Organic nanoparticles, more lethal to tumours

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Radiotherapy used in cancer treatment is a promising treatment method, albeit rather indiscriminate. Indeed, it affects neighbouring healthy tissues and tumours alike. Researchers have thus been exploring the possibilities of using various radio-sensitizers; these nanoscale entities focus the destructive effects of radiotherapy more specifically on tumour cells.

In a study published in *EPJ D*, physicists have now shown that the production of low-energy electrons by radio-sensitizers made of carbon nanostructures hinges on a key physical mechanism referred to as plasmons - collective excitations of so-called valence electrons; a phenomenon already documented in rare metal sensitizers. This reseach was conducted by Alexey Verkhovtsev, affiliated with the MBN Research Center in Frankfurt, Germany and A.F. Ioffe Physical-Technical Institute in St Petersburg, Russia and an international team.

Nanoparticle radio-sensitizers are nanoscale compounds, typically composed of rare metals such as coated gold, platinum, or gadolinium. Alternatives sensitizers could be made of carbon-based nanostructures, such as fullerenes or nanotubes, provided they are biocompatible and non-toxic. Previous studies have revealed that gold and platinum nanoparticles produce a large number of electrons via the plasmon excitation mechanism. In the case of a carbon nanoparticle, this phenomenon yields electrons with higher energy than pure metals, thus inducing greater biological damage.

In this study, the authors analysed the spectra of secondary electrons emitted from a carbon nanoparticle composed of fullerite, a crystalline form of C60 fullerene, irradiated by an ion beam consisting of fast protons. They quantified the electron yield in a broad kinetic energy range, using several different theoretical and numerical approaches. They found that a medium with an embedded carbon nanoparticle results in a number of low-energy electrons several times higher than that emitted by pure water. This may lead to the development of novel types of sensitizers composed of metallic and carbon-based parts.

More information: "Comparative analysis of the secondary electron yield from carbon nanoparticles and pure water medium," *Eur. Phys. J. D* 69: 116, DOI: 10.1140/epjd/e2015-50908-y

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