

Development of biocatalysts based on carbonic anhydrase for CO₂ sequestration조병훈[†]

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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 capture. 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. Second, we developed and characterized bioinspired silica nanoparticle with recombinant *ngCA* autoencapsulated by the silica-condensing R5 peptide fused to the *ngCA*. Next, we designed and engineered de novo disulfide bond in *ngCA* in order to improve the thermostability of the enzyme. Finally, we found and characterized thermophilic α -CAs originated from *Persephonella marina* and *Thermovibrio ammonificans*, demonstrating their remarkable thermostabilities.