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A review of toxicity studies on graphene-based nanomaterials in laboratory animals

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Abstract

We summarized the findings of toxicity studies on graphene-based nanomaterials (GNMs) in laboratory mammals. The inhalation of graphene (GP) and graphene oxide (GO) induced only minimal pulmonary toxicity. Bolus airway exposure to GP and GO caused acute and subacute pulmonary inflammation. Large-sized GO (L-GO) was more toxic than small-sized GO (S-GO). Intratracheally administered GP passed through the air-blood barrier into the blood and intravenous GO distributed mainly in the lungs, liver, and spleen. S-GO and L-GO mainly accumulated in the liver and lungs, respectively. Limited information showed the potential behavioral, reproductive, and developmental toxicity and genotoxicity of GNMs. There are indications that oxidative stress and inflammation may be involved in the toxicity of GNMs. The surface reactivity, size, and dispersion status of GNMs play an important role in the induction of toxicity and biodistribution of GNMs. Although this review paper provides initial information on the potential toxicity of GNMs, data are still very limited, especially when taking into account the many different types of GNMs and their potential modifications. To fill the data gap, further studies should be performed using laboratory mammals exposed using the route and dose anticipated for human exposure scenarios.

Keywords: Biodistribution; Graphene; Graphene oxide; Graphene quantum dots; Graphene-based nanomaterials; Inflammation; In vivo; Reduced graphene oxide; Toxicity.

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