

# **A SIMULATED TEST FOR CLEANING EFFICIENCY OF TWO KINDS OF INDOOR AIR CLEANERS**

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## **ABSTRACT**

Indoor air quality is decreasing year by year. It is very necessary to find a kind of efficient cleaner to improve the indoor air quality. Two kinds of cleaners were tested. Both of them were made in China. Four simulated chambers were used. The research was performed with monitoring and toxicological tests. The results showed the cleaner A absorbed and filtered smoke very fast. But CO and CH<sub>2</sub>O could not be absorbed and filtered. Cleaner B either could absorb smoke or could exchange air with outdoor air. The cleaning efficiency of cleaner B is better than that of cleaner A.

## **INTRODUCTION**

Either in work place or in non-workplace, the indoor air quality decreases more and more. Many kinds of air cleaners are displayed in the markets. A lot of consumers wait to know which kind is better. This study was performed to evaluate the cleaning efficiency of two kinds of indoor air cleaners with the simulated test.

## **METHODS**

### **Two kinds of cleaners were used**

Cleaner A is the general air cleaner with an activated charcoal filter. Cleaner B is an air exchanger not only with an activated charcoal filter but also with a pump. The indoor air can be emitted to outside, and outdoor fresh air can come to indoor.

### **Simulation chamber**

Four simulation chambers were made of glass. The volume of each chamber is 2.3m<sup>3</sup> (1.6 x 1.4 x 1.1). Each one has a small hole at the top of chamber for air sampling. Cigarette smoke was also through the hole into the chamber as the pollutant to treat experimental animals.

36 Wistar male rats were used, divided into 4 groups. Each chamber had 6 small cages in it. Each small cage had a rat in it. The period of the test was 4 weeks, 5 days a week, 6 hours a day. Group A was in Chamber A. 6 rats were given cigarette smoke. Cleaner A was running in it. Group B was in Chamber B. 6 rats also were given cigarette smoke. Cleaner B was running in it. Group C was in Chamber C. 6 rats also were given cigarette smoke. There was not any cleaner in it. Group D was in cleaner D. 6 rats were not given cigarette as the control group.

## Test indexes

Air monitoring: CO, CH<sub>2</sub>O, PM<sub>10</sub>.

Animals' health effects: blood COHb%, mortality, pathologic diagnosis.

## RESULTS

The concentrations of carbon monoxide, formaldehyde and PM<sub>10</sub> are given in Table 1 and the results of the animal tests in Table 2.

Table 1. Air Monitoring Results

| Group | CO                       |                   | CH <sub>2</sub> O        |                   | PM <sub>10</sub>         |                   |
|-------|--------------------------|-------------------|--------------------------|-------------------|--------------------------|-------------------|
|       | mg/m <sup>3</sup><br>(%) | efficient<br>rate | mg/m <sup>3</sup><br>(%) | efficient<br>rate | mg/m <sup>3</sup><br>(%) | efficient<br>rate |
| A     | 97.5                     | 61.8              | 0.246                    | 39.7              | 0.273                    | 57.9              |
| B     | 4.5                      | 98.2              | 0.063                    | 84.6              | 0.255                    | 60.7              |
| C     | 255.0                    |                   | 0.408                    |                   | 0.649                    |                   |
| D     | 1.25                     |                   | 0.046                    |                   | 0.106                    |                   |

Table 2. The Result of Animal Test

| Group | Mortality | COHb (%) | Pathologic Diagnosis |
|-------|-----------|----------|----------------------|
| A     | 0/6       | 4.0      | ±                    |
| B     | 0/6       | < 1      | -                    |
| C     | 1/6       | 12.1     | +                    |
| D     | 0/6       | < 1      | -                    |

In chamber A, the cleaner A can absorb and filter smoke. The smoke could be absorbed in 3 minutes, after the cleaner running. But the concentrations of CO and CH<sub>2</sub>O were still very high and the level of blood COHb also very high. But no any rat was died.

In chamber B the cleaner B either can absorb smoke or can exchange air with outdoor air. So, chamber B does not have smoke. The concentrations of CO, CH<sub>2</sub>O and PM<sub>10</sub> in it were normal. The level of blood COHb was also normal.

Chamber C was polluted. The concentrations of CO, CH<sub>2</sub>O and PM<sub>10</sub> in it were very high. The smoke was very heavy. One rat was died at 3<sup>rd</sup> day. The level of blood CDHb in all rats was higher than that of normal's.

Chamber D was the clean one, there was no smoke in it. The levels of blood COHb, CO, CH<sub>2</sub>O and PM<sub>10</sub> were normal.

## **CONCLUSION**

The result shows that the cleaning efficiency of cleaner B was better than that of cleaner A if the outdoor air quality is good.