Air Pollution And Prevention Technology in Interior Decoration of High-rise Buildings in Chengdu

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Abstract: In this paper, the indoor air pollution caused by interior decoration of high-rise buildings in Chengdu was studied. The high-rise buildings of Chengdu University were selected as the main research object, and the indoor pollutants such as formaldehyde, benzene, TVOC, ammonia and radon were detected. From the time and style of decoration, as well as the type and floor of the room, this paper analyzed the concentration of pollutants, obtained its variation rule, and put forward corresponding prevention measures. Through the study of indoor air pollution, we can further improve people's understanding of housing use, increase people's understanding of building decoration, and thus know how to take relevant indoor air control measures.

Key words: High-rise building; Interior decoration; Air pollutants; Prevention and control technology

1. Introduction

Indoor air quality was closely related to people's life and health, and most indoor air pollutants come from indoor decoration materials. At present, about 70% of the decoration materials on sale in the market contain harmful substances[1-3]. If these materials were used excessively and no preventive measures were taken at the same time, toxic and harmful substances will be released, which will further endanger people's health[4,5]. Through the study of indoor decoration air pollution, we can improve people's understanding of housing use, pay attention to their living environment and care for their health.

2. Experimental Methods

On the basis of the previous research [6], the experiment was completed at about 20℃ under standard atmospheric pressure. The third-stage high-rise building of Chengdu University was selected. Under other conditions being the same, the reference objects were selected, and the indoor concentrations of formaldehyde, benzene, TVOC, ammonia, radon and other pollutants were detected in terms of decoration time, decoration style, room type and floor, and their changing trends were studied. The determination method of formaldehyde in air was phenol reagent spectrophotometry, which was mainly based on GB/T18204.26 "Determination Method of Formaldehyde in Air of Public Places"[7,8], and its concentration standard value was 0.08 mg/m^3. The determination method of benzene was gas chromatography, which was mainly based on GB/T11737 "Standard Method for Hygienic Inspection of Benzene. Toluene and Xylene in the Atmosphere of Residential Area-Gas Chromatography"[9], and the standard value was 0.09 mg/m^3. TVOC was determined by gas chromatography with thermal desorption and direct injection, mainly according to GB/50325-2010 Code for Indoor Environmental Pollution Control of Civil Building Engineering[10], and the standard value was 0.5 mg/m^3. The determination method of ammonia was Nessler's reagent spectrophotometry, which was mainly based on GB/T18883-2002 Indoor Air Quality Standard[11], and the standard value was 0.2 mg/m^3. The measurement method of radon was sampling condition method, which was mainly based on GB/T14582-93 Standard Measurement Method of Radon in Ambient Air[12], and the standard valuewas200Bq/m^3.

3. Experimental Results and Analysis

3.1 Different Decoration Time, Indoor Pollutant Concentration Changes

The 18th floor householder was selected as a reference, and 30 households with similar apartment type and decoration were tested for indoor pollutant concentration. See Figure 1 and Figure 2 for the changes of indoor pollutant concentration in different decoration time. As can be seen from the figure, the indoor concentration of formaldehyde, benzene, TVOC, ammonia and radon were higher during renovation. However, over time, the concentrations of various pollutants also gradually decreased. Among them, formaldehyde and benzene were obvious in the process of decoration.

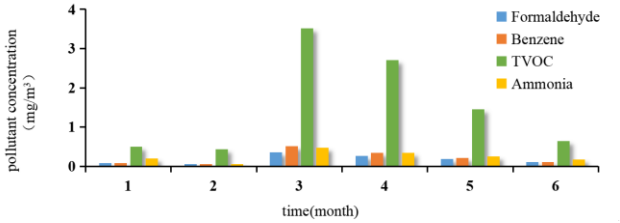

Figure 1. Changes of concentration of four kinds of pollutants in indoor air at different decoration time

(time: 1--Standard values; 2--before decoration; 3--being decorated; 4--1 month after decoration; 5--3 months after decoration; 6--6 months after decoration)

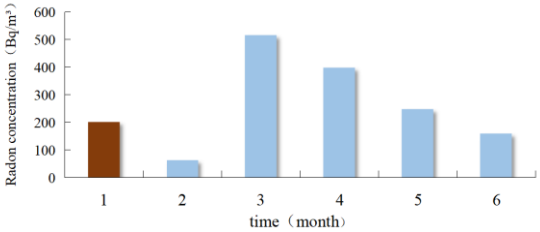

Figure 2. Changes of radon concentration in indoor air in different decoration time

(time: 1--Standard values; 2--before decoration; 3--being decorated; 4--1 month after decoration; 5--3 months after decoration; 6--6 months after decoration)

3.2 Different Decoration Styles, Indoor Concentration Changes of Various Pollutants

15 households with Chinese, European, rural, modern and Mediterranean decoration styles were selected as reference, and the household heads with similar apartment types and about half a year after decoration were selected for indoor pollutant concentration detection. See Figures 3 and 4 for changes of indoor pollutant concentration of householders with different decoration styles.

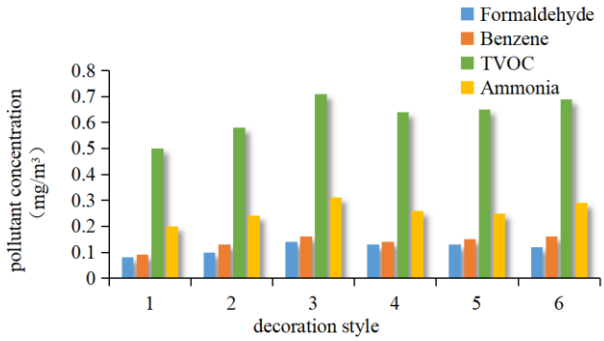

Figure 3. Changes of concentration of four kinds of pollutants in indoor air with different decoration styles

(decoration style: 1--Standard values; 2--ChineseEuropean; 3--European; 4--Garden; 5--Modern; 6--Mediterranean)

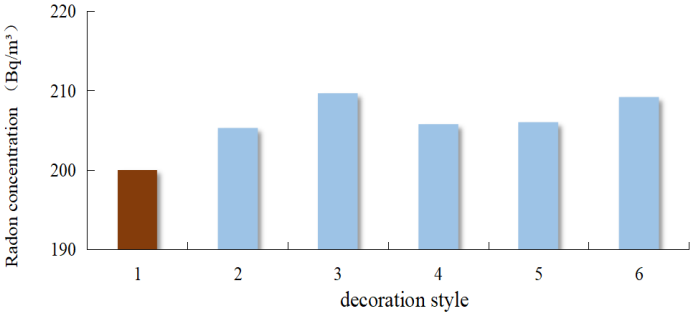

Figure 4. Changes of radon concentration in indoor air with different decoration styles

(decoration style: 1--Standard values; 2--ChineseEuropean; 3--European; 4--Garden; 5--Modern; 6--Mediterranean)

It can be concluded that the concentration of pollutants in other styles was slightly higher, while that in Chinese style was the lowest. Therefore, the complexity of decoration can directly affect the content of pollutants.

3.3 Different Types of Rooms, Indoor Concentration Changes of Pollutants

The 18th floor householder was selected as a reference, and 30 households with similar apartment type and decoration style and about half a year after decoration were tested for indoor formaldehyde concentration. See Figure 5 and Figure 6 for the variation of indoor pollutant concentration in different kinds of rooms.

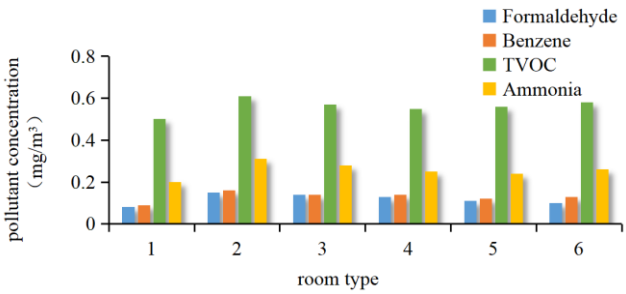

Figure 5. Concentration changes of four kinds of pollutants in indoor air in different kinds of rooms

(room type: 1--Standard values; 2--Living room; 3--Horizontal; 4--Study; 5--Kitchen; 6--Toilet)

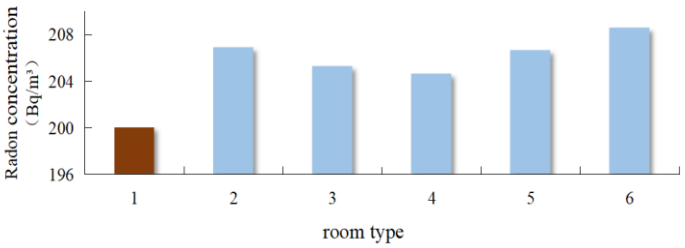

Figure 6. Changes of radon concentration in indoor air in different kinds of rooms

(room type: 1--Standard values; 2--Living room; 3--Horizontal; 4--Study; 5--Kitchen; 6--Toilet)

The overall comparison of the pollutant content: living room > horizontal > study[13,14]. The kitchen and toilet

had their own particularity, for formaldehyde, benzene and other pollutants had their own characteristics, the bathroom radioactive gas radon content was high.

3.4 Different floors, indoor concentration changes of pollutants

15 households on floors 5, 10, 15, 20, 25 and 30 were selected as reference, and indoor pollutant concentration of households with similar apartment type and decoration style and about half a year after decoration was detected. For different floors, taking the living room as an example, see Figure 7 and Figure 8 for the changes of indoor pollutant concentration.

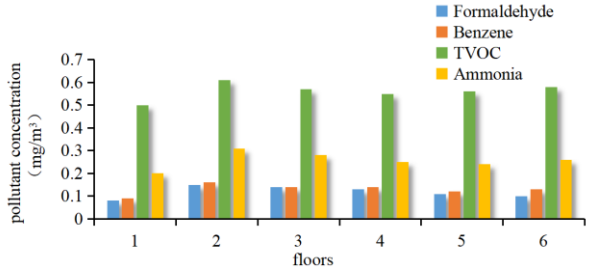

Figure 7. Concentration changes of four kinds of pollutants in indoor air between different floors

(floors: 1--Standard values; 2--Fifth layer; 3--Tenth layer; 4--Fifteenth layer; 5--Twentieth layer; 6--Twenty-fifth layer; 7--Thirtieth layer)

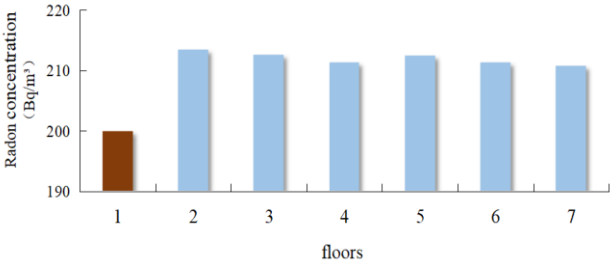

Figure 8. Changes of radon concentration in indoor air between different floors

(floors: 1--Standard values; 2--Fifth layer; 3--Tenth layer; 4--Fifteenth layer; 5--Twentieth layer; 6--Twenty-fifth layer; 7--Thirtieth layer)

The pollutant concentration can be analyzed and its value was not affected by the floor. For normal ventilation and ventilation in each floor, there was no significant change in the concentration of formaldehyde, benzene, TVOC, ammonia and radon.

3. Prevention and Control Technology

3.1 Reasonable Design

First of all, we should establish correct decoration awareness. The more luxurious the decoration, the more pollution there was. The decoration was for the purpose of health and comfort, do not pursue luxury excessively. Therefore, try to use simple decoration to reduce the amount of materials used. It was best not to put carpet or wallpaper in the room, so as to reduce pollution sources[15-17].

3.2 Control Pollution Sources

The most effective way to control indoor decoration pollution was to start from the pollution source, and the building, decoration and finishing materials were the main sources of indoor air pollution. When choosing decoration materials, we should select high-quality materials according to the series standards of "Limits of Harmful Substances in Interior Decoration Materials", and avoid toxic and harmful unqualified materials[18,19]. Advocate the use of green decoration materials.

3.3 Natural Ventilation

Natural ventilation was the most effective, simple and economical way to improve indoor air quality. Through continuous ventilation, air convection was used to reduce the concentration of indoor air pollutants. According to the "Indoor Air Quality Standard", it should be ensured that there was not less than 30m³ indoor fresh air volume per person per hour[20,21]. The renovated room should be ventilated for one to two hours every day, and stay at least two months later.

3.4 Plant Adsorption Method

Plant adsorption method was widely used because it doesn't need precise equipment and complicated operation process. Different plants have different adsorption effects on various pollutants, and some plants can secrete bactericidal agents to kill air bacteria[22]. Planting cactus can absorb indoor carbon dioxide and supplement indoor oxygen.

3.5 Ozone Oxidation Method

Ozone oxidation was to use the strong oxidizing property of ozone to remove harmful gases in indoor air, so as to achieve the purpose of purifying the air. When using this technology, people need to leave the room temporarily to avoid poisoning. Ozone oxidation has a great effect on removing pollutants[23].

4. Conclusion

Decoration was a very complicated and tedious process. When decorating, the choice of decoration materials, specific family style layout and indoor plants should be considered from all aspects. Therefore, before and after decoration, we should carefully plan, use environmental protection materials and carry out necessary detection and prevention of indoor air pollution, so as to reduce indoor air pollution and ensure our own health. According to the relevant measures put forward, people can stay healthy, safe and relax.

Acknowledgements

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