Novel gold nanocomplex for cancer drug delivery

We are trying to design a system that can release the drug more efficiently, says Chitra Mandal (left).

Using gold nanoparticles coated with a simple organic molecule (porphyrin), researchers from CSIR-Indian Institute of Chemical Biology, Kolkata, have designed an efficient drug nanocarrier. The nanocarrier was found to effectively deliver doxorubicin (anti-tumour drug) to the nucleus of the diseased cell and bring about programmed cell death.

Porphyrin was armoured on the gold nanosurface via continuous stirring method. “Porphyrin is a simple organic compound and it gives the necessary protection and stability to the nanosurface. Porphyrins are essential co-factors in many human proteins such as hemoglobin and so it can escape from the macrophages in our body,” explains Dr. Nakul C. Maiti, Senior Scientist at the Structural Biology and Bioinformatics Division of CSIR-IICB and one of the corresponding authors of the paper published in *ACS Omega.*

The porphyrin molecule was found to be uniformly distributed on gold nanoparticles and the porphyrin–gold complex was stable.

The anti-tumour drug doxorubicin was then successfully loaded on the porphyrin–gold nanosurface. “Doxorubicin is selectively released when it reaches the low-pH environment seen in cancerous cells,” explains Kaushik Bera, research scholar at the institute and one of the first authors of the paper.

Activity of the complex

Its activity was then tested on brain and lung cancer cells and normal healthy cells. The porphyrin–gold complex without the drug showed no toxicity to healthy and cancerous cells. The nanoparticles coated with the drug showed very low toxicity to normal cells and caused programmed cell death both in brain and lung cancer cells.

Multidrug resistance is one of the major barriers in cancer cells, where the drug is quickly ejected out, reducing the effective drug concentrations within the cells and thus decreases its sensitivity.

“We found that the drug-coated nanoparticles were retained well inside the cells thus showing higher activity,” says Samarpan Maiti, another research scholar at the institute and one of the first authors of this paper in an email to *The Hindu.*

“There are several pathways by which the drug can damage the DNA. Currently we are studying the pathways, and trying to design a system that can release the drug more efficiently. We are also studying how the system works in real scenario of tumour model,” says Prof. Chitra Mandal from the Cancer Biology & Inflammatory Disorder division of this institute and one of the corresponding authors of the paper.

The quadrivalent vaccine will have two A virus strains — H1N1 and H3N2 — and two B virus strains — Victoria and Yamagata

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