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VIRUS- LIKE NANOPARTICLES FOR SMART MEDICINE

Enzyme replacement therapy (ERT) has been used to treat a few of the many existing diseases which originate from the lack of, or low enzymatic activity. Exogenous enzymes are administered to contend with the enzymatic activity deficiency. Nanotechnology has significantly impacted the development of medicine; a significant research effort is currently focused on the use of nanoparticles (NPs) for drug delivery, nonetheless, NPs can also be used as nanocarriers for enzymatic activity. Enzymatic nanoreactors based on enzyme encapsulation inside virus-like particles (VLPs) are excellent delivery vehicles for therapeutic enzymes as they are biodegradable, uniformly organized, and porous nanostructures that transport and can protect the biocatalyst from the external environment without greatly affecting their bioactivity.

On the other hand, endocrine disruptors (EDs) are exogenous compounds with the potential to alter hormonal synthesis and regulation, consequently affecting health and reproduction in animals and humans. On the other hand, the superfamily of cytochrome P450 enzymes (CYP) play important roles in the biosynthesis of steroids and prostaglandins. CYPs are also involved in the detoxification of a wide range of compounds such as pharmaceuticals or chemical pollutants (including EDs), and it has been established that these enzymes produce the initial biotransformation of many EDs.

In this work, we discuss ongoing research being conducted in our lab concerning the use of virus-based enzymatic nanoreactors for the treatment of lysosomal storage diseases, as well as potential therapies for galactosemia. In addition, a bionanoreactor based on the encapsulation of an enhanced peroxygenase CYPBM3 "21B3" inside the capsid of bacteriophage P22 VLPs was designed and characterized. VLPs were covered with glucose oxidase (GOx) in order to generate hydrogen peroxide necessary to activate the transformation of different Eds such as bisphenol A (BPA), nonylphenol (N2), 17 beta-estradiol (E2) and triclosan (TCS).

Keywords

virus, nanoparticles, smart-medicine

Reference

[1] Chauhan K., Olivares-Medina C.N., Villagrana-Escareño M.V., Juárez-Moreno K.O., Cadena-Nava R.D., Rodríguez-Hernández A.G. and Vazquez-Duhalt R. (2022) Targeted enzymatic VLP-nanoreactors with β -glucocerebrosidase activity as potential enzyme replacement therapy for Gaucher's disease. ChemMedChem 17: e202200384

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