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Silver nanodots anchored on functional cellulose nanocrystals as sustainable catalysts and antimicrobial agents for environmental applications

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PURPOSE OF THE ABSTRACT

The aggregation of nanoparticles has been shown to significantly reduce the activity of nanomaterials, resulting in inferior catalytic1 and antimicrobial2 performance. Stabilization of unstable nanoparticles onto dispersible and biocompatible carriers is a promising alternative. Cellulose nanocrystal (CNC) is an inexpensive, biocompatible material that has been regarded as amongst the most promising bio-derived nanomaterials3. In this work, CNCs were firstly modified with EDTA groups, followed by in situ generation and anchoring of silver nanodots (AgNDs) on the surface of CNCs through the spontaneous reduction of silver ions by EDTA-modified CNCs. These reactions occurred at room temperature in the absence of stabilizer and reducing agent. The resulting nanohybrids were employed in the catalytic reduction of 4-nitrophenol, which is a common organic pollutant in wastewater. Moreover, the antibacterial activity of the nanohybrids were also investigated based on antibacterial studies using Escherichia coli. The resulting nanohybrids exhibited superior dispersibility and excellent silver size control, which in turn resulted in eight times higher efficiency in the catalytic reduction of 4-nitrophenol, and five times increase in antibacterial activity over pristine silver nanoparticles. The proposed nanocatalysts and antimicrobial agents can significantly enhance the added value of the cellulose resources through an environmentally friendly pathway.

FIGURES

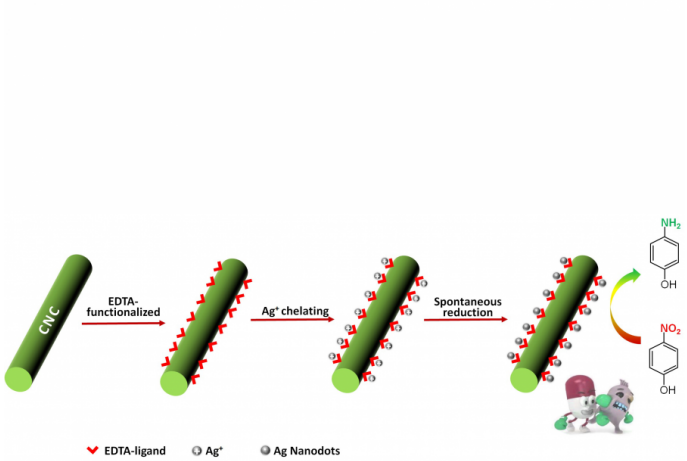

FIGURE 1

Fig. 1

Silver nanodots anchored on functional cellulose nanocrystals as sustainable catalysts and antimicrobial agents for environmental applications

FIGURE 2

KEYWORDS

Silver nanodots | cellulose nanocrystals | sustainable catalysts | environmental applications

BIBLIOGRAPHY