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Nanoclay materials as the instrument to reduce the toxicity of graphene oxide

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The relevance of graphene oxide (GO) toxicity studies is associated with an increasing number of publications about the use of graphene oxide as a system for drug delivery. However, there is information about the toxicity of graphene oxide for living objects. In this regard, the search for methods and agents that reduce the toxicity of graphene oxide is relevant. The practical use of nanoclay kaolin in the production of ceramics is widely described as well as its use as a sorbing agent. It is known that both silica and aluminum, which have a positive charge at low pH values, are found on kaolin edges. The use of nanoclay is expected to increase in the future due to its ability to improve the functional properties of materials. In this study, we report on the ability of natural nanoclay to reduce the toxic effect of graphene oxide during their co-incubation with eukaryotic cells for 24 hours. A colorimetric viability test and flow cytometry method were used to show a decrease in the toxic effect of graphene derivative on proliferation and induction of apoptosis in mammalian cells with addition of graphene oxide along with kaolin. Enhanced dark-field microscopy was used to visualize the interaction of nanoparticles with cells.The results of the analysis showed that after the introduction of graphene oxide, the proportion of cells in apoptosis exceeds 9%, which suggests the realization of the toxic effect of graphene through apoptosis. The toxic effect of graphene can be associated with exposure to the membrane as well as due to the internalization of GO. Kaolin had no toxic effect on the cells and the features of this variant are comparable with the control. Interestingly, the combined addition of kaolin and graphene reduced the toxic effect of the latter, and the proportion of cells in apoptosis decreased significantly. Thus, graphene oxide has been shown to induce apoptosis in rat skin fibroblasts and to reduce proliferative activity in human colon carcinoma cells (HCT116).

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