PREPARATION OF PECTATE LYASE/$Cu_3(PO_4)_2$ HYBRID NANOFLOWER AND ITS CATALYTIC PERFORMANCE AS AN IMMOBILIZED ENZYME

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Biocatalysts could substitute conventional chemical reagents in textile industrial process for green-production process as well as lowering the costs. Alkaline pectate lyases (Pels) are enzymes that could be used in scouring and degumming process, in which the biochemical properties of Pels with high activity and stability under process conditions are of great interests. In our previous studies, an alkaline pectate lyase PEL168 derived from *Bacillus subtilis* 168 was engineered with improved enzymatic performance. The obtained Pel3 mutant presented an increased specific activity of 4.3-fold and extended T_{50} to 330 min. Here, we introduce a facile and rapid method of preparing an immobilized enzyme Pel3-inorganic hybrid nanoflower to increase its biocatalytic efficiency. After evaluating four divalent ions, including Mn^{2+}, Ca^{2+}, Zn^{2+} and Cu^{2+} as inorganic part with PBS buffer, Pel3/$Cu_3(PO_4)_2$ hybrid nanoflower was obtained with improved biocatalytic properties. The optimum temperature and pH of Pel3/$Cu_3(PO_4)_2$ hybrid nanoflower were determined to be 55℃ and pH 9, respectively, exhibiting subtle difference from the free Pel3. However, the Pel3/$Cu_3(PO_4)_2$ hybrid nanoflower maintained 33% total activity after treated at 55℃ in 24 h, while the free Pel3 completely lost its activity in 18 h. Furthermore, the residual activity of the Pel3/$Cu_3(PO_4)_2$ hybrid nanoflowers remain over 50% even after four times of repeatitive utilization, demonstrating its promising stability for practical application.