Effect of quantum dots on S. oneidensis growth

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Long-term monitoring experiments of microbial growth were performed to determine the effect of exposure of S. oneidensis to QDs compared to exposure to Zn2 + or Cd2 +.

The evolution of the growth curves carried out in the presence of [QDs] at 17.6 ppm in Zn shows that their presence slightly decreases the growth of bacteria over a short duration of exposure (<24h). On the other hand, the exposure for the same duration to Zn2 + or to Cd2 + induces a greater decrease of the growth by toxicity effect.

At longer exposure times (> 24h), the presence of QDs seems to lead to an increase in the growth of S. oneidensis. This observation shows that the environment manages to make it more favorable - than it was - its multiplication. Thus, it seems that the bacterium is gradually reaching the use of QDs as an element of growth. In particular she could find in the POAMA surrounding the shell an additional source of carbon for growth. This hypothesis suggests a biodegradation / superficial alteration of QDs. The biodegradation of QDs by bacterial strains such as E. coli has already been demonstrated by Pathem (2007). Experimentation at different concentrations of QDs (and their equivalences in Zn and Cd) shows that this effect decreases with concentration. Thus a QD concentration of 3.6 ppm Zn leads to a smaller increase in the long-term growth of S. oneidensis. A QD concentration of 0.7 ppm Zn does not completely inhibit this effect.

Beyond 48 hours of exposure, an increase of the growth is also observed in the presence of Zn and Cd. Thus, the toxicity of these two elements seems to have been canceled probably because of their complexation / association with bacterial residues (cells , lysis compounds or exudates). The remaining viable bacteria can then be propagated without disruption by utilizing previously poorly used nutrients in the medium. Growths at 0.2 and 0.7 ppm Cd or Zn, respectively, show the disappearance of toxicity or growth effects of S. oneidensis.