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Acute exposure to C60 fullerene damages pulmonary mitochondrial function and mechanics

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Abstract

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C60 fullerene (C60) nanoparticles, a nanomaterial widely used in technology, can offer risks to humans, overcome biological barriers, and deposit onto the lungs. However, data on its putative pulmonary burden are scanty. Recently, the C60 interaction with mitochondria has been described in vitro and in vivo. We hypothesized that C60 impairs lung mechanics and mitochondrial function. Thirty-five male BALB/c mice were randomly divided into two groups intratracheally instilled with vehicle (0.9% NaCl + 1% Tween 80, CTRL) or C60 (1.0 mg/kg, FUL). Twenty-four hours after exposure, 15 FUL and 8 CTRL mice were anesthetized, paralyzed, and mechanically ventilated for the determination of lung mechanics. After euthanasia, the lungs were removed en bloc at end-expiration for histological processing. Lung tissue elastance and viscance were augmented in FUL group. Increased inflammatory cell number, alveolar collapse, septal thickening, and pulmonary edema were detected. In other six FUL and six CTRL mice, mitochondria expressed reduction in state 1 respiration [FUL = 3.0 ± 1.14 vs. CTRL = 4.46 ± 0.9 (SEM) nmol O_2/min/mg protein, p = 0.0210], ATP production (FUL = 122.6 ± 18 vs. CTRL = 154.5 ± 14 μmol/100 μg protein, p = 0.0340), and higher oxygen consumption in state 4 [FUL = 12.56 ± 0.9 vs. CTRL = 8.26 ± 0.6], generation of reactive oxygen species (FUL 733.1 ± 169.32 vs. CTRL = 486.39 ± 73.1 nmol/100 μg protein, p = 0.0313) and reason ROS/ATP [FUL = 8.73 ± 2.3 vs. CTRL = 2.99 ± 0.3]. In conclusion, exposure to fullerene C60 impaired pulmonary mechanics and mitochondrial function, increased ROS concentration, and decrease ATP production. © 2020 Informa UK Limited, trading as Taylor & Francis Group.

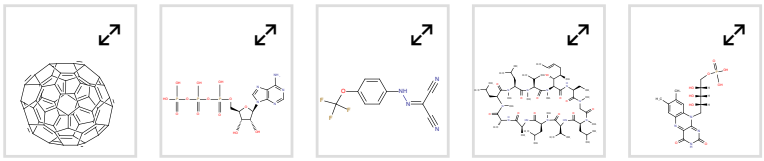
SciVal Topic Prominence

Topic: Fullerenol | Gd@C82(Oh)22 | Pristine (C60)

Prominence percentile: 97.293

Chemistry database information

Substances



Author keywords

alveolar collapse | ATP production | Fullerene C60 | lung mechanics | mitochondrial function | reactive oxygen species

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