BIOTRANS
LA ROCHELLE 2023

N°281 / OC / PC
TOPIC(s) : Biocatalytic cascade reactions / Enzyme production, immobilization

Cry1Ab-mediated In Vivo Co-immobilization of Enzymes for the Biosynthesis of Putrescine from L-Arginine

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PURPOSE OF THE ABSTRACT
Putrescine is an important industrial chemical used in the production of polymers. It can be chemically synthesized from propene and methane, but this route is neither environmental-friendly nor sustainable due to its production of the toxic intermediate hydrogen cyanide, and its use of the non-renewable raw material propene.
Another route that has attracted intense academic interest is the biological synthesis of putrescine due to its being renewable, environmentally friendly, and green. The biosynthesis of putrescine in cells has gained great attention, but this route is challenging for large-scale production due to the limited tolerance of cells to putrescine products. One route that avoids this limitation is the in vitro biosynthesis of putrescine, but a platform for immobilizing the enzymes is required.
Here we report the direct co-immobilization of arginase and ornithine decarboxylase as genetic fusions to the crystal-forming protein Cry1Ab. Here arginase promotes the conversion of arginine to ornithine, which is further converted to putrescine by the ornithine decarboxylase. We show that Cry1Ab-mediated direct co-immobilization could produce active particles, which exhibited higher stability than their free enzyme counterparts and improved catalytic efficiency than the mixture of individually immobilized particles. Furthermore, the co-immobilized biocatalyst was shown to promote the conversion of arginine to putrescine for multiple reaction cycles.

FIGURES

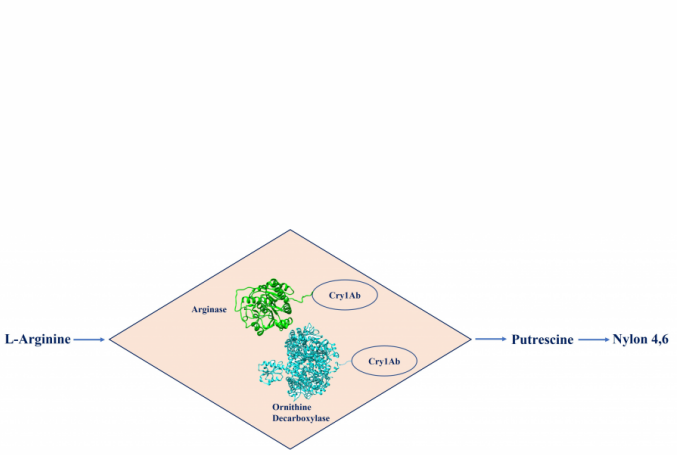

FIGURE 1

Graphic abstract

Arginase and ornithine decarboxylase was directly co-immobilized by Cry1Ab protein in vivo. The active particles could be used to promote the conversion of L-arginine to putrescine and its subsequent conversion to nylon 4,6 was also demonstrated.

FIGURE 2

KEYWORDS

Cry1Ab | putrescine | co-immobilization

BIBLIOGRAPHY

[1] B. Heater, J. Am. Chem. Soc. 2020, 142, 22, 9879-9883.

[2] Q. SUN, Bioconjugate Chem. 2022, 33, 2, 386-396.