curves for D/L/ β - alanine at 2 °C/min; D and L-alanine show almost 100% weight loss over the temperature range of 30-300 °C, with no signs of moisture. The sharp weight loss and complete degradation are distinctive of sublimation. β -Alanine shows a distinct two stage weight loss with an onset at 196 °C. A first weight loss of 46.04% and a second weight loss of 45.79% equate to a total mass loss of 91.83%. Figure 2 shows the TG/dTG curves of L/D-alanine at 2 °C/min. There is a subtle but distinct reproducible difference in the TG and dTG curves for L and D-alanine. L-Alanine and D-alanine exhibit onset temperatures of 225.96 °C and 231.83 °C, respectively, showing the L-isomer to be more susceptible to temperature change than the D-isomer.

Conclusion

In conclusion, this study has demonstrated that thermal analysis alone can provide useful information about the physicochemical properties of amino acids, and more importantly, distinguish between structural and stereoisomers.

References

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