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Heats of Dissolution of Thiamine Disulfide-Fatty Acids Complexes in Ethanol*

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The heats of dissolution ($\Delta H_{\rm d}$) of thiamine disulfide (TDS)-fatty acids (FA) complexes, (FA)₆ (TDS), were measured at 310.15 K in ethanol using a calorimetric technique, where the FA are tetradecanoic acid (C14), pentadecanoic acid (C15), hexadecanoic acid (C16), heptadecanoic acid (C17) and octadecanoic acid (C18). The values of $\Delta H_{\rm d}$ were 432.8, 475.0, 493.9, 541.0 and 558.5 kJ mol⁻¹ for (C14)₆ (TDS), (C15)₆ (TDS), (C16)₆ (TDS), (C17)₆ (TDS) and (C18)₆ (TDS), respectively. The values of $\Delta H_{\rm d}$ of (FA)₆ (TDS) increased by increasing the carbon numbers (n) of the constituent fatty acids. However, the plots of $\Delta H_{\rm d}$ of (FA)₆ (TDS) against n showed a zig-zag pattern which indicates an upward convex at an odd-numbered position, while the plots of $\Delta H_{\rm d}$ of FA against n indicate a single line pattern.

The differences between $\Delta H_{\rm d}$ of (FA) $_{6}$ (TDS) and $\Delta H_{\rm d}$ of (6FA+TDS) were 23—37 kJ mol⁻¹ for even-numbered FA and 33—41 kJ mol⁻¹ for odd-numbered FA, indicating a stronger binding force for (FA) $_{6}$ (TDS) formed from odd-numbered FA than those formed from even-numbered FA. Furthermore, the estimated values of the binding force between FA and TDS are very small, leading to a conclusion that (FA) $_{6}$ (TDS) is a clathrate (or an inclusion compound) formed by van der Waals forces and hydrophobic interactions between FA and TDS.

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