GREEN AND ONE-POT SYNTHESIS OF COUMARINS VIA KNOEVENAGEL CONDENSATION BY CO-IMMOBILIZED LACCASE AND TEMPO INTO MESOPOROUS SILICA

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The immobilization of laccase provides some improvements such as the biocatalyst stability and reusability which makes it suitable for using in green and sustainable organic synthesis.[1,2] Herein, the development of an efficient bifunctional catalyst was established based on co-immobilization of laccase (an oxidoreductase) and TEMPO (the enzyme mediator) into SBA-15 mesoporous silica (a material containing pores with diameters between 2 and 50 nm). The catalyst showed potential for one-pot synthesis of coumarin-3-carboxylates in aqueous medium under mild condition (Figure 1). A maximal yield was obtained after 10 h incubation at a pH of 6.0 and 45 C. In addition, the reusability of the hybride catalyst was demonstrated preserving 90% of the initial activity after 10 cycles. Effect of organic solvents was also studied and the obtained results showed 10% organic solvent is proper for the organic synthesis catalyzed by the applied bifunctional catalytic system. This study indicated that the proximity of the two catalytic species conferred an enhanced efficiency of synthesis of organic compounds. Co-immobilized catalysts with different functions into mesoporous materials show great promise for creating other hybrid catalysts. This will be important for the future development of cooperative chemo- and biocatalysts that can applied for organic syntheses.

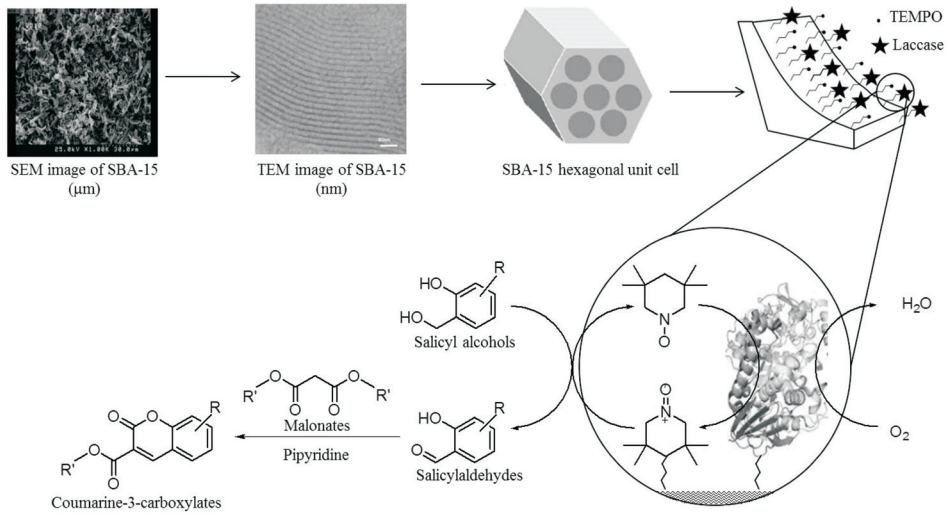

Figure 1. One-pot synthesis of coumarin-3-carboxylates by co-immobilized laccase and TEMPO into SBA-15.

[1] Mogharabi, M.; Faramarzi, M. A. *Adv. Synth. Catal.* **2014**, *356*, 897-927.
[2] Witayakran, S.; Ragauskas, A. J. *Adv. Synth. Catal.* **2009**, *351*, 1187-1209.