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NANOCATALYSIS-A BRIEF OVERVIEW

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ABSTRACT

Because of their special qualities, nanocatalysts are employed to accelerate catalytic reactions. It is a better option for catalysis because of features like exposed active sites and a larger surface area than conventional catalysts. Metal, metal oxide, and hybrid nanocatalysts are the three standard categories for nanocatalysts. For example, metal nanocatalysts, such as palladium nanoparticles, have a large surface area and are highly dispersible, which significantly boosts reaction rates. Thus, nanoscale materials can maintain surface tension, optimize atomic shape, and improve atom use, they are more catalytically efficient than their traditional equivalents.

KEY WORDS: Nanoparticles; Catalysis; Biosensing; Nanozyme; Accelerate.

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INTRODUCTION

Researchers in this field use tiny particles called nanoparticles to speed up the chemical reaction process [1]. These nanoparticles range in size from 1-100 nanometers. Because of their tiny size the chemical reactions work more efficiently [2].

Applications of nanocatalysis in nanobiotechnology:

1) Biosensing and Diagnostics:

- Nanozymes which are nanoparticles with enzyme-like properties are used in biosensors to detect specific substances in things like blood, food or water [3].
- Iron oxide nanoparticles, gold nanoparticles and carbon-based nanomaterials help make signals stronger so it's easier to see that what's being detected either by measuring electricity (electrochemical) or by color change (colorimetric) [4].
- These sensors can quickly find things like germs, DNA, proteins, sugar or other toxins [5].

2) Targeted drug delivery:

- Tiny particles such as nano catalysts can help release medicine in a smart way like changes in pH, specific chemicals like redox conditions or enzymes [6].
- These nanoparticles can either breakdown certain substances or produce active molecules that can help treat cancer in more controlled way [7].

3) Antibacterial and Antiviral Agents:

- Nano catalysts are tiny particles that kill viruses and bacteria. They work by creating special molecules that damage the germ outer layer and ultimately kill germ stopping them from multiplying. Silver and copper nanoparticles are nano

catalysts examples that can fight germs [8].

4) Bioremediation and Environmental Biotechnology:

- Nanocatalysts help breakdown harmful waste like chemicals. A special process called catalytic oxidation is used to remove these pollutants. This helps in the cleaning of water and making it safer for the environment and people [9].

The future of nano catalysis in nanobiotechnology is incredibly promising. Here's a concise overview of future plans and directions in this field:

1) Smart Nanozymes for diagnostics and therapy:

- Nanozymes: are artificial enzymes that are more stable and stronger than natural ones [10].
- Cancer treatment: will work on special nanoparticles that target cancer cells and produce substances that kill them [11].
- Health monitoring: nanozymes can be used in devices that track health in real time, like checking blood sugar [12].

2) Environmental bioremediation:

- Breaking down pollutants: special kind of tiny materials can help break down harmful substances like heavy metals, pollutants and microplastics [13].
- Long lasting solutions: some of these tiny materials can even regenerate themselves making them effective for a long time. These tiny helpers can make a big difference in keeping our environment clean [14].

3) Artificial organelle design:

- Scientists are creating tiny artificial organs inside cells that can help with jobs like regulating metabolism and removing

harmful substances. These tiny helpers can also release medicine in a precise way so the medicine works exactly where and when it's needed [15].

4) Green and sustainable solutions:

- Eco-friendly: scientists are working in using natural, biodegradable materials to create catalysts that help with chemical reactions [16].
- Circular economy: this helps turn waste into valuable products hence reducing waste [17].

CONCLUSION

Thus, in the years to come, the potential of nanocatalysis in enabling energy innovations and a circular economy is vast.

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