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# Orthogonal experiment of research on coordinated control method of indoor multiple pollutants

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## ABSTRACT

Indoor air pollution in office buildings is complex and serious. This research is targeted at three types of air pollutants: CO<sub>2</sub>, VOCs, and PM<sub>2.5</sub>. In order to seek the optimal control method to achieve good indoor air quality, an orthogonal experiment was carried out in the environmental chamber to compare the control time and energy consumption of four control methods (purifier+ and window+, purifier+ and window-, purified fresh air 240 m<sup>3</sup>/h and purified fresh air 400 m<sup>3</sup>/h) required for pollutants to meet the standard. The result shows that the purifier+ and window+ method is more effective in most conditions. Its control time is reduced by 8.06% and the energy consumption is reduced by 11.91% compared with the traditional control method of purified fresh air 240 m<sup>3</sup>/h. This research guides the optimization control strategy of indoor air quality under different pollution conditions in office buildings.

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#### KEYWORDS

Indoor air pollutants, Orthogonal experiment, Coordinated control

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#### GUIDELINES

This experiment aims to obtain the optimal coordinated control method under different multiple pollutants conditions; provide guidance for building designers, building occupants, and building managers on the comprehensive management of indoor multi-pollutants for excellent indoor air quality.

#### MATERIALS TEXT

Industrial CO<sub>2</sub> cylinder, mosquito coil, Florida water

#### SAFETY WARNINGS

During the experiment, try to ensure that no experimenter is in the environmental chamber to prevent the inhalation of excessive indoor air pollutants from causing damage to the personnel's respiratory system.

#### BEFORE STARTING

Calibrate the instrument. Close the doors and windows. Switch on all temperature, humidity, and IAQ sensors. Switch on the air purification equipment until the concentrations of CO<sub>2</sub>, VOCs, and PM<sub>2.5</sub> are reduced to the lowest level. Then switch off the purifiers.

1 Turn on the air conditioning. Turn on all the temperature, humidity, and indoor air quality sensors. Close the doors and windows. Start the experiment.

2 Create the indoor air pollution sources artificially until the CO<sub>2</sub>, VOCs, and PM<sub>2.5</sub> in the

breathing zone have exceeded the values set for each condition, and then stabilize for 2 minutes.

- 3 Turn on the air purifier or purified fresh air system according to the condition, and set the fresh air volume. Turn on the time monitor and energy power monitor to record the control time and energy consumption.
- 4 When all the IAQ sensors show that CO<sub>2</sub>, VOCs, and PM<sub>2.5</sub> are below the standard, record the time and energy power again. Then stabilize for 5 minutes.
- 5 Turn off all the equipment and sensors and end the experiment.