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新型洗扫车设计与仿真

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摘 要:

CFD

关键词: ; ; ;
中图法分类号: U469.6+91 **文献标识码:** A **文章编号:** 1000-2324(2016)01-0095-04

Design and Simulation for a New Cleaning Sweeper

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Abstract: Aiming at the problem of big labor intensity and low efficiency of human cleaning for some time, a new kind of cleaning sweeper with sweeping and washing was designed. It adopted the composite dust removing theory which combined gravity dust removing, inertia dust removing and spray dust removing and sucked the waste water after washing into dust removing box to spray creatively. It was used the computational fluid dynamics (CFD) to simulate the flow field of dust removing system and analyze the motion state of dust particles under the situation of sucking waste water or not. The results showed that sucking waste water into dust removing box to spray could effectively catch dust and reduce the secondary pollution. The cleaning sweeper was economical, practical and with great popularization and application value, suitable for factory workshop, warehouse, airport, station and other large places.

Keywords: Cleaning sweeper ; composite dust removing ; CFD; simulation

2006~2008

2009~2011 2006

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[3]

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1 洗扫车总体结构和工作原理

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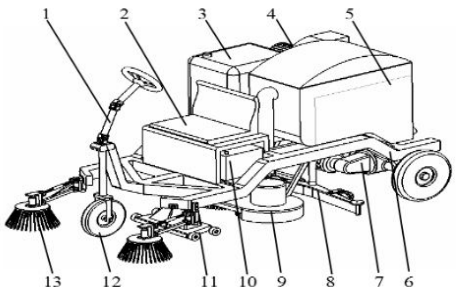

1 转向器 2 座椅 3 水箱 4 风机 5 除尘箱 6 车架 7 驱动电机 8 吸水扒 9 洗地盘刷 10 蓄电池 11 吸口 12 导向轮 13 盘扫

图 1 洗扫车结构示意图

Fig.1 The structure of the cleaning sweeper

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2 除尘系统的设计

2.1 除尘原理

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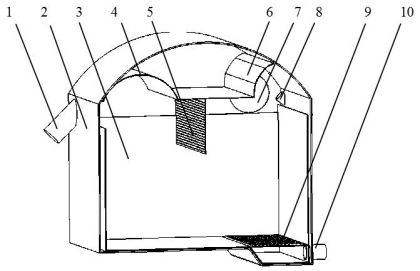

1 进气口 2 除尘箱 3 垃圾斗 4 弧形挡板 5 帘网 6 挡板 7 出气口 8 进水管 9 孔板 10 出水管

图 2 除尘系统结构示意图

Fig.2 The structure of dust removing system

2.2 除尘箱结构尺寸设计

v_g

$$v_g = \frac{(\rho_s - \rho)d^2}{18\mu} \cdot g \qquad 1$$

ρ_s 2650 kg·m^{-3} ρ 1.29 kg·m^{-3} d 1×10^{-4} m μ μ 1.84×10^{-5} p$_a$.s 1 0.8 m·s^{-1}

:

$$v_l = \frac{Q}{b \cdot h} \qquad 2$$

[4]

v_l 1 m·s^{-1} Q 0.34 m^3·s^{-1} b 0.5 m h 2 h 0.68 m

t $l=v_l \cdot t$ $h=v_g \cdot t$

$$\frac{l}{v_l}=\frac{h}{v_g} \qquad 3$$

3 l=0.85 m 0.85 m

3 除尘箱流场仿真分析

(CFD)

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3.1 除尘箱流场仿真建模与网格划分

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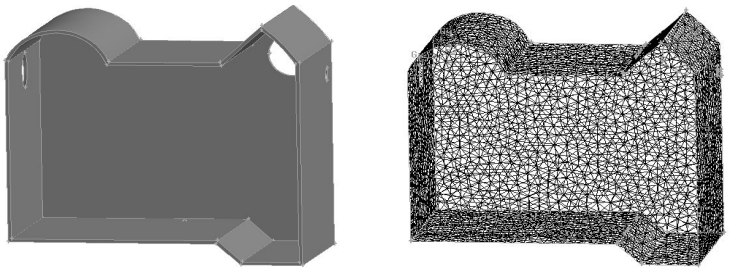

图 3 除尘箱简化几何模型与网格结构

Fig.3 Simplified geometric model and mesh structure of dust removing box

3.2 流场求解计算参数的设定

$k-\varepsilon$

40 m·s^{-1} 45 ° outflow

Trap

2650 kg·m^{-3} 1 100 μm 10 μm 0.01 kg·s^{-1}

Stochastic

collision Coalescence Breakup 30 m·s^{-1}

0.1~1 mm 0.02 kg·s^{-1}

3.3 数值模拟结果分析

4

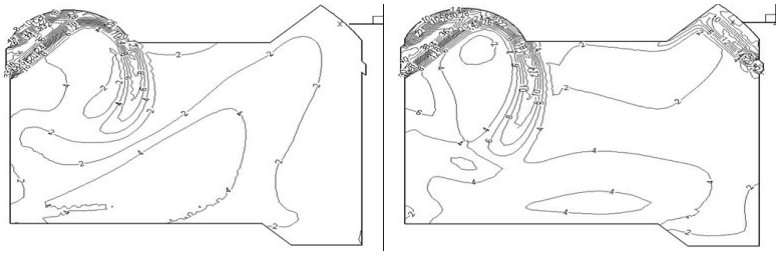

图 4 除尘箱中心截面速度等值线图

Fig.4 Velocity contour map of the central section in dust removing box

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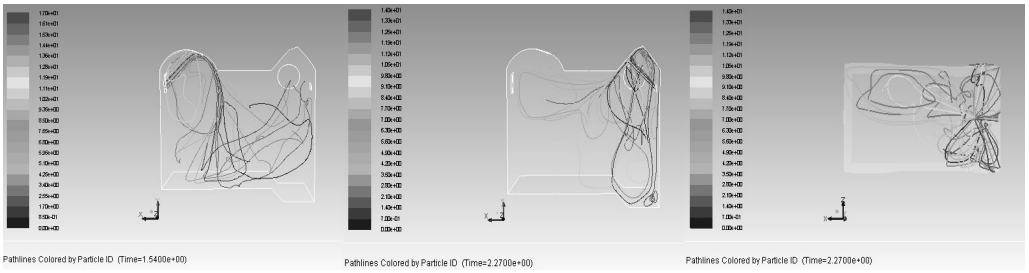

图 5 粉尘颗粒运动轨迹　　**图 6 水滴运动轨迹**　　**图 7 水滴运动轨迹俯视图**

Fig.5 Path-lines of dust particle　　**Fig.6 Path-lines of water drops**　　**Fig.7 Overlooking path-lines of water drops**

8　　18　　6

[5]

number tracked=18	escaped=4	aborted=0	number tracked=18	escaped=1	aborted=0
number tracked=18	escaped=6	aborted=0	number tracked=18	escaped=1	aborted=0
number tracked=18	escaped=7	aborted=0	number tracked=18	escaped=3	aborted=0
number tracked=18	escaped=7	aborted=0	number tracked=18	escaped=3	aborted=0
number tracked=18	escaped=7	aborted=0	number tracked=18	escaped=3	aborted=0
number tracked=18	escaped=7	aborted=0	number tracked=18	escaped=3	aborted=0

图 8 粉尘颗粒跟踪结果

Fig.8 Tracking result of dust particles

4 结 论

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