

**Biocatalysis for rare ginsenoside Rh2 production in high level
with co-immobilized UDP-glycosyltransferase *Bs-YjiC* mutant
and sucrose synthase *AtSuSy***

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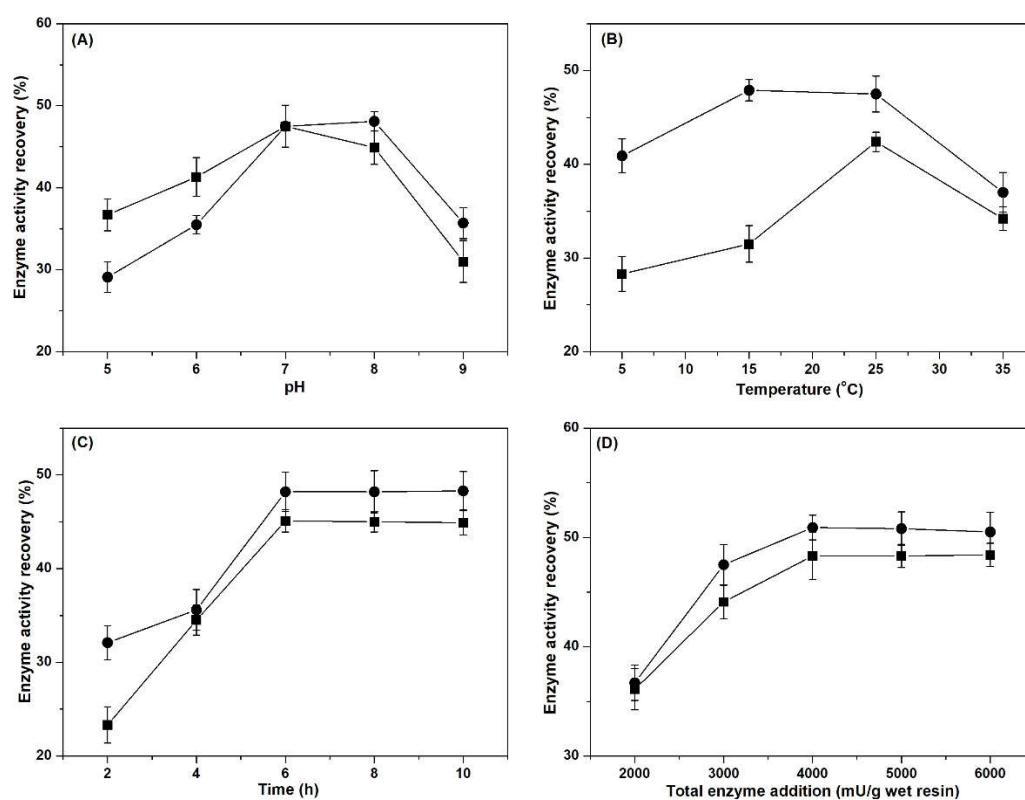


Figure S1 optimization of the adsorbed condition for enzymes of M315F (●) and AtSuSy (■) bound. Influence of pH (A), temperature (B), adsorption time (C) and total enzyme addition (D) on the bienzyme coimmobilization.

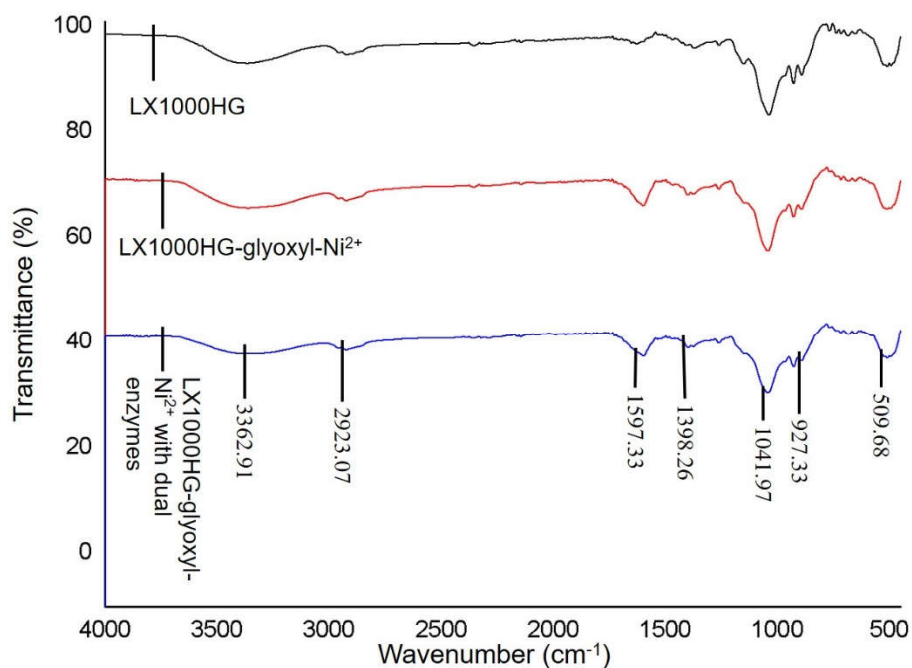


Figure S2 FTIR spectra of resin LX1000HG, LX1000HG-glyoxyl-Ni²⁺ and LX1000HG-glyoxyl-Ni²⁺ with enzymes. The absorption peak 1398 cm⁻¹ are the deformation vibration of -NH- bending of the amide. The enzymes immobilized resin had a characteristic peak at 1597 cm⁻¹, suggesting the enzymes were binding onto the supports.

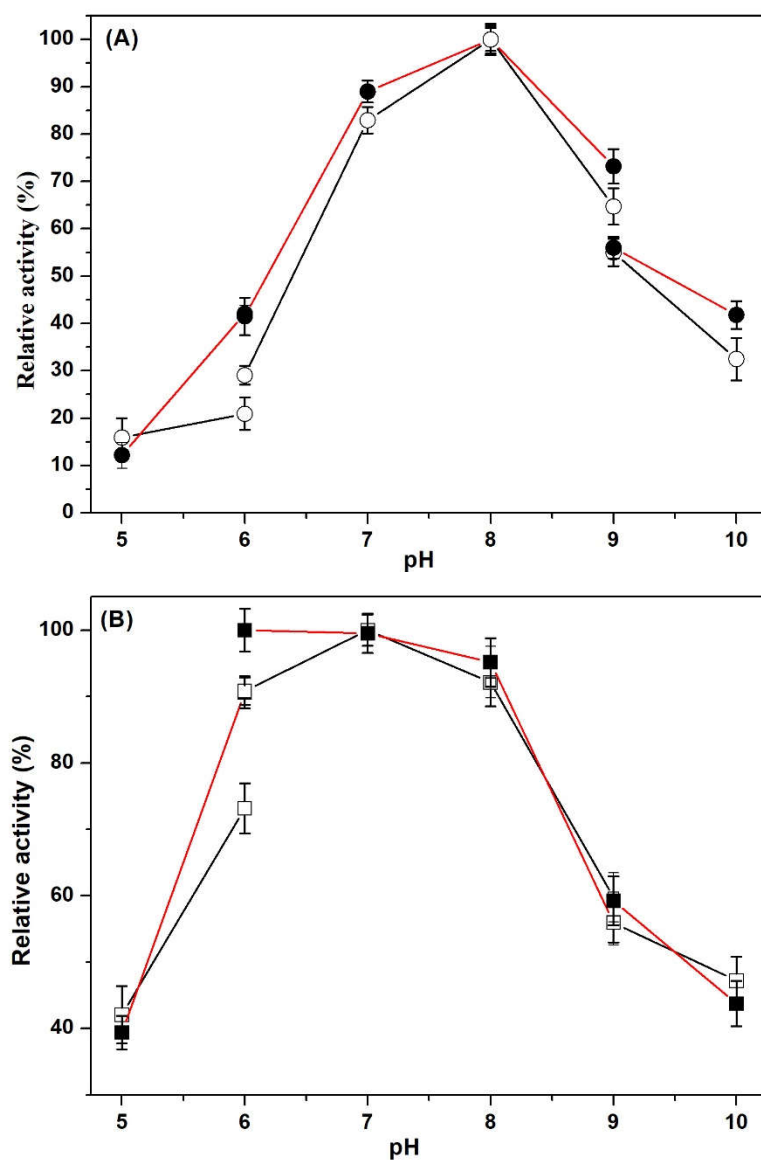


Figure S3 Effect of pH on the activities of free and immobilized enzyme M315F/*AtSuSy*: (A) Effect of pH on the activities of free enzyme M315F (○) and immobilized enzyme M315F (●), and (B) Effect of pH on the activities of free enzyme *AtSuSy* (□) and immobilized enzyme *AtSuSy* (■).

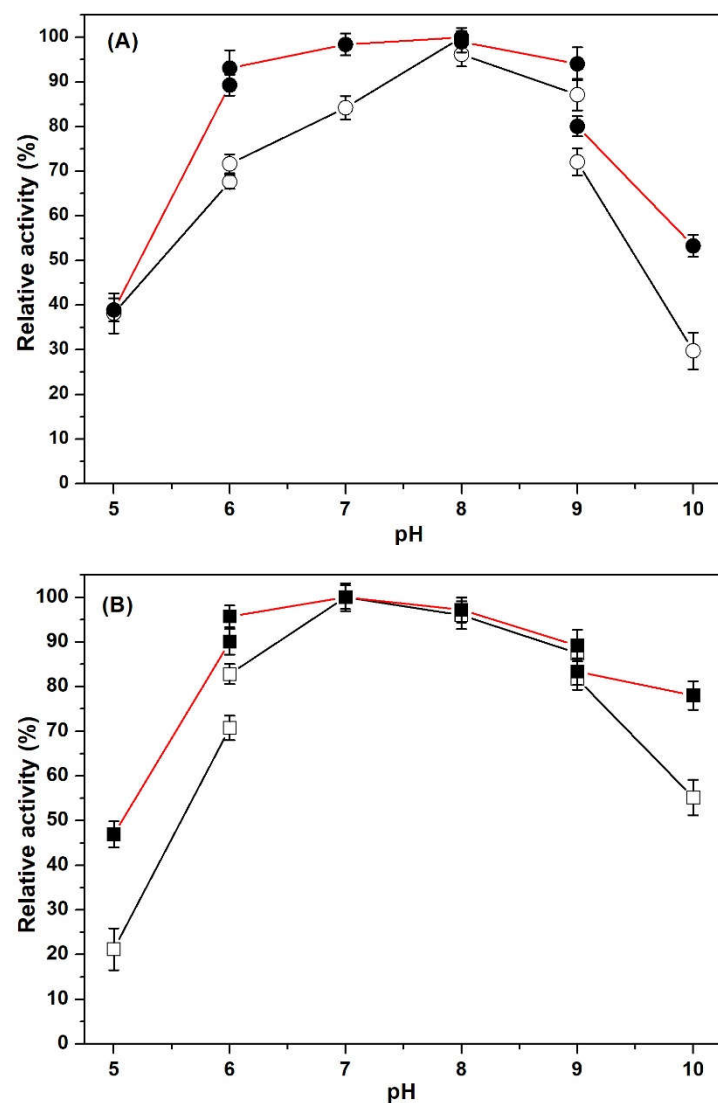


Figure S4 pH stability of free and immobilized enzyme M315F/*AtSuSy*: (A) pH stability of free enzyme M315F (○) and immobilized enzyme M315F (●), and (B) pH stability of free enzyme *AtSuSy* (□) and immobilized enzyme *AtSuSy* (■).

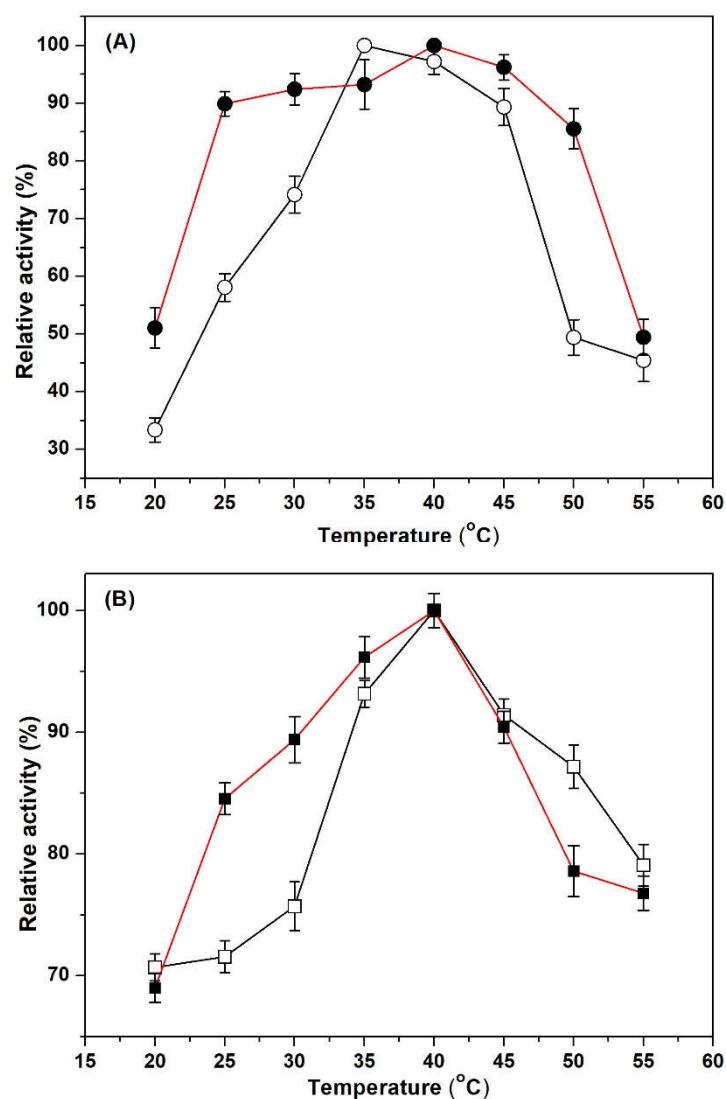


Figure S5 Effect of temperature on the activities of free and immobilized enzyme M315F/*AtSuSy*: **(A)** Effect of temperature on the activities of free enzyme M315F (○) and immobilized enzyme M315F (●), and **(B)** Effect of temperature on the activities of free enzyme *AtSuSy* (□) and immobilized enzyme *AtSuSy* (■).

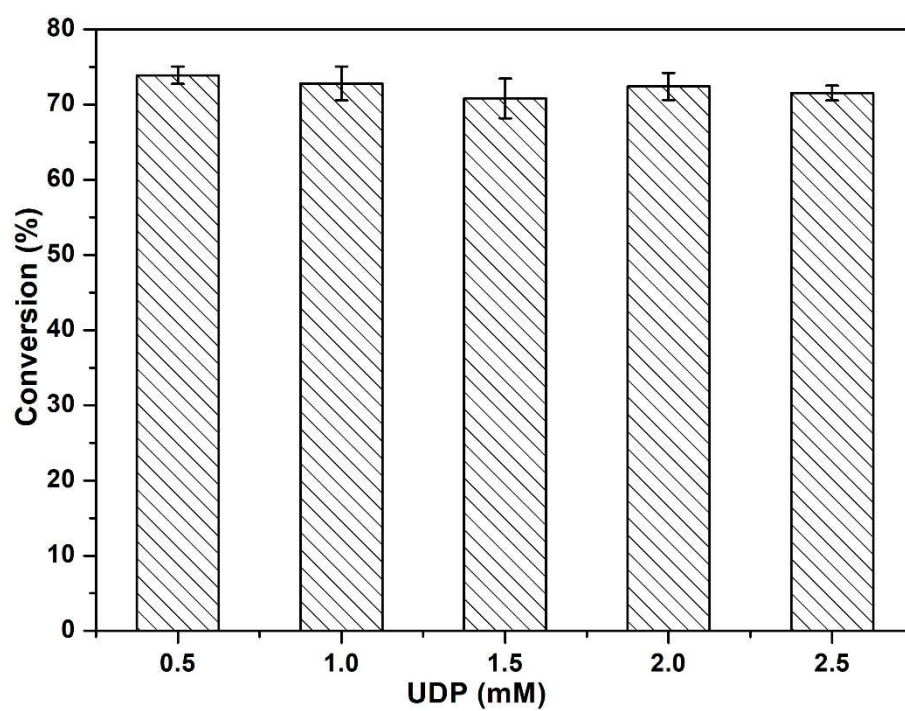


Figure S6 Effect of UDP concentration on the immobilized M315F and *AtSuSy* coupled reactions for Rh2 synthesis

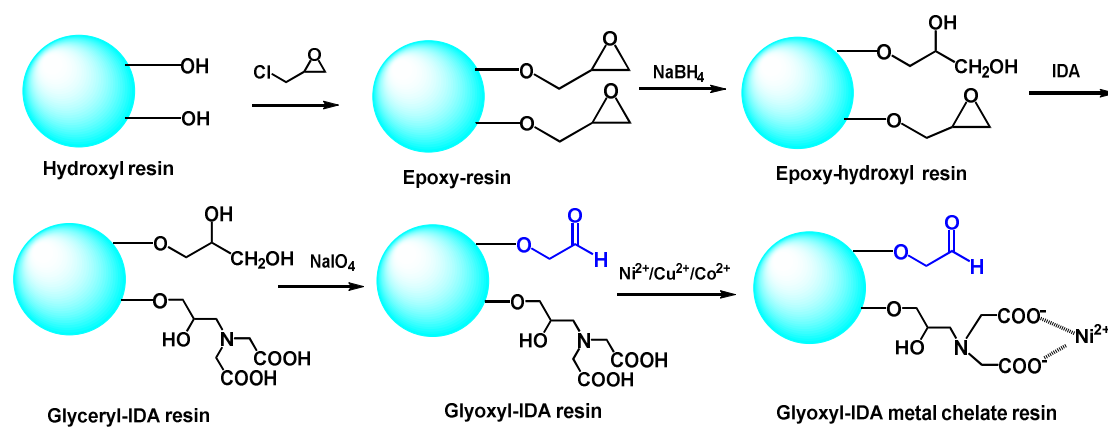


Figure S7 Activation procedure for heterofunctional resin preparation