

Environmentally-friendly chitosan nanoparticles with GOx as highly-effective antimicrobial agents

김리나, 연경민¹, 유지성, Manab Deb Adhikari, 권석준², 김문일³, Jonathan S. Dordick², 김종배[†]
고려대학교; ¹삼성물산; ²Rensselaer Polytechnic Institute; ³가천대학교

Enzymes can be used as an environmentally friendly alternative to conventional antimicrobials. Glucose oxidase (GOx), hydrogen peroxide (H₂O₂) generating enzyme, is a prime example. Here, we have demonstrated GOx, immobilized chitosan nanoparticles (CS-NPs) for highly effective antimicrobial approach. CS-NPs were prepared, followed by the immobilization of GOx via four approaches of covalent attachment (CA), enzyme coating (EC), enzyme precipitate coating (EPC), and magnetic nanoparticle-incorporated EPC (Mag-EPC). EPC represents an approach consisting of enzyme covalent attachment, precipitation, and cross-linking, with CA and EC being control samples while Mag-EPC was prepared by mixing magnetic nanoparticles with enzymes during the preparation of EPC. Activity of Mag-EPC was about 26-fold higher than that of the CA and 12-fold higher than the EC. Also, EPC and Mag-EPC have 3-fold higher stability than CA and EC. In the presence of glucose, 100% bacterial killing against *S. aureus* was observed in EPC and Mag-EPC after the incubation, while there is no significant bacterial killing with the controls, CA, and EC. This opens up potential applications in many different fields.