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

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The heats of dissolution (ΔH_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 ΔH_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 ΔH_d of $(FA)_6(TDS)$ increased by increasing the carbon numbers (n) of the constituent fatty acids. However, the plots of ΔH_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 ΔH_d of FA against n indicate a single line pattern.

The differences between ΔH_d of $(FA)_6(TDS)$ and ΔH_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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