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## Analysis on the Influence of Indoor Air Pollution on Human Health and Prevention Measures

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# Analysis on the Influence of Indoor Air Pollution on Human Health and Prevention Measures

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**Abstract.** Indoor air pollution has become another murderer endangering human health, so indoor pollution control has become an urgent need to be solved. This paper mainly analyzes the sources and hazards of pollutants, the means of prevention and control of pollutants, and offers countermeasures and suggestions. It aims to let people know the source of indoor pollutants and realize the harm of indoor air pollution. According to pollutants and their concentrations, Take appropriate control measures to avoid or reduce the harm of pollutants to the human body.

**Key words:** indoor air pollution; source of pollutants; hazard to health; control measures.

## 1. Introduction

As people's awareness of health and environmental continue to increase, people are increasingly concerned about the impact of the surrounding environment on health. The problem of indoor air pollution has gradually entered the field of vision. Indoor air pollution mainly refers to that there are some substances in indoor air that may cause discomfort or harm to the human body. Indoor air pollutants are mainly classified into chemical pollutants, physical pollutants and biological pollutants. Chemical pollutants mainly include volatile organic pollutants (VOCs) and inorganic gas pollutants (such as ammonia, carbon monoxide, etc.); physical pollutants are mainly suspended particulates such as PM10 and PM2.5; biological pollutants refer to bacteria. Virus, plant pollen, etc. [1, 2, 3]. Pollutants can also be divided into two categories according to their existence: suspended particulate matter and gaseous pollutants [4]. Suspended particulate matter mainly refers to suspended particles such as dust and cotton wool that can be filtered by the nose and throat. Small suspended particles that are invisible to the naked eye, such as secondary dust, fiber, bacteria, and viruses, are mostly in the category of aerosols. Gaseous pollutants include formaldehyde, carbon monoxide, ammonia and other gases, as well as various volatile organic compounds (TVOC). In 1997, the World Environment Congress pointed out that indoor air pollution is more serious than outdoor air pollution [5]. Air pollution problems can cause a variety of diseases, including sickness building syndrome (SBS), building-related diseases (BRI) and a variety of chemical pollutant allergies (MCS), so air pollution problems need to be taken seriously.

## 2. Sources of indoor air pollution and their impact on human health

Indoor air pollution mainly comes from interior decoration and building materials, indoor products, human activities and outdoor sources.



### *2.1. Construction and decoration materials*

In today's decoration building materials market, there are more and more chemical building materials. In the building materials, cement, ceramic tiles, concrete, wood-based panels, waterproof materials, etc., as well as decorative materials such as paints, paints, wall coverings, etc., will emit toxic pollutants. People can't really avoid the harm caused by air pollution inside the indoor environment after decoration. Especially the latex paint mixture and other substances generally contain harmful substances to the human body, including formaldehyde, toluene lead and lead compounds, etc. It is irreversible, but people can not really recognize the importance of this problem, thus causing indoor air pollution problems.

### *2.2. Daily life and office supplies*

When using daily chemical products indoors, it is also necessary to pay attention to the release of harmful gases from daily chemical products. In addition, harmful substances may also be present in articles such as insecticides and disinfectants. Since the raw material of the product contains a certain harmful substance or a certain volatile organic compound (benzene, formaldehyde) is added in the production process, the produced product also contains such a substance. As the product enters the room, this harmful substance can be released from the chemical product and pollute the indoor air.

### *2.3. Human breathing*

The pathogens and chemicals produced by the metabolism of the human body are excreted through tissues such as the respiratory tract and pores. These excretions include some toxic substances, which will affect human health if they are inhaled again. In addition, the shedding of human skin will also form dust in the air and constantly float to affect the air environment.

### *2.4. Kitchen fume and smoking*

Kitchen fumes cause mutations and substances produced by oxidative decomposition of high-temperature edible oils are another cause of cancer. Another major source of pollution in the kitchen is the burning of fuel. The concentration of carbon monoxide and nitrogen oxides produced by burning appliances greatly exceeds the standard limit. It can cause harm to human health. In addition, the smoke produced by smoking also contains many carcinogens, these carcinogens are more than forty kinds, and their impact on human health should not be underestimated.

### *2.5. Air conditioning syndrome*

People who work in an air-conditioned environment for a long time often feel bored, weak, unmotivated, and susceptible to colds, which can affect work efficiency and physical health. Human activities, as well as pollutants emitted by metabolism and polluting gases remaining in the chamber, stay indoors for a long time, causing accumulation of pollutants. In addition, suitable temperature and humidity are also favorable conditions for bacterial growth.

### *2.6. Outdoor source*

Outdoor pollution will also have effect on the indoor air quality. Outdoor pollutants such as haze, automobile exhaust, industrial waste gas, road dust and other polluting gases can enter the room through windows, walls and wall gaps. When people enter and exit the door, they will also bring pollutants into the room. People living near roads, factories, and lower vents are closer to pollution sources and more vulnerable to outdoor pollution.

In summary, the sources and hazards of major indoor pollutants are as follows:

**Table1.** Main sources of pollutants and hazards in the room.

Harmful Substance	Source	Harm
formaldehyde	Wood-based panels, coatings, cosmetics	Cause chronic respiratory diseases, toxic hepatitis, nasopharyngeal cancer, sinus cancer, etc.
ammonia	Additives, brighteners, antifreeze	Causes respiratory irritation, nausea, vomiting, chest tightness, dizziness, fatigue, etc.
radon	Brick sand, plaster, cement, ceramic tile	Cause lung cancer, leukemia, melanoma and some childhood tumors
TVOC	Coatings, adhesives, man-made materials, detergents	Irritating to eyes and respiratory tract, causing skin irritation, headache, sore throat, etc.
Benzene and benzene series	Coatings, adhesives, waterproof materials	Mainly affect the nervous system and hematopoietic system, the symptoms of neurasthenia, manifested as dizziness, memory loss, decreased thinking and judgment, etc.; may also cause leukemia, female irregular menstruation, abortion, etc.

### 3. Method of indoor air purification

Indoor air purification methods include pollutant transfer method and pollutant removal method. The pollutant transfer method is to transfer pollutants in the air to other places by means of wind or by means of adsorbent having adsorption properties to reduce the amount of pollutants in the indoor air and purify indoor air. The other method is more thorough, which is to completely eliminate the pollutants from the root cause by degrading, decomposing or oxidizing harmful pollutants.

#### 3.1. Contaminant transfer method

*3.1.1. Frequent ventilation and ventilation.* It is the most convenient and economical means to frequently open the doors and windows to ventilate and reduce the indoor pollutant content. The air flow carries away indoor pollutants and introduces fresher air. The newly renovated house has high indoor pollutant content. It is best to keep the house ventilated for 2-6 months before the check-in. At this time, the indoor pollutant concentration can reach a safe level [6].

*3.1.2. Plant purification method.* Many plants have a good function of purifying air, and by directly absorbing and adsorbing polluting gases or self-metabolism and transformation, eliminating indoor polluting gases and purifying them [7]. The purification of several common plants is shown in the table below.

**Table 2.** Several common plants and their purification.

Name	Features
Aloe	Absorbing harmful substances such as carbon monoxide, sulfur dioxide, and formaldehyde in the air, its most prominent feature is its strong absorption capacity for formaldehyde.
Chlorophytum	It absorbs harmful substances such as benzene, carbon monoxide and formaldehyde in the air. Its biggest characteristic is the high absorption rate of formaldehyde and benzene. Known as the indoor "green purifier", it is suitable for hanging on a balcony or indoors.
asparagus	It has an antibacterial ingredient in its odor, which can effectively kill indoor germs and has a strong health care function.
Green radish	Strong absorption capacity for benzene, formaldehyde and ammonia
Jasmine	It secretes bactericidal substances that inhibit the growth of tuberculosis, sputum pathogens and typhoid bacteria, and also absorbs ammonia.
cactus	It has the ability to absorb the electromagnetic radiation emitted by various household appliances, and it is convenient for people to sleep and rest in the bedroom.
Clivia	A freshener that absorbs smoke, while the carbon dioxide released by nighttime breathing is minimal

*3.1.3. Adsorption purification method.* Activated alumina, zeolite molecular sieve, silica gel, activated carbon, etc. are all good adsorbents. The porous solid adsorbent is used to treat gaseous air pollutants, so that the pollutants are adsorbed on the solid surface. The disadvantage of this method is that it can only temporarily adsorb certain pollutants. When the temperature and wind speed rise to a certain extent, the adsorbed pollutants may be released again.

### *3.2. Contaminant removal method*

*3.2.1. Photo-catalyst technology.* Photo-catalyst is a photo-catalytic material with titanium dioxide as the main component. Under the action of ultraviolet light and visible light, it has catalytic degradation function, can treat toxic gas harmlessly, and has anti-fouling and deodorizing effects. Ultra-photo catalyst is an upgraded product of photo-catalyst. After adding platinum, it can achieve 95% effect and produce semi-permanent effect, making up for the short-term effect of photo-catalyst relying on ultraviolet light and visible light.

*3.2.2. Photo-catalytic oxidation technology.* The chemical reaction is carried out under the action of light. Firstly, the catalyst and the harmful substance are fused, then the redox reaction is carried out, we will obtain carbon dioxide, water and other ions, finally the adsorption means is used as an aid. After two treatments, the safety of the treated air is improved. The photo-catalytic oxidation technology is characterized by high efficiency in treating indoor pollutants, and the treated materials do not cause secondary pollution.

*3.2.3. Low temperature plasma technology.* The mechanism of low temperature plasma to remove volatile organic compounds (VOCs) is: in the process of generating plasma, the high energy generated by high frequency discharge is enough to open the chemical energy of some harmful gas molecules and decompose them into elemental atoms or harmless molecule; the plasma contains a large number of high-energy electrons, positive and negative ions, excited-state particles and strong oxidizing free radicals, under the action of electric field, some odor molecules combine with active ions and are excited when they obtain energy. When it is possible to break its molecular bond, the odor molecule will be decomposed into a single atom or a harmless gas molecule composed of a single atom. At the same time, active free radicals and ozone are generated, which react with the pollutant gases to form harmless substances. In addition, the static electricity generated in the plasma process also has a particle sedimentation effect, and the generated ultraviolet rays have the function of antiviral and sterilization.

## **4. Countermeasures**

Green and moderate decoration. Building decoration materials are one of the main causes of indoor air pollution. Green decoration is using environmentally-friendly building decoration materials appropriately to make a reasonable decoration for the interior. When choosing decoration materials, people should emphasize safety and use non-polluting or low-pollution materials. Green decoration can effectively reduce the indoor air pollution source, thereby reducing or avoiding the generation of indoor air pollutants and strengthening the control of the source of pollutants.

Use clean energy to reduce the amount of pollutants produced by combustion. Pay attention to the air sanitation in the kitchen, keep it ventilated during cooking, and every time you cook, you had better to open the window to change the air to remove the pollutants in time, and reduce the accumulation of pollutants.

Take clean-up measures, open the window to ventilate, place green plants, use the adsorbent or machine to purify the air, to discharge the indoor polluting gas that has been generated into the room or convert it into non-polluting substances.

Strengthen the monitoring of indoor pollutant content. Relevant documents have given the safe range of pollutant concentrations, but in general, the public does not know the specific content of indoor

pollutants. Strengthening the monitoring of indoor pollutants and quantifying the content of pollutants will enhance people's perception of the concentration of polluted gases and take timely measures.

## 5. Summary

The variety of indoor air pollutants, long release period, wide source, and serious accumulation effect seriously threaten people's life and health. In order to improve the quality of indoor air, we must raise awareness of indoor environmental protection, pay attention to indoor ventilation, and pay attention to green decoration and indoor pollutant monitoring. Good air quality is good for the health of the residents, improving the mental state of the occupants and enhancing the comfort of the residents.

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