

Enzyme-based biocatalysts for CO₂ sequestration

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Carbonic anhydrase (CA) is an enzyme that catalyzes reversible hydration of CO₂. It has been recently suggested that this remarkably fast enzyme can be used for sequestration of CO₂, making this a promising alternative for chemical CO₂ mitigation. For its practical application, we developed efficient and economic biocatalysts with high stability, mainly based on a recombinant CA originated from *Neisseria gonorrhoeae* (*ngCA*).

First, we engineered *ngCA* in the periplasm of *E. coli* to promote the economical use of enzymes, thereby creating a bacterial whole-cell catalyst. Next, we developed and characterized bioinspired silica nanoparticle with recombinant *ngCA* autoencapsulated by the silica-condensing R5 peptide fused to the *ngCA*. Finally, we found and characterized thermophilic -CAs originated from *Persephonella marina* and *Thermovibrio ammonificans*, demonstrating their remarkable thermostabilities.