CARBON NANOTUBES AND THEIR EFFECT ON *E. COLI* VIABILITY

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Keywords: Carbon nanotubes, chemical vapor deposition, functionalization, E. Coli, bacterial effect, cells viability.

ABSTRACT

Carbon nanotubes (CNTs) are one of the most appealing nanomaterials with unique physicochemical, mechanical, and electrical properties that find application in many different fields, e.g. biology, medicine and mechanics[1]. Moreover, they have a tremendous increase in commercial interest and subsequent mass production. Hence, it is considered crucial to study and understand the effect of CNTs on living organisms and environment for their proper future use. It has been indicated that CNTs size, surface area, purity and surface chemistry are considered important parameters for the toxicological effect on living organisms. The differences in CNTs properties could be the first reason that explains why the results of their toxic effect on various types of cells are diverse, controversial and sometimes conflicting. Another reason could be the different cell culture media and the different cell types. It is obvious that more studies are needed in order to conclude to specific results about the effect of CNTs on cells.

In the current study, *E. coli* was used as a microorganism model and CNTs, with and without functionalization were tested regarding the viability effect[2]. Generally, there are various ways of CNTs' synthesis in a laboratory scale. In our study, MWCNTs were synthesized via thermal chemical deposition method and two different approaches were used (supported catalyst and floating catalyst approach), resulting in differences in length, diameter size and purity of the produced carbonaceous material. Subsequently, purification with hydrochloric acid and functionalizion of the surface of the obtained CNTs' took place, to compare the toxicity effect and adhesion of pristine and functionalized CNTs on *E. coli* cells. In addition, the effect of different CNTs concentrations on bacteria's viability and their ability to adhere with *E. coli* was determined after different incubation time and conditions.

To conclude, it was observed that the growth rate of *E. cells* after incubation with various CNTs concentrations in a culture medium was lower for the cultures containing lower amount of CNTs compared to control, due to higher dispersion of CNTs in the medium. On the contrary, higher CNTs concentration resulted in no significant effect on *E. coli* growth compared to control due to lower dispersion of CNTs. From the colony-forming unit (CFU) evaluation of control and *E. coli* with different concentrations of CNTs, it was observed that the low CNTs concentration resulted in more substantial reduction of the viable colonies than the medium and highest concentration. Hence it is estimated that the more efficient the dispersion of the CNTs in the medium the higher the effect on cells growth rate. Last but not least, the effect of directly depositing CNTs onto petri dish with the addition of *E. coli* cells was investigated. It was observed that increasing the amount of CNTs, *E. coli* presented lower amount of colonies, indicating possible inhibition in the viability of cells. Hence, it is understood

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that depending on the application of the CNTs there are different mechanisms affecting the growth and/or viability of bacteria.

Acknowledgments

This research is supported by the EU FP7 Project "Low-toxic cost-efficient environment-friendly antifouling materials" (OCEAN) under Grant Agreement no. 612717. AFT acknowledges 'IKY Fellowships of Excellence for Postgraduate Studies in Greece – Siemens Program'.