

## **Morphological changes and cellular uptake of functionalized graphene oxide loaded with protocatechuic acid and folic acid in hepatocellular carcinoma cancer cell**

### **ABSTRACT**

The development of nanocomposites has swiftly changed the horizon of drug delivery systems in defining a new platform. Major understanding of the interaction of nanocomposites with cells and how the interaction influences intracellular uptake is an important aspect to study in order to ensure successful utilisation of the nanocomposites. Studies have suggested that the nanocomposites' ability to permeate into biological cells is attributable to their well-defined physicochemical properties with nanoscale size, which is relevant to the nanoscale components of biology and cellular organelles. The functionalized graphene oxide coated with polyethylene glycol, loaded with protocatechuic acid and folic acid (GOP-PCA-FA) nanocomposite intracellular uptake was analysed using transmission electron microscope. The accumulation of fluorescent-labelled nanocomposites in the HepG2 cell was also analysed using a fluorescent microscope. In vitro cellular uptake showed that there was uptake of the drug from 24 h into the cells and the release study using fluorescently tagged nanocomposite demonstrated that release and accumulation were observed at 24 h and 48 h. Moreover, the migration ability of tumor cells is a key step in tumor progression which was observed 48 h after treatment. The GOP serves as a potential nanocarrier system which is capable of improving the therapeutic efficacy of drugs and biomolecules in medical as well as pharmaceutical applications through the enhanced intracellular release and accumulation of the encapsulated drugs. Nonetheless, it is essential to analyse the translocation of our newly developed GOP-PCA-FA, and its efficiency for drug delivery, effective cellular uptake, and abundant intracellular accumulation would be compromised by possible untoward side effects.

**Keyword:** Graphene oxide; Protocatechuic acid; Cellular uptake; Drug delivery system