

Biocompatibility and antibacterial activity of Carbon dots in vitro

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Carbon dots (CDs) are quasi-spherical carbonaceous nanoparticles less than 20 to 60 nm constituted by sp^2 - sp^3 core and an irregular surface rich of polar functional groups that confers intriguing and tunable physico-chemical properties [1]. They display brilliant and excitation wavelength dependent photoluminescence, aqueous dispersibility, easy synthetic and functionalization conditions [2]. Recently great attention has been paid to the CDs, due their variegated physical-chemical properties that makes them appealing for multiple biomedical application. In this work we assessed the biocompatibility of sustainable CDs prepared, according to Sawalha et al method [3], recycling the discard of olive oil production. Firstly, the physico-chemicals properties of new synthesized CDs were evaluated. HRTEM analysis performed on the produced CDs confirm their presence with a range from 5 to 25 nm, UV-Vis spectroscopy showed broadband UV absorption and fluorescence spectroscopy an excitation wavelength dependent photoluminescence. Cell imaging displayed that CDs are mainly located in proximity of the cell membrane. Lastly, we assessed the biological properties of CDs. Biocompatibility studies were performed on two osteoblastic cell lines (U2-OS and hFOB) after 24 and 48 h of CDs incubation. Antibacterial activity was evaluated on a Gram+ bacterial strain *S. aureus*, after 24 h of culture in presence of CDs. Our results showed that Carbon dots exhibit a good biocompatibility up to 240 $\mu\text{g/mL}$, while at 360 $\mu\text{g/mL}$ become cytotoxic. Differently, antibacterial assays showed that the bactericidal activity is slight at 240 $\mu\text{g/mL}$, but become more important at the concentration of 360 $\mu\text{g/mL}$. These results on CDs biosafety get the base for their promising application for biomaterial engineering. Further experiments may be performed for surface nano-functionalization obtaining new materials with CDs physico-chemical properties exploitable for many bio-applications.

References

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