Causes and Treatment Technology of Indoor Air Pollution

Dong Mao, Yu Wang and Manyu Wei

Economics and Management, Shenyang Aerospace University, Shenyang 110136

Keywords: Indoor air pollution, control technology, prevention measures

Abstract: More and more people have begun to realize this; people's negative impact on the environment has become more and more obvious. There are two main types of air pollution: outdoor air pollution and indoor air pollution. Particulate pollutants and other gaseous pollutants constitute outdoor air pollutants. There are many different reasons that cause indoor air pollution. If the harmful substances in indoor air exceed the limit, it will harm our health and we are prone to respiratory diseases. Formaldehyde, containing stupid substances and stupid derivatives, ammonia, radioactive radon and so on is the main components of chemical pollutants. In the past three decades, the most serious urban pollution in China has been the smog, which has become worse and worse with the worsening environment in the central and western regions.

1 Introduction

With the development of economy and social progress, the consumption of fuel in human society is gradually increasing, which leads to the decline of air quality, and the diseases related to air are also quietly emerging. Because today's air quality has deteriorated, the residents of the city life is becoming more and more poor health, the incidence of throat disease has been rising, people used to think that air pollution is serious, outdoor however indoor air pollution severity often than outdoor 1 to 3 times or more, this and people's cognitive deviation, people should pay more attention to this, people usually open a window ventilated also became the enter indoor or primary sources of air pollution because of the bad ventilation quantity of the number and kinds of indoor air pollutants are the growth and cause a series of symptoms in humans. In terms of the impact of environmental pollution on human health, indoor environment is far more serious than outdoor environment. However, people's work, study, entertainment and other activities are more indoor. Accordingly, purify indoor air to having pivotal position. The types and characteristics of indoor pollutants are different from outdoor pollutants, because the long-term environment of these two types of pollution is also different.

2 Characteristics of Indoor Air Pollution

Indoor pollutants have a cumulative characteristic, which is closely related to the indoor confined space. Once pollutants enter the room from the outside, it is difficult to circulate from the room to the outside, which will lead to the increasing concentration of pollutant particles in the room, plus some indoor furniture will also secrete and release pollutants. After a long time of accumulation, it will inevitably cause a certain degree of damage to the human body. Indoor pollution is also long-term. When a person is in a closed indoor environment for a long time, a certain amount of pollutants will be absorbed for a long time, which will accumulate in the human body and eventually affect the health of the person. Indoor pollution is diverse, there are chemical pollutants, such as formaldehyde, benzene and benzene derived organic matter, ammonia, nitrogen oxides, sulfur dioxide, carbon monoxide, ozone, etc. There are biological pollutants, such as bacteria, viruses, parasites, etc. There are also radioactive pollutants, such as radon gas and its daughters.

3 Sources of Indoor Air Pollution

3.1. Harmful Gases Released by the Burning of Various Fuels

Burning fuel release of harmful gases, mainly carbon dioxide, sulphur dioxide and other chamber of nitrogen oxides, hydrocarbons and total suspended particles, their main fossil fuels produced by the industry and rural burning wood, straw and other crops, belongs to the non-renewable resources, fossil fuels and the release of carbon dioxide, sulphur dioxide and other harmful gas combustion cause serious damage to human body health, carbon dioxide is the main cause of the greenhouse effect, according to the survey shows that carbon dioxide concentrations reach 1500-2000 parts per million (PPM), people will feel the asthma, symptom such as headache, dizziness. When the concentration of CO2 in the office reaches 2000 PPM, employees will feel sleepy, unfocused and mentally tired. After exceeding 2000PPM, we don't even want to continue working, and our thinking ability decreases significantly. When the concentration of carbon dioxide rises above 5000 PPM, it will cause obvious harm to the human body. At this time, the human body's functions will be seriously confused and people will lose consciousness.

3.2. Indoor Activities

Indoor allergens will breed in dirty, dirty rooms. Fungi and dust mites are the main indoor allergens, mainly from poultry, dust, etc. The breeding ability of fungus is very strong, want to have a little moisture and organic matter only, can grow namely indoor activity indoor is not clean, send sensitive sex biology to breed. Indoor those who cause allergic biology is main are fungus kind and dust, mite bug. They come mainly from dust, domestic animals, etc. Fungi are highly adaptable to the environment and can grow wild with only a little water and organic matter. Some household electronic instruments and equipment can also produce indoor chemical pollutants, such as the most common photocopiers, dust remoters and so on can produce ozone, ozone will use its strong oxidation nature to stimulate people's respiratory tract, especially damage our alveoli. Household appliances also produce electromagnetic radiation. Electromagnetic radiation if long-term stimulation of the human body, people will appear dizziness, memory decline, no strength and other symptoms.

3.3. Smoking

Cigarette smoke produces about 91 percent of indoor pollutants and contains high concentrations of carcinogens. Cigarette smoke in the composition of nicotine, tar, carbon monoxide and benzo pyrene, formaldehyde and other 69 kinds of carcinogenic substances. Cigarettes have a huge impact on indoor pollutants, investigation shows that as long as a person in 40 square meters of indoor smoking two cigarettes will cause indoor formaldehyde concentration up to more than 0.1mg/m3.The concentration of benzo pyrene, a carcinogen, can be as high as 0.16 micrograms per cubic meter of air.

3.4. Interior Decoration Materials

Indoor decoration materials pollutants mainly include formaldehyde, benzene, stupid substances or gases, ammonia, ammonia, ammonia containing substances and TVOC, among which formaldehyde has even been confirmed by the world health organization as carcinogenic and deformed substances, decoration materials must be used in the decoration of new house. Decorate material to be able to release the material that is harmful to human body, affect body health or mental health. In the newly decorated new house, formaldehyde, benzene, amine, radon and a large number of substances increased, these are harmful to the human body.

4 Application Technology to Solve Indoor Air Pollution

4.1. Activated Carbon Adsorption and Filtration Technology

This method is a physical method, mainly through mechanical equipment, ion dust removal and electrostatic dust removal technology to achieve the adsorption and filtration of small particles in the indoor air, effectively reduce the particulate matter in the air. It is a common problem that several adsorption and filtration technologies cannot effectively control the harmful gas in the room. And activated carbon adsorption method, although has strong adsorption ability, strong stability, can be to formaldehyde, sulfur dioxide, ammonia, nitrogen oxides, such as the effective purification, however, is because of its adsorption capacity on inorganic gas is relatively poor, and sensitivity to the humidity is stronger, at the same time, ester, ketone, aldehyde pollutants will also block the pores of active carbon in different degrees, and adsorption power reduction.

4.2. Plasma Static Power Grid Purification Technology

Under the condition of low temperature, under the action of the external electric field, the plasma will discharge a large number of electrons to bombard the pollutant molecules, which will effectively decompose and ionize the pollutant molecules. This is the plasma static power grid purification technology. At this time, the large molecule pollutants will be transformed into small molecule safe substances, and at the same time, the toxic and harmful substances will become non-toxic and harmless or low-toxic and low-harm substances, and finally the pollutants can be degraded and removed.

4.3. HEPA Filtration Technology

HEPA is High Efficiency Particulate Air FILTER (High Efficiency Particulate Air FILTER), HEPA initially applied in nuclear research protection work, now is mainly used in laboratory, and the medical industry has a High demand on cleanliness of fields such as. The purification efficiency of this technology is very high, the adsorption capacity is larger and it has the characteristics of water absorption. Studies have shown that the purification rate of particles about 0.3 micron also reaches 99.98%, which means that only 20 particles can penetrate the HEPA filter membrane for every 100,000 particles. The filter element used in this technique is woven with tiny organic fibers. Therefore, its filtering effect of particulate matter is very obvious. If we use this technique to filter the pollution emitted by cigarettes, the final result will be 100%, because the particles in the pollutant cannot penetrate the HEPA film, and the particles in cigarettes are between 0.5 and 2 microns. The method works by separating suspended particles from the air, and has already been developed for indoor use. Initially the purifier was very limited in function because of the thin adsorptive material that the technology limited. However, the problem of insufficient adsorption provides a choice for high adsorption materials to a certain extent. In the practical evaluation of filter materials, the use of HEPA is more common. HEPA filter materials have large area and strong chemical adsorption, which can effectively remove particles and dust in pollutants.

4.4. Photocatalyst Technology

Catalyst is the sunlight, fluorescent lamp, ultraviolet light is energy, stimulate the price bring electronic (e -) jumps to the conduction band, the price with a corresponding holes (h +), generation of strong oxidation of active oxygen and hydrogen and oxygen free radicals, this will make a lot of chemical pollutants and bacteria, such as oxidation into harmless CO2 and H2O, decomposition of harmful substances and purify the air, kill two birds with one stone. The filter made of ordinary activated carbon and catalyst can purify air by consuming medium, and has no long-term effect. Photocatalyst itself is not involved in chemical reactions, only provide the reaction site, and because of this can be used for a long time. Photocatalyst is an environmentally friendly product that does not produce secondary pollution.

4.5. Fiber Filtration Technology

Most of the particles entering the filter medium will hit the medium with great probability, and once they touch the medium, they will be stuck, and the large particles will be formed by the friction and collision of the small particles. After a certain period of time, the areas hit, walls and ceilings will lose their color. This is due to the impact of dust and particles in the room, and black patches will appear in local areas with high airflow velocity. This requires filtration materials: in real life, non-uniformly distributed fiber materials meet this requirement. Irregular fiber forms numerous barriers to form resistance to dust, and the open gap in the middle of fiber allows airflow to pass through it barrier-free. Other breathable materials can also be made into filtration materials, such as perforated foam materials. However, fiber materials are more breathable and lighter, which makes them widely used in daily life. The amount of fiber in the filter media as much as possible will make the filter more efficient, the fiber should be as thin as possible to reduce the air resistance, the fiber media should also be safe, not easy to aging, low cost. For this reason, people have tried many fiber materials for repeated experiments and comparative screening. Currently, the most widely used materials include glass fiber and plant fiber, etc. In mineral fiber, due to safety problems, countless materials have been eliminated and only glass fiber has not been eliminated. Fiber filtration technology has become one of the most popular and cost-effective technologies for filtering 10 micron particles.

4.6. Polymer Polymerization

Will produce peculiar smell material adsorption to its carrier, and produce chemical reaction, through changing the molecular structure of the object material, to decompose harmful substances, make more powerful to eliminate odor and achieve the purpose of purifying air. The active polymer chain can adsorb harmful air and odor molecules quickly and powerfully, and then decompose the active functional groups to eliminate harmful substances. It can change the molecular structure of harmful air components; break down organic matter and water. Non-toxic, tasteless, no side effects, safe and reliable. Moreover through the flocculation principle: flocculation adding high polymer flocculants is mainly in the system, high polymer flocculants by its polarity base or ionic groups and particle form hydrogen bond or ion pair, combined with the adsorbed on the particle surface, van der Waals force and bridge between particle form even huge flocks and separated from aqueous solution. Flocculation is characterized by small amount of flocculants, fast increase of volume, fast formation of flocculants and high efficiency of flocculation. By grafting coincidence technology of molecular structure, the grafting and the grafted material form a stable polymer, which fundamentally solves the problem of the lack of stability caused by the low substructure and will not degrade the product performance due to the passage of time. The adsorption and decomposition speed is greatly accelerated and the use conditions are relatively low. Benzene, toluene, xylene, total volatiles of TOVC, etc. are completely purified and eliminated under the macromolecule condition. From this point of view, it does reduce their impact on the air, thus ensuring the safety of indoor air.

5 Conclusion

Indoor air pollution is now widely concerned, with the development of science and technology, more and more technology is applied to the field of indoor air pollution control, now we can through planting plants, choose the appropriate decoration materials, more ventilation measures to reduce indoor air pollution.

Acknowledgements

Innovation and entrepreneurship training program for college students of Shenyang Aerospace University (Item No: 110418249).

References

[1] Li meng. Analysis of indoor air pollution and air purification technology. 2018/8/27: frontiers of architectural research, issue 9, 2018

[2] Indoor air pollution and its prevention and control measures [J]. Chen qiming, niu runping, wang qiang, zhu jia. Building heat energy ventilation and air conditioning. 2007(03)

[3] Investigation and prevention of indoor air pollution in newly decorated rooms [J]. Zhou linhong, wu yan. Gansu science and technology. 2004(08)

[4] Indoor air pollution and selection of air purifiers [J]. Lin Lin. Tianjin science & technology. 2017(01)

[5] "Invisible killer" of human health -- indoor air pollution [J]. Zhao kaige, zhang liang. Journal of gansu normal university. 2018(06)

[6] On the harm of indoor air pollution and its prevention and control [J]. Li hua. Green and environment-friendly building materials. 2018(02)