Indoor air pollution and prevention

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Abstract. With the continuous improvement of the social level, the physical health condition is gradually paid attention to. However, most people spend most of their life indoors. Indoor environmental pollution has become a major problem affecting people's health and safety in modern society. This paper analyzes the status quo of indoor pollution, indoor pollutant sources, indoor pollution hazards, and describes the prevention and control measures of indoor pollution to reduce the harm of indoor air pollution to human body.

1. Introduction
With the rapid and healthy development of China's national economy, people's material life has been greatly satisfied, and people's needs have become diversified. More and more people are paying more and more attention to themselves and the surrounding environment. Now the world is facing "the third environmental pollution, mainly indoor air". The United States blames indoor air pollution on factors that threaten our health. The World Health Organization also lists indoor air pollution as one of the top ten factors and threats to our human health. Survey results show that in modern cities, indoor air pollution is many times more than outdoor air, most people spend most of their time indoors, the old, young, sick, disabled, pregnant and other groups in the indoor time longer, indoor air pollution harm is more significant.

2. Current situation of indoor pollution
At present, China has formulated some system standards for the pollution of the indoor environment, from the production and development of construction materials to the control of the content of pollutants in the indoor environment, which is not for the implementation of comprehensive and thorough monitoring of the indoor environment. However, people often believe that with the progress of science and technology and the increasingly strict national supervision, the indoor living conditions of residents are constantly improving, the living environment level has also been greatly improved, indoor environmental pollution has been slightly small or minimal harm. Actually otherwise, people is in understanding and understanding indoor environment when the harm that pollution place brings is far from enough.

WHO reports that nearly half of the world's population is exposed to indoor pollutants. Indoor air pollution has caused 35.7% of respiratory diseases, 22% of chronic lung diseases, and 15% of bronchitis, bronchitis and lung cancer. Lv Tianfeng et al. [1] investigated the newly decorated living environment of residential and office places in Beijing and found that the over-standard rates of formaldehyde, total volatile organic compounds (TVOC), benzene, toluene, xylene and ammonia were 50.8%, 76.3%, 1.8%, 22.9%, 26.9% and 0.09%, respectively. Wang Bin et al. [2] found that children's respiratory diseases are...
related to formaldehyde. About 2.1 million children die each year due to respiratory infections in China, of which 1 million are directly or indirectly related to indoor air pollution, especially in newly decorated indoor places. Beijing children's hospital an investigation shows, in the leukaemia children that sees a doctor in this hospital, the space that major children lives or lives had been decorated within half a year, this expert thinks, the harmful substance in decorating material may be a big factor that causes leukaemia.

3. Sources and hazards of indoor pollutants

3.1. Sources of indoor pollutants
Indoor pollutants pose a threat to human health. Explore the source of pollutants is a necessary prerequisite for the study of indoor pollution. Table 1 shows indoor pollutants that pose a greater threat to human health.

| pollutant       | Sources of pollution                                                                 |
|-----------------|--------------------------------------------------------------------------------------|
| ammonia         | Ammonia admixtures in building materials, an additive or brightening agent in decorative materials, Perm neutralizing agent, etc |
| formaldehyde    | Industry, automobile exhaust, decoration materials, etc                                |
| benzene         | Automobile exhaust, burning tobacco smoke, solvents, paints, dyes, fax machine, printer, etc |
| Toluene and xylene | Perfume, detergent, wallpaper, paint, etc                                             |
| TVOC            | Building materials, detergents, paints, water-containing coatings, adhesives, cosmetics and detergents, etc |
| radon           | Building materials, water supply and natural gas used for heating and kitchen equipment |

Through the above-mentioned is not hard to find, most of pollutants from the decoration materials, but also from the decoration, decoration materials, not only in People's Daily activities, pollutants are everywhere, for example a perm neutralizer of ammonia release of radon gas, heating process, without timely and effective treatment, these substances also exist long indoor, is a threat to human health. Although some pollutants are not directly generated indoors, the outdoor environment is closely related to the indoor environment. In the process of window opening, automobile exhaust will also enter the room with the air flow, thus threatening human health.

To sum up, the sources of indoor pollutants mainly include the following aspects: (1) buildings and interior decoration materials; (2) People's own activities such as heating, cooking, smoking, and the use of office equipment; (3) Open the window for ventilation, and outdoor pollutants are brought into the room with the air circulation. Among them, building and interior decoration materials are the main aspects that cause indoor pollution.

3.2. Harm of Indoor Pollutants
In cities with rapid technological development, people tend to think that outdoor pollution is more serious. But the survey shows that indoor air pollution than outdoor many times, the longer you stay indoors, the indoor environment pollutant infected people suffered impact is more significant, especially for children, because of their age is small, low immunity, and these children most of their time indoors, more than most adults stay indoors, so they are more vulnerable to indoor environmental pollutants than most adults. The World Health Organization has announced that indoor air pollution may cause severe asthma in up to 100,000 people worldwide each year, with children affected accounting for up to 35%.
In order to explore whether the pollutants brought by decoration exceed the standard, indoor environment of residents (newly decorated) in a new community in Shijiazhuang City was tested according to common indoor pollutants. The results are shown in Table 2.

**Table 2. Test results of newly decorated houses**

| test items       | Number of tests | Exceeding Standard Rate | limit              |
|------------------|-----------------|-------------------------|--------------------|
| formaldehyde/(mg/m³) | 30              | 96%                     | ≤0.08 mg/m³        |
| ammonia/(mg/m³)  | 30              | 10%                     | ≤0.20 mg/m³        |
| benzene/(mg/m³)  | 30              | 90%                     | ≤0.09 mg/m³        |
| TVOC/(mg/m³)     | 30              | 96%                     | ≤0.5 mg/m³         |
| radon/(mg/m³)    | 30              | 0%                      | ≤200 bp/m³         |

It is not difficult to find that most of the newly decorated families have serious formaldehyde, benzene and TVOC standards, and these substances pose a serious threat to human health. The World Health Organization has determined that formaldehyde is a carcinogen, and many investigations show that formaldehyde has an inseparable relationship with leukemia. In China, the main pollutant of newly decorated indoor buildings is formaldehyde, and children are the biggest victims. Therefore, formaldehyde pollution should be paid attention to by the whole society and even the whole world. Long-term exposure to formaldehyde will cause great damage to the nervous system and immune system, threatening human health.

The American institute of occupational safety and health in formaldehyde environment work 3 months more than 11039 workers in the investigation, found to have 15 died of leukemia, the U.S. national cancer institute, surveyed 25019 workers, found 69 died of leukemia, the death rate is slightly higher than the general population, and the formaldehyde concentration is higher, the greater the risk. [3] Therefore, it is speculated that formaldehyde is a major inducement of leukemia.

Benzene can stimulate respiratory tract and affect hematopoietic function, long-term exposure to benzene can cause aplastic anemia, even leukemia, a serious threat to human health. People in a short period of time inhalation of high concentration of toluene, xylene, serious can lead to respiratory failure, thus bringing life danger. Long-term exposure to a certain concentration of toluene, xylene will cause chronic poisoning, neurasthenia symptoms, causing serious harm to the body.

4. Indoor air pollution prevention and control measures

Through the analysis of indoor pollutants, it is not difficult to find that different pollutants have produced a greater threat to human health, and the longer you spend indoors, the greater the health threat brought by indoor pollutants. Chai Yuhong et al. [4] studied the houses decorated within one year in Changzhou and found that the pollutants in the rooms with different functions exceeded the standard, and the pollution in the rooms decorated for more than half a year was slight, while the pollution in the rooms decorated for less than half a year was serious. For less than half a year of the decoration of the room, it can be seen that decoration materials contain a large number of indoor pollutants, in the absence of certain treatment, in a short time to enter the decoration of indoor places, will produce a great health threat to the human body. Therefore, it is very important to take certain measures to prevent and control indoor pollutants.

4.1. Harm of Indoor Pollutants

The traditional building materials industry not only consumes a large amount of natural resources and energy, but also causes serious pollution to the atmosphere. In the process of raw materials selection and product production, the maximum limit of harmful substances is not considered, and it is also one of the important factors causing indoor air pollution. Now advocated "green building materials" in the selection of raw materials, product production and other links are all adhering to the principle of environmental protection and human health, green building materials using green materials in the protection of human health and also protect the ecological environment we are in, kill two birds with one stone. Therefore,
when choosing decoration materials, green materials without formaldehyde, benzene and other harmful substances should be selected to achieve the purpose of blocking pollutants from the source into the room, and to fundamentally solve the indoor air problem.

4.2. **Strengthen supervision and administration of building materials market**

As living standards improve, people decorate demand increased, criminals in pursuit of higher interests, opportunistic, and ignored the state law, production does not conform to the standard of decoration materials, shoddy, caused great harm to people health, regulators should according to the standard of related industries, building materials enterprises to supervise. Measures shall be taken and penalties shall be imposed on enterprises that do not meet the standards to prevent inferior materials from entering residents' lives at the source. Support policies should be adopted for green building materials, and supervision should be strengthened to ensure the quality of green building materials and ensure people's life safety.

4.3. **Strengthen ventilation measures and use of air purifiers**

After the end of interior decoration, do not immediately move into the new house, should maintain natural ventilation for more than a year, after confirming no safety problems to move in. If conditions permit, professional equipment can be used to detect the indoor pollutant content, so as to ensure safety more effectively. Attention to indoor ventilation after check-in, outdoor environment well increase the number of ventilation, to strengthen the indoor air flow and speed up the pollutant discharge, for outdoor areas with severe pollution of the environment, use high quality air purifier for indoor environment purification, disinfection, regularly to ensure indoor air is fresh, safe, and to minimize the harm of human body even to zero.

4.4. **Strengthen the ecological construction of outdoor environment and promote indoor flower and grass cultivation.**

Indoor and outdoor are organic unity. When indoor pollution is higher and outdoor air quality is better, more ventilation measures should be taken to make indoor air and outdoor air circulate each other, so that the indoor environment can be improved. In the environment with better outdoor greening, indoor pollutants circulate to the outdoors with the air, and outdoor plants purify the air through a series of their own activities, thus improving the indoor environment. Indoor plant flowers and plants can edify sentiment, cheerful body and mind not only, still can absorb indoor harmful substance on certain level. For example, Chlorophytum, Ivy, Aloe, Chrysanthemum, Cactus, Begonia are plants that can remove formaldehyde. Cactus can also absorb the radiation brought by electronic products and reduce the harm caused by radiation to the human body.

5. **Conclusion**

To sum up, after the house decoration, the pollution is more serious, and the indoor pollutant content is relatively high. With the increase of time, the pollutant content decreases. Therefore, for the sake of safety, green building materials should be adopted when decorating, and ventilation measures should be taken after the completion of the decoration to reduce the content of pollutants in the house.

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