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## Research on the Measured Ventilation Effect of the Chemical Lab Building

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### Abstract

Chemical lab building ventilation has immediate impact on teachers' and students' physical health. This paper studies the ventilation system of a university's chemical lab building in Mianyang. The ventilation system of chemical lab building combines mechanical exhaust ventilation with natural supply wind through windows. The research group select two typical ventilation systems under stable condition to test the wind speed of natural ventilation through windows, fume hood exhaust inlets and the general exhaust ventilation vents. Meanwhile, it also tests roof exhaust air speed of the vertical ducts. It evaluates the ventilation difference between the actual working condition and the design condition; it also evaluates the actual effect of ventilation system, through comparing actual and design conditions. At the same time, suggestions are put forward for the lab ventilation system design.

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*Keywords:* Chemical lab building, Ventilation , Exhaust air speed, Air change rate

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### 1. INTRODUCTION

Lab ventilation is a technology to control the influence and destruction of harmful substances in lab on indoor and outdoor air environment.

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Many of the pollutants emitted from chemical lab are sulfur, nitrogen compounds, nitrogen oxides and halogen compounds, although the amount of these pollutants is relatively small, but if inhaled more hydrogen sulfide, sulfur dioxide and other chemical gases, in less severe cases, the pollutants can cause nausea, in more severe cases, shock and even death may arise. In addition, these pollutants discharge into the atmosphere, may affect the living people nearby, and may exacerbate the atmospheric environmental problems such as greenhouse effect and the formation of acid rain. Therefore, the efficient ventilation of the chemical lab is the responsibility of design, construction and operation personnel.

In recent ten years, due to the rapid development of universities and research institutes, the design and operation of ventilation system are also increasingly concerned[3-10].The establishment of the current professional code" scientific experimental building design standards" (JGJ91-93[2] has been used 23 years, so, it is difficult to meet the requirements, many designs not only refer to this standards but also refer to some domestic and foreign trade standards, such as the" chemical heating ventilation and air conditioning design standards" (HGT 20698-2009)[1] and ASHRAE 1999 HVAC Applications Chapter13.

According to the measurement of the ventilation system after the reconstruction of the chemical lab building in Mianyang, Sichuan province, the difference between the actual operation conditions and design conditions of the ventilation system is analyzed, and the problems in operation are analyzed, and suggestions for the design and operation are presented

## 2. METHODS

### 2.1. Engineering Survey

The chemical lab building was built in 2004, and in 2008 the earthquake caused serious damage to the ventilation system. Then the ventilation system reconstruction design in 2010, the ventilation system reconstruction project was completed in April 2011 and put into use. The chemical lab building is located in the university campus, total 5 floors; the total height is 19.8 meters, belonging to the Class two multi-storey building. According to teachers working in the chemistry building, the reconstruction of the front ventilation system has a lot of problems, part of the system is not in normal operation, pollution gas cannot be discharged, corridor and indoor pungent smell is strong. In the reconstruction design, based on the existing system, measures are taken to increase the exhaust air rate and frequency conversion operation. The 14 systems before the system redesign are transformed into the present 20 independent exhaust systems, which still use mechanical exhaust, natural ventilation by opening windows, mechanical exhaust including the general room exhaust and local exhaust; The ducts in the ceiling does not change, the vertical ducts diameter changes, the vertical ducts position is changed from the indoor building to the outdoor; Replace the fan with smaller wind volume, retain several large wind turbines, and add frequency converter, each branch duct has an electric airtight valve, and with the exhaust fan interlock control, exhaust system variable air volume adjustment; The exhaust fan is still set on the roof of the fifth floor, and the height of the dilution air outlet is changed from 0.6 m to 1.2 m. In the reconstruction design, the air exchange rate of the lab ventilation is 5 times/hour, the single fume hood exhaust is designed as 1200 m<sup>3</sup> / h. The desktop exhaust is designed as 1200 m<sup>3</sup> / h.

### 2.2. Ventilation Systems Testing

Testing group measured a typical system from 3rd May to 2nd Jun, 2015. as shown in P-10 plan layout in Figure 1 and Figure 2. P-10 system in the third floor includes three ventilation branches, such as the general ventilation(exhaust ventilation), fume hood exhaust and desktop exhaust, as shown in Figure 3. Measure the wind speed using TSI9596-A multi-parameter anemometer, measurement accuracy:  $\pm 1.5\%$ , monitoring four groups at the same time. (1) Close the fume hood and the desktop exhaust ducts to measure the cross sectional wind speed of the whole room ventilation exhaust, in the two conditions such as window half open and fully open; (2) the windows are fully open, close the whole room ventilation and desktop exhaust ducts, measuring the fume hood inlet cross sectional wind speed; (3) the windows are fully open, measuring the desktop exhaust outlet air velocity; (4) all three branch ducts open, test the total discharge capacity of the exhaust duct.

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