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Carbon dots as radiosensitizers in tumor treatment.

Sabrina Conoci
University of Messina, ChiBioFarAm Department, Viale Ferdinando Stagno d'Alcontres, 31 - 98166 Messina
sabrina.conoci@unime.it

In the last decade nanotechnology became decisively in the biomedical research and carbon-based nanomaterials are among those most promising in a plethora of bio-applications [1]. In particular, Carbon Dots (CDs) that are the youngest member of this family are carbonaceous nanoparticles less than 20 to 60 nm with an irregular surface rich of polar functional groups that confers intriguing chemical properties [2]. Aqueous disperdibility, brilliant photoluminescence and good biocompatibility together with easy synthetic procedures make these nanomaterials appealing systems for multiple biological applications.

In particular, they are very promising material for new approaches in cancer application [3]. In this context, radiotherapy is largely used for tumor treatment. However, its effectiveness is highly dependent on the patient specific answer [4] and also side effects can be relevant since the dose levels of ionizing radiations can largely damage adjacent normal tissue [5].

Therefore, currently great efforts are made to develop effective and biocompatible radiosensitizers. A Nano-radiosensitizer is an ideal material to improve radiotherapy due to its high degree of tumor tissue uptake and secondary electrons or radical production.

In this work, surface oxygenated CDs prepared from olive solid waste (CDs-B) [6] have been fully characterized and investigated as radiosensitizers in tumor treatment. The enhanced radio-sensitization effect of CDs-B at different dose irradiation was studied on two cellular cancer lines, Human Osteosarcoma (U-2 OS) and Lung Carcinoma Steam Cells (LCSC) and the possible involved mechanism was preliminarily investigated. Data show for the first time that CDs-B in synergy with ionizing radiation could noticeably inhibits cells proliferation and improve apoptosis at irradiation dose level lower than standard treatment. This is mainly due to the production of reactive oxygen species (ROS) by CDs-B in combination with irradiation. This study indicates that the CDs-B are new promising nano-radiosensitizers for tumor radiotherapy paving the way for innovative treatments of tumors.

Reference

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