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Investigating the Catalytic Mechanism of β-Cyclodextrin Dimer in Previtamin D3 Isomerization

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The sigmatropic isomerization reaction of previtamin D3 to vitamin D3, when encapsulated within a dimer of β-cyclodextrin, exhibits a 40-fold enhanced rate compared to its counterpart in an isotropic organic solution [1]. Despite several hypotheses, the exact mechanism by which β-cyclodextrin dimer catalyzes the reaction remained elusive.

We have conducted a rigorous investigation of the isomerization dynamics of previtamin D3 within a β-cyclodextrin dimer through a combination of molecular dynamic simulations and statistical multi-structural transition state theory to address this knowledge gap. Two key programs in the field of Chemical Kinetics, namely *TorsiFlex* [2,3] and *Pilgrim* [4], play a crucial role in facilitating our investigations. *TorsiFlex* allows for an extensive conformational search encompassing both previtamin D and the reaction transition state, while *Pilgrim* enables precise calculations of thermal rate constants within systems comprising multiple conformations.

Our results verify the experimental observations and provide unprecedented insights into the β-cyclodextrin dimer catalytic mechanism.

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References

[1] X. Q. Tian and M. F. Holick, "Catalyzed Thermal Isomerization between Previtamin D3 and Vitamin D3 via β-cyclodextrin Complexation", *J. Bio. Chem.* 270 (**1995**), 8706–8711.
[2] D. Ferro-Costas, A. Fernández-Ramos, "A Combined Systematic-Stochastic Algorithm for the Conformational Search in Flexible Acyclic Molecules", *Front. Chem.* 8 (**2020**), 16.
[3] D. Ferro-Costas, I. Mosquera-Lois, A. Fernández-Ramos, "Torsiflex: an automatic generator of torsional conformers. Application to the twenty proteinogenic amino acids", *J. Cheminform.* 13 (**2021**), 100.
[4] D. Ferro-Costas, D.G. Truhlar, A. Fernández-Ramos, "Pilgrim: A thermal rate constant calculator and a chemical kinetics simulator", *Comput. Phys. Commun.* 256 (**2020**), 107457.

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