

徐雯,江俊康,杨北平,梅德清,戴兵.不同粒径汽车尾气颗粒物对A549细胞毒性作用的比较[J].环境科学学报,2013,33(12):3407-3412

不同粒径汽车尾气颗粒物对A549细胞毒性作用的比较

Comparison of the toxic effects in A549 cells induced by automobile exhaust particulates with different sizes

关键词: [汽车尾气颗粒物](#) [粒径](#) [人肺癌上皮细胞](#) [细胞毒性](#)

基金项目: [国家自然科学基金 \(No.50976051\)](#); [交通运输部联合科技攻关项目 \(No.2009-353-332-280\)](#); [江苏省交通运输厅科技创新攻关计划项目 \(No.10Y25\)](#)

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摘要: 讨论并比较了不同粒径汽车尾气颗粒物对人肺癌上皮细胞A549的毒性作用.通过采样器MOUDI分级捕获不同粒径的汽车尾气颗粒物,再分别以0、50、100、200、400 $\mu\text{g} \cdot \text{mL}^{-1}$ 的浓度及不同粒径的尾气颗粒物对A549细胞染毒48 h,然后用四甲基偶氮唑盐比色法检测颗粒物对细胞活力的影响,用乳酸脱氢酶(LDH)释放法测定细胞膜完整性的改变,用超氧化物歧化酶(Super oxide dismutase, SOD)及丙二醛(Malondialdehyde, MDA)试剂盒测定细胞的氧化应激水平及氧化损伤.结果显示:染毒浓度为50 $\mu\text{g} \cdot \text{mL}^{-1}$ 时,各粒径染毒组与对照组,以及各粒径染毒组之间细胞生存率的差异均不显著($p>0.05$);染毒浓度为100~400 $\mu\text{g} \cdot \text{mL}^{-1}$ 时,与对照组相比,各粒径汽车尾气颗粒物均以剂量依赖的方式引起细胞存活率降低($p<0.05$);同一染毒浓度下,PM_{0.18-1.00}组抑制细胞增殖的能力、破坏细胞膜完整性的能力及引起胞内氧化应激水平升高的能力均显著强于PM_{1.00-3.20}组,其中,PM_{0.56-1.00}组毒性最大.与对照组相比,各粒径染毒组胞内MDA含量均上升($p<0.05$),其中,PM_{0.56-1.00}组胞内MDA含量最高,其他粒径染毒组彼此之间的MDA含量差异不显著($p>0.05$).因此,汽车尾气颗粒物可抑制A549细胞增殖功能,破坏细胞膜的完整性,引起细胞氧化应激及膜脂质的过氧化损伤.不同粒径汽车尾气颗粒物对细胞的损伤作用有所差异,PM_{0.18-1.00}的毒性强于PM_{1.00-3.20},而PM_{0.56-1.00}的毒性又强于PM_{0.18-0.56}.

Abstract. This study investigated and compared the toxic effects in human lung adenocarcinoma cells A549 induced by automobile exhaust particulates with different sizes. Automobile exhaust particulates were captured by MOUDI according to their sizes. A549 cells were treated with automobile exhaust particulates with different sizes for 48 h at 0, 50, 100, 200 and 400 $\mu\text{g} \cdot \text{mL}^{-1}$, respectively. 3-(4,5-Dimethylthiazol-2-yl)-2,5-diphenyltetrazolium bromide (MTT) assay was performed to detect cell viability rate, and LDH releasing was used to examine the change of cytomembrane integrity. The alteration of intracellular super oxide dismutase (SOD) and malondialdehyde (MDA) were determined by SOD kit and MDA kit, respectively. Results showed that at the concentration of 50 $\mu\text{g} \cdot \text{mL}^{-1}$, there were no significant differences of the cell viability from either the two exposed groups or the control groups ($p<0.05$); Compared with the control group, the cell viability significantly decreased with a dose-dependent manner from 100 $\mu\text{g} \cdot \text{mL}^{-1}$ to 400 $\mu\text{g} \cdot \text{mL}^{-1}$ ($p<0.05$); PM_{0.18-1.00} were more effective in inhibiting cell viability, in damaging cytomembrane integrity, and in ascending the level of intracellular SOD than PM_{1.00-3.20}, with PM_{0.56-1.00} showing the strongest toxicity. Compared with the control group, the level of intracellular MDA increased in each group exposed to automobile exhaust particulates with different sizes ($p<0.05$). The level of intracellular MDA in the PM_{0.56-1.00} reached a peak, and there was no significant difference among any other groups exposed to automobile exhaust particulates with different sizes. Therefore, automobile exhaust particulates could inhibit the proliferation of A549 cells, damage the integrity of the cell membrane, cause cellular oxidative stress, and lead to the membrane lipid peroxidation injury. The adverse effects of particulate matters of different sizes on A549 cells were different, with the toxicity of PM_{0.18-1.00} stronger than that of PM_{1.00-3.20} and the toxicity of PM_{0.56-1.00} stronger than that of PM_{0.18-0.56}.

Key words: [automobile exhaust particulates](#) [particle size](#) [A549](#) [cytotoxicity](#)