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Modelling non-redox enzymes: Anaerobic and aerobic acetylene hydratase

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Acetaldehyde is the first metabolite produced during acetylene degradation by bacteria either aerobically or anaerobically. Conversion of acetylene into acetaldehyde, ethanol, acetate, and biomass occurs in anaerobic cultures of *Palobacter acetylinicus* or aerobically with *Mycobacterium lacticola, Nocardia rhodochrous, Rhodococcus Al, Bacillus* sp and also with strains like MoAcy 1, MoAcy 2, TueAcy 1, and TueAcy 3 [1]. The first step of the fermentation pathway, the hydration of acetylene to acetaldehyde, is catalyzed by the enzyme, acetylene hydratase. A detailed biochemical assay on these systems showed that the anaerobic strain, WoAcy 1, from *Palobacter acetylinicus* possesses a tungsten-containing acetylene hydratase but the dependency on either molybdenum or tungsten of the aerobic strains could not be biochemically established. Among these, strains like MoAcy 1, and Tue Acy 1, though isolated from aerobic bacteria, require anaerobic conditions and strong reductants to catalyze the hydration of acetylene. In contrast, strains like MoAcy 2 and TueAcy 3 perform similar activity even under oxidising conditions without involving any reducing agent [1]. Based on the biochemical report on the presence of tungsten-pterin enedithiolate ligation in the acetylene hydratase of *Palobacter actylinicus* [2], we have revealed the relevant chemistry prevalent in such enzymatic reactions involving synthetic model compounds [3]. In continuation of our work related to the chemistry of meaningful analogue reactions of pterin containing molybdo- and tungsto-enzymes [4], the present work focuses on the essential difference in reactivity between the isolates from the aerobic and anaerobic strains of native systems by model reactions.

References

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