

Functionalized Fullerenes as ife Stimulant **Biomass** and **Extension Agent**

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OPPORTUNITY

Since their discovery in 1985, C60 fullerenes have been among the most widely studied and used carbon-based nanomaterials due to their unique structural and electronic properties that enable numerous industrial, electrical and medical applications. Compared with the pristine form, functionalized fullerenes have more potential applications due to their enhanced water solubility. Functionalized fullerenes have been reported to reduce oxidative stress by scavenging reactive oxygen species and have been examined for their antioxidant properties. Conversely, C60 fullerene and its watersoluble derivatives have been the subject of concern because of their rapidly growing production and potential environmental and health implications. One heavily studied functionalized fullerene is the polyhydroxy fullerene (PHF, also named fullerol or fullerenol), wherein the fullerenes are decorated with 12-42 hydroxyl groups per molecule leading to enhanced solubility.

As the global production of fullerenes and their derivatives is growing rapidly, fullerenecontaining products will inevitably enter various environmental theatres during their production, deployment and disposal, it is critical to identify the potential impacts of this nanomaterial in ecological systems and impact on humans.

PRODUCT

Cleveland Clinic Researchers have found that an "effective amount' of polyhydroxy fullerenes is capable of stimulating an increase in biomass by stimulating the growth, lifespan and/or reproduction of organisms such as fungi, algae, plants, and other

aquatic organisms. The results showed that PHF had no acute or chronic negative effects on the freshwater organisms. Conversely, PHF could increase the algal culture density over controls at higher concentrations and extend the lifespan and stimulate the reproduction of Daphnia. The current innovation opens new uses in the potential applications of PHF, e.g., in biofuel production and aquaculture, thereby influence the mechanisms of growth stimulation and life extension by PHF (Fig. 1)



Fig 1. Effects of polyhydroxy fullerenes (PHF) on growth and/or lifespan.

PRODUCT

Polyhydroxy fullerenes (PHF) as a biomass and life extension agent.

VALUE PROPOSITION

- Fullerenes effective at low levels.
- Can be applied to the organisms as unformulated particles, solutions, formulated liquid or solid composition, slurry of particles, or emulsion

DEVELOPMENT STAGE

Proof of concept established

INTELLECTUAL PROPERTY

U.S. Patent Granted US 9,399,756

RELATED PUBLICATIONS

Gao, Jie et al. "Polyhydroxy fullerenes (fullerols or fullerenols): beneficial effects on growth and lifespan in diverse biological models." PloS one vol. 6,5 (2011)

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