Enhancing nanomotor stability: the role of enzymatic protection and immunological safety

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In the last few decades, advancements in nanotechnology have paved the way for harnessing the power of enzymes through their integration with micro- nanoparticles, endowing them self-propulsion features[1–3]. Among these enzymes, **catalase (CAT)** has gained significant prominence due to its intrinsic properties, i.e., high turnover number and dismutation of hydrogen peroxide in water and oxygen bubbles which drive to enhanced motion properties by means of jet-like mechanism or buoyancy effect[4]. Recently they have been successfully applied in biomedical applications[5]. However, the presence of biomacromolecules with high potential to produce immune response hindering its application in clinic. In this regard, **single enzyme nanogles (SENs)** is an emerging technology which provides polymeric mantle around the enzyme protecting them from the media. It has been reported that this technology could increase the enzyme stability against temperature and organic solvents in addition to potential functionalities for further applications [6–8].

Here, we show the synthesis of catalase nanogels **(CAT@NGs)** functionalized with amine groups **(Figure 1)** and its immobilization covalently onto mesoporous silica nanoparticles **(MSNPs)** to fabricate for first time CAT@NGs-based nanomotors **(Figure 2)**. The preliminary results showcased not only the **preservation of catalytic properties** in the CAT@NGs but also upon immobilization we demonstrated its ability to exhibit enhanced self-propulsion at the **single particle** level and **collective behavior (swarm)**.

Furthermore, we propose a future experiment to demonstrate that the CAT@NGs-based nanomotors have the potential to evade immune responses, thereby safeguarding the organism from immunological overreactions.

References

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Figures

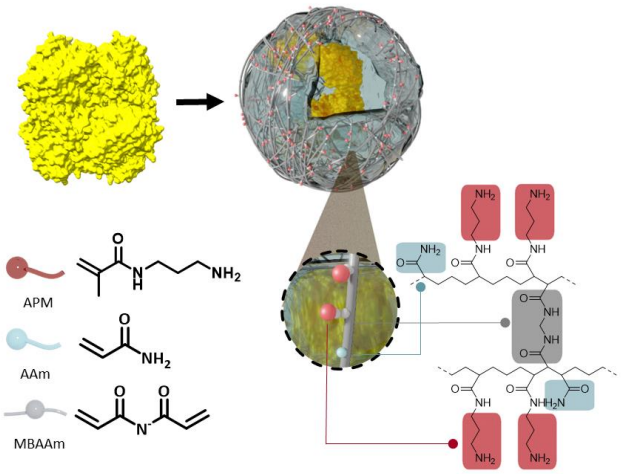

Figure 1. Schematic representation of CAT@NGs. Radical polymerization was performed with the monomers N-(3-aminopropyl)methacrylamide (APM), acrylamide (AAm), and N,N´-Methylenebis(acrylamide) (MBAAm) as a crosslinker to form catalase-based nanogels.

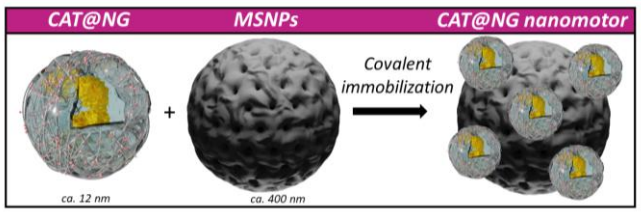

Figure 2. Schematic representation of CAT@NGs-based nanomotors manufacturing. The amines groups provided by CAT@NGs promote the covalent attachment onto MSNPs.