American Journal of Pharmacology and Pharmacotherapeutics

Short Communication

Comment on Nanobiocatalyst Advancements and Bioprocessing Applications

Munusamy Thirumavalavan[1*] and Kalpana Settu[2]

[1]*Graduate Institute of Environmental Engineering, National Central University, Chung-Li, 32001, Taiwan, R.O.C*

[2]*Department of Electrical Engineering, National Central University, Chung-Li, 32001, Taiwan, R.O.C*

*Corresponding author e-mail: mtvala@yahoo.com

ABSTRACT

A review on researches entitled "Nanobiocatalyst advancements and bioprocessing applications" reported by Mission et al. in 2014 in Journal of Royal Society Interface (J. R. Soc. Interface 12: 20140891) has verified the significance and wide applications of nanobiocatalysts (NBCs) comprising of nanocarriers and enzymes (immobilized) and concluded that, it has been successfully employed in diverse bioprocess applications.

Keywords: Nanobiocatalysts, Pharmacology applications, Biotechnology.

INTRODUCTION

Nanobiocatalysts (NBCs) is a relatively merging field[1,2] and, since the effects of NBCs are not completely understood, there is a growing concern to explore the role of NBCs for bioprocess and pharmacology applications, including drugs and value addition to primary wastes of bio-products. The design and synthesis of NBCs synergistically combine advance nanotechnology and biotechnology, which is ultimately termed as nanobiotechnology. Various strategies for immobilizing enzymes onto nanocarriers made from polymers, silicas, carbons and metals by physical adsorption, covalent binding, and cross-linking or specific ligand spacers were discussed in details[3].

Advances in biotechnology have witnessed a growing interest in the development of green and sustainable bioprocesses using enzymes as biocatalysts. The exquisite activity, specificity and selectivity of enzymes have made them promising biocatalysts for numerous fascinating applications including bio-catalysis, biosensors, and biomedicine[4,5].

Mission et al. confirmed "Hierarchical nanostructures based on their activity,

functionality and stability play a significant role in improving the performance of immobilized enzymes". Various forms[6-8] of nanocarriers such as nanofibers, nanoparticles and nanocages have been employed to obtain NBCs. They have compiled recent advancement in nanocarriers and NBCs based on polymer silica, carbon and metal based nanoparticles. They have also demonstrated the detailed engineering performance of NBCs with respect to bioprocess applications. The intrinsic characteristics of different NBCs and their activity were mainly discussed.

They have also discussed the significant reusability and process ability of NBCs. A detailed study of various research works on bioprocess applications of NBCs such as carbohydrate hydrolysis, biofuel production and biomass transfer were discussed with valid examples. They have emphasized that the significance integration of enzymes with nanocarriers leads to a hybrid assembly that effectively combines the biocatalytic and specific properties of enzymes with the unique functions within the nanostructure network. Mission et al. claimed that the immobilization of multi-enzymes on the functionalized nanocarriers to form NBC assembly for a continuous process still remains a challenge and they hope that it can be achieved by using nanocomposite materials possessing various functional sites within the same component as nanocarriers.

In this review they have put their extra efforts to combine all significant research works focusing on versatile NBCs for various possible bioprocess applications and thanks to their most valuable work.

REFERENCES

1. Husain Q., Ansari SA., Alam F., et al. Immobilization of *Aspergillus oryzae* beta galactosidase on zinc oxide nanoparticles via simple adsorption mechanism. Int. J. Biol. Macromol. 2011;49:37-43.
2. Datta S., Christena LR., Rajaram YRS. Enzyme immobilization an overview on techniques and support. Biotechnol. Adv. 2012;3:1-9.
3. Rodrigues RC., Ortiz C., Berenguer-Murcia A., et al. Modifying enzyme activity and selectivity by immobilization. Chem. Soc. Rev. 2013;42:6290-307.
4. Illanes A., Cauerhff A., Wilson L., et al. Recent trends in biocatalysis engineering. Bioresour. Technol. 2012;115:48-57.
5. Lopez-Gallego F., Schmidt-Dannert C. Multi-enzymatic synthesis. Curr. Opin. Chem. Biol. 2012;14:174-83.
6. Plessis DM., Botes M., Dicks LMT., et al. Immobilization of commercial hydrolytic enzymes on poly (acrylonitrile) nanofibers for anti-biofilm activity. J. Chem. Technol. Biotechnol. 2012;88:585-93.
7. Wang L., Jiang R. Reversible His-tagged enzyme immobilization on functionalized carbon nanotubes as nanoscale biocatalyst. Methods Mol. Biol. 2011;743:95-106.
8. Tran DT., Chen CL., Chang JS. Immobilization of *Burkholderia* sp. lipase on a ferric silica nanocomposite for biodiesel production. J. Biotechnol. 2012;158:112-19.