Efficient biosynthesis and molecular mechanisms of collagen-based high-value chemicals

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Abstract: Effective and ecofriendly converting biomass to chemicals is important for sustainable engineering due to the increasing environmental concerns and decreasing fossil resources. Amino acids are essential biosynthetic precursors for neomycin and undecylprodigiosin. Collagen peptide (CP), as an abundant renewable nitrogen-contained biomass, have a unique amino acid composition and significant potential for the synthesis of biomedical chemicals. Here, the addition of CP to the fermentation medium for 7 d resulted in a neomycin production of 930 U/mL, representing a 1.68-fold increase compared to the control. Besides, CP considerably accelerated the proliferation of *Streptomyces sp.* SLL-523. We achieved a 7-fold increase in undecylprodigiosin yield and a 10-fold reduction in fermentation time by utilizing CP. Moreover, CP increased the intracellular levels of precursor amino acids, which may contribute to its high contents of the precursors (glycine and proline). Notably, CP efficiently triggered and boosted the expression of key genes in the undecylprodigiosin synthesis pathway, including *redQ*, *redM*, *redN*, and *redL*, leading to highly efficient synthesis of undecylprodigiosin. Therefore, this innovative approach provides a novel framework for the high-efficiency synthesis of biomedical chemicals based on nitrogen-contained biomass.

Key words: Collagen peptide, amino acids, biosynthesis, biomedical chemicals, Sustainability

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