

Scientists at DBT's inStem characterized enzyme DMFase which can utilize toxic solvent dimethyl formamide

Collaboration between DBT's Stem Cell Science & Regenerative Medicine (inStem), National Center for Biological Sciences (NCBS), Indian Institute of Technology, Kanpur and Purdue University discovered that certain bacteria have evolved to use DMF as their carbon source with help of some special enzyme called as Dimethyl Formamidase (DMFase) which breaks down DMF. The team recently completed its biochemical characterization and determined the structure of DMFase using cryo-electron microscopy.

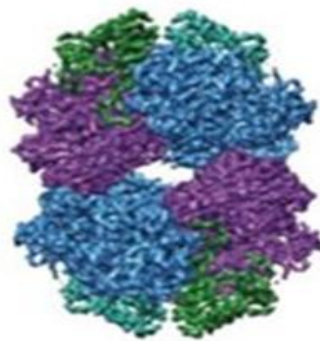


Figure: The tetrameric form of DMFase determined by cryo-EM.

The structure reveals a multimeric protein complex that is made of three new protein folds, and a hitherto undiscovered mono-iron active site. Iron is bound by two tyrosine phenolates and a carboxylate. Its active site is trigonal bipyramidal and strained. By quantum mechanical calculations it was shown that the strain energy at the active site is similar to the reduction in activation energy required to break down this stable bond. Interestingly, the evolutionary origin of the protein folds or active site is still a mystery. However, the work opens up the possibility of exploring ways by which the enzyme can be developed as a bioremediation tool to clean up DMF from the environment.

The collaboration involved the laboratories of Prof. Gurunath at IIT-Kanpur, Prof. Ramaswamy at inStem and Dr Vinoth Kumar at NCBS and leveraged the National Cryo-EM facility at the Bangalore Life Science Cluster.

Dimethyl Formamide (DMF) is a man-made industrial solvent which does not naturally exist in nature. It is one of the most used solvents in chemical and pharmaceutical industry. DMF is used as a solvent for both polar and non-polar compounds. It is thermostable and stable under harsh

chemical conditions. The properties that make it a great solvent also makes it very difficult to break down and responsible for its toxicity.

Links: <https://onlinelibrary.wiley.com/doi/10.1002/anie.202005332>

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