VIDEO ARTICLE

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Assessing Cobalt Nanocomposites For Water Remediation and Antimicrobial Coatings Development

Erwan Rauwel[1,*], Protima Rauwel[1], Kristi Praakle[2], Elisabeth Dorbek-Colin[2], Olga Volobujeva[3]

[1]Institute of Forestry and Engineering, Estonian University of Life Science, Tartu, Estonia

[2]Inst. of Veterinary, Estonian University of Life Sciences, Tartu, Estonia

[3]Dpt. of Materials and Environmental, Tallinn University of Technology, Tallinn, Estonia

*Corresponding author: E-mail: erwan.rauwel@emu.ee

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Abstract

Metallic nanoparticles (MNP), due to their unique properties, spurred a lot of interest. During the last decade, many types of nanomaterials have been developed and widely tested for the water remediation due the present water scarcity problem, and antimicrobial coatings with the recent Covid-19 outbreak. Among them, cobalt MNP and their nanocomposites do not have been extensively studied due to their pyrophoric properties that prevent their easy integration in such applications. The paper focuses more particularly on ultrastable cobalt nanomaterials and their possible uses in the development of solutions to extract heavy metal ions from polluted water and antimicrobial coatings to prevent the spread of pathogens like SARS-Cov-2. Cobalt is a non-cumulative element in human body, and toxicity studies demonstrated their low toxicity against human cells which makes them promising nanomaterials for these applications. To this end, we demonstrated that these NM can magnetically extract metallic pollutants (Pb, Zn, Cu, Fe, Mn, Sn, U and As). To industrialize the technology, we have developed a sand/glass based nanocomposite that exhibits similar extraction properties by a single passage through the filter, and extract contaminants from water with high yield. Many water samples were tested (lake water, well water, oily water, ground water) and even complex pollutants like uranium and arsenic were successfully extracted with a high efficiency. The biocidal properties of cobalt MNP were also evaluated against bacteria (E. coli, Staphylococcus A.), virus (SARS-Cov-2) and fungi (Microsporum canis), and showed a high toxicity against all microorganisms. Co MNP were combined with polymers and the nanocomposites were tested against microorganisms to develop a coating that can prevent the spread of disease. Multiple surfaces were coated like plastic sheets, Eppendorf, computer mouse and the coating showed a real prevention of bacteria and virus survival. For both applications, it was possible to recycle the exhausted nanocomposites after use to promote the development of a circular economy.

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