

## Graphene Oxide-induced Neurotoxicity Affecting Locomotive Behavior and AFD Neurons through Oxidative Stress in *Caenorhabditis elegans*)

에쁜꼬마선충의 산화적 스트레스를 통한 행동변화 및 AFD 신경세포에 영향을 미치는 그래핀 산화물의 신경독성 연구

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예쁜꼬마선충의 산화적 스트레스를 통한 행동변화 및 AFD 신경세포에  
영향을 미치는 그래핀 산화물의 신경독성 연구  
(Graphene Oxide-induced Neurotoxicity Affecting Locomotive  
Behavior and AFD Neurons through Oxidative Stress  
in *Caenorhabditis elegans*)

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### Abstract

Graphene oxide (GO) and graphene-based nanomaterials have been widely applied in recent years, but their potential health risk and neurotoxicity potentials remain poorly understood. In this study, the effects of GO on neurotoxicity and the underlying molecular and cellular mechanism were investigated using the nematode, *Caenorhabditis elegans*. After exposure to GO, acute tissues were deposited in the head region, and reactive oxygen species (ROS) generation and oxidative stress were both significantly increased in GO-exposed *C. elegans*. The neurotoxic potential of GO was investigated, focusing on neuronal activity using AFD sensory neurons and locomotive behavior. GO exposure significantly degraded locomotor behavior, and modulated several neurotransmitters like dopaminergic, glutamatergic and other biogenic amines, AFD neuronal genes and genes associated with body morphogenesis, reproductive, feeding behaviors and other important metabolic pathways. The present study confirmed the neurotoxicity inducing behavioral deficits and neural damage in GO-exposed nematodes. These findings provide useful information to understand the toxic potential and safe application of GO and other graphene-based nanomaterials. This work was supported by the Mid-career Researcher Program (2017R1A2B3002242) through the National Research Foundation of Korea (NRF) funded by the Ministry of Science and ICT.

**Keywords:** *Caenorhabditis elegans*, Graphene oxide, Neurotoxicity, AFD neurons, Locomotive behavior