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Nanozymes - High Biological Activity and Broad Applications Spectrum

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Editorial

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Abstract

Artificial enzymes - nanozymes have attracted significant attention last decade due to their unique properties and broad field of applications. With their exceptional catalytic abilities nanozymes have shown promise in biomedical, environmental, and industrial sectors as well. The editorial provides an overview of the potential of the nanozymes, highlighted their high biological activity and great spectrum of applications.

Keywords: Nanozymes; Catalytics; Nanoparticles; Biological Activity

Editorial

In recent years, artificial enzymes, known as nanozymes, have garnered significant attention due to their distinct properties and wide range of potential applications. These nanomaterials exhibit remarkable catalytic capabilities, showing considerable promise across various sectors, including biomedicine, environmental science, and industry. This editorial aims to highlight the vast potential of nanozymes, emphasizing their notable biological activity and the broad spectrum of their uses.

Nanozymes are a class of nanomaterials exhibiting enzymatic catalytic behavior, such as peroxidase-like, catalase-like, oxidase-like, and superoxide dismutase-like activities. Natural enzymes play a crucial role in almost all biological processes, ensuring their occurrence. Recently, the development of non-protein enzyme analogs has emerged as a promising field in bioengineering. Over the past decades, several artificial enzymes have been developed to replace their natural counterparts in various practical applications. With the advancement of nanotechnology, it has been discovered that numerous nanomaterials, including Fe_3O_4, Mn_3O_4, ZnO, CeO_2, and their metal-doped derivatives exhibit enzyme-like activity.

These nanoscale artificial enzymes are classified as a unique group of biomimetics, known as “nanozymes.” Both natural enzymes and conventional inorganic catalysts share similarities. They both accelerate reaction rates that would otherwise occur at a very slow pace. Additionally, they possess the ability to regenerate, returning to their original state after completing a catalytic cycle. However, natural enzymes are generally more efficient in reaction speed compared to artificial catalysts, although they are less stable. In contrast, recent advancements in nanomaterials have

led to the creation of catalysts that rival natural enzymes in performance, and in some cases, even exceed them in certain processes.

Natural enzymes, being predominantly protein-based, are sensitive to reaction conditions, becoming inactive at high temperatures or extreme pH levels. They are characterized by: 1) high substrate selectivity, 2) selectivity in reaction direction, and 3) stereoselectivity. In comparison, artificial enzyme analogs offer several advantages, including lower cost, higher stability across a wide range of pH and temperature conditions, and superior mechanical properties. These features make nanozymes highly promising for various applications in environmental remediation, biosensing, industrial processes, medical and biological fields.

Conclusion

As one can see, very promising nanomaterials - artificial enzymes, nanozymes, which have extraordinary redox properties, require intensified theoretical and experimental research on the creation of new classes of nanozymes. This will lead to increased investment in this area and the large-scale introduction of nanozymes into many areas of human activity.