# Hybrid Suspension of Nanodiamonds-Nanosilica/Titania in Cytotoxicity Tests On Cancer Cell Lines

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*Keywords: nanodiamonds, nanosilica/titania, cytotoxicity, cancer, sarcoma.*

## Introduction

The nanodiamonds (NDs) hold a unique position among biocompatible drug supports and have shown themselves to good advantage to tune the surface active sites and applied approaches. Silica/titania nanoparticles have been proven to exhibit anticancer treatment. Particularly, the necessity of crystalline titania phase is required by its ability to generate reactive oxygen sites (ROS) under X-ray, near infrared (NIR), and/or ultrasound treatment [1-3]. Chemical and colloidal stability of the nanoparticle suspensions under physiological conditions (saline buffers and/or cell cultures) is crucial for their biomedical application since it is allows to maintain the biocompatibility and cure efficiency. The combination of NDs with silica can improve bioactivity of the resulted suspension. However, the information about composition and colloidal stability of such binary suspensions is very limited. For example stability of nanosilica-nanodiamond suspension was studied by Goncharuk *et al.* with dispersion in water only [4]. We report about recent results related to stable hybrid suspension consisting of nanodiamonds and nanosilica/titania mixed oxide (15 wt% of $TiO_2$) in normal saline solution (NSS, 0.9 wt.% NaCl). In this research, the suspension was developed and adapted for anticancer composition tested in the mouse sarcoma (J774.G8) and the ovarian carcinoma (OVCAR 8) cell lines.

## Results and Discussions

The suspension is characterized by a negative interface charge of $\zeta$ = - 28.8 mV. Diluting the suspension with NSS leads the $\zeta$-potential to decrease down to zero (4-times dilution) with a loss of aggregative stability owing to formation of agglomerates ($d \leq 160$ nm) with a monomodal particles size distribution. Dried samples demonstrate a "spongiform" coagulation structure typical for colloidal xerogels (Fig.1a). It provides a proof that liquid phase is confined inside the voids among the agglomerates. After culturing the cell lines J774.G8 and OVCAR8 for 24 hours at varied concentrations of the suspension diluted by cell culture media (0.01% to 0.155 % wt/vol) and analyzing their viability with MTT, no statistically significant toxicity was detected (Fig. 1b,c). Asterisk indicates a significant difference in respect to the control and *ns* is „not significant".

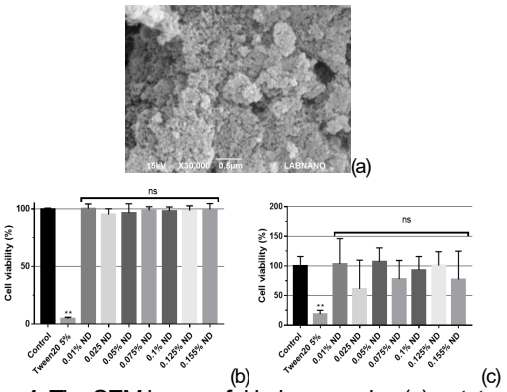


**Figure 1.** The SEM image of dried suspension (a), cytotoxicity results on J774.G8 (b) and OVCAR8 (c) cell lines at different concentrations of NDs-nanosilica/titania suspension.

## Conclusions

The suspension containing nanodiamonds is instantiated by the stability due to the combination with silica/titania nanocomposite which are carriers of active component (titania) to produce reactive oxygen sites. The cytotoxicity tests have shown low toxicity of the hybrid suspension for the mouse sarcoma cell line J774.G8 and the ovarian carcinoma cell line OVCAR 8. Our results show that the hybrid nanomaterials we developed are suitable for biomedical application and particularly for sonodynamic therapy for cancer treatment.

## Acknowledgements

The authors are grateful to the CAPES (№ 2013037-31005012005P5 – PNPD-PUC Rio) for receiving funds to carry out the research. The authors thank LabNano (Brazilian Center for Research in Physics, CBPF) for continued assistance in the microscopy studies.

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