5. *Shah Z.A., et al. // Phytochem. Lett., 2016.– №17.– P.107–113.*
6. *Lindroth R.L., et al. // Oecologia, 1987.– №70.– P.144.*
7. *Richtmyer N.K., et al. // J. Am. Chem. Soc., 1934.– №56(11).– P.2495–2497.*
8. *Rayavarapu S., et al. // Sci. Rep., 2017.– №7.– 8309.*
9. *Belyanin M.L., et al. // Carbohydr. Res., 2012.– №363.– P.66–72.*

DATES PIT DERIVED CARBON NANODOTS INDUCE DNA DAMAGE

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Abstract

Carbon Nanodots (c-dots), as a type of "green" nanoparticle, can be widely applied in medical diagnosis, imaging and drug delivery because of its biocompatibility, fluorescence, and low cost. Recently food derived carbon nanoparticles demonstrated selective cancer cell growth inhibition, showing a potential as anti-cancer drugs [1, 2]. However, the detailed mechanisms of c-dots effect on cancer cell proliferation need further study.

Use the techniques such as western blotting, flow cytometry, cell viability assay, immunofluorescence (IF) microscopy, ROS assay, fluorescence absorbance measurements and Nanodrop spectrometer, the DNA damage in PC3 cells was detected by increased Gamma-H2AX protein upon treatment with date pits nanodots (D-c-dots) drug with cell-cycle dependent foci formation at G2/M phase. Moreover, D-c-dots induced changes in the levels of RAD51 and PARP-1 proteins, generation of reactive oxygen species (ROS), cell cycle arrest at the checkpoint, significant increase in total apoptotic PC3 cells than normal cells NRK and early apoptosis by Annexin V assay showed similar in PC3 and NRK cells. In addition, D-c-dots decreased pH of PC3 cells in culture suggesting an effect of nanoparticles on the acidity of the cancer cells. In vitro binding assay showed that D-c-dots decreased absorbance of DNA at 260 nm. Upon direct incubation with double strand DNA (dsDNA), D-c-dots absorbance spectra was also shifted, demonstrating the binding of nanoparticles to the dsDNA results in bi-directional effect on each other. Meanwhile, quantum mechanical calculation will be performed to study the interaction between dsDNA and D-c-dots and its pH dependence.

Consistent experimental results suggest that Date pits derived Carbon Nanodots induce DNA damage of cancer cells through interaction with dsDNA. Further analysis of mechanism demonstrated inhibition of cell growth through selective cell cycle arrest and increased apoptosis with pH changes. Thus, dates derived c-dots show potential as an efficient and low cost nano drug for cancer therapy.

Reference

1. *Xie Yingqiu, et al. "Inhibition of Cancer Cell Proliferation by Carbon Dots Derived from Date Pits at Low-Dose." ChemistrySelect 2.14 (2017): 4079–4083.*
2. *Xie Yingqiu, et al. "Dysregulation of YAP by ARF Stimulated with Tea-derived Carbon Nanodots." Scientific reports 7.1 (2017): 16577.*