Employment of a genetically modified bioluminescent bioreporter to assess formation and toxicity of biosynthesized nanosilver

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Abstract:
From both industrial and environmental points of view, production of nanosilver biologically is environmentally friendly compared to physical and chemical methods. As well as, looking for efficient microorganisms able to produce nanosilver in a large amount and short time is one of the priorities of the researchers in this field. In this regard recently, we discovered a strain of yeast could convert silver nitrate to nanosilver in a good amount to be used as a disinfector of water and wastewater. However, to determine if the disinfection effect comes from the use of nanosilver or silver nitrate and to monitor nanosilver formation by the yeast strain, DF4/PUTK2 bioreporter was employed. Previously, the genetically constructed bioluminescent bioreporter DF4/PUTk2 was successfully employed to assess the toxicity of phenolics, polyaromatics, heavy metals, antibiotics, and cosmetics. In the present study, the toxicities of 3.5 mM of silver nitrate, sodium nitrate and potassium nitrate were assessed. Comparing to the control, no bioluminescent inhibition (BI%) was observed with all nitrate species, reflecting the absence of any toxic effect of these substances on the bioreporter. Preparation of the nanosilver particles from the yeast strain was occurred by incubation of the yeast cells with 3.5 mM silver nitrate for five days. The data clearly reported that after 24 h the produced nanosilver particles were able to inhibit the bioluminescence of the bioreporter to ~ 30% and gradually increased to reach 97% inhibition at the end of the experiments (5 days). In addition, the DF4/PUTK2 bioreporter was very sensitive to the presence of nanosilver from 1 to 100 µl. The best contact time gave the best BI% was 25 min with all examined nanosilver concentrations. Out of these results, we conclude that the bioreporter DF4/PUTK2 can assess both formation and toxicity of nanosilver. It could be used as a sensitive, fast and cheap kit in discovering of novel nanosilver bio-factories.

References

1- Sahar Zaki, M.F. El Kady, Desouky Abd-El-Haleem, Materials Research Bulletin, 46 (2011) 1571–1576.

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Figure 1

Illustrate the effect of different concentration of biosynthesized nanosilver on the bioluminescent Acinetobacter bioreporter with time.