

Determination of Volatile Organic Pollutants in the Atmosphere by GC/MS Methods

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[Abstract] At this stage, China's environmental protection work is in full swing, and the path of sustainable development has become the direction of China's future development. This requires economic development and environmental health as well as the health of the atmospheric environment. It is necessary to pay full attention to the detection of atmospheric environmental quality and provide a basis for the treatment of air pollution problems. This paper mainly analyzes the application of the determination method of volatile organic pollutants in the atmosphere, and mainly studies the application of GC/MS measurement methods. It is hoped that this theoretical study will help volatile organic pollutants in the atmosphere. The actual management work is carried out.

[Keywords] Air pollution; Organic pollutants; GC/MS methods

1. Introduction

Volatile organic pollutants in the atmosphere are the most widely distributed outside of particulate pollutants, and the most abundant types of gaseous emissions, which pose a great hazard to human health. The problem of atmospheric pollution in China has become more and more serious. It is imperative to strengthen the control of atmospheric pollution. This requires an effective method for the detection of pollutants in the atmosphere, combined with the characteristics of pollutants, and determined by GC/MS. The application of the method has positive significance for solving the problem of volatile organic pollutants in the atmosphere.

2. Volatile Organic Pollutants and Sources in the Atmosphere

For the volatile organic pollutants in the atmosphere, the World Health Organization defines it as an organic compound in the air at room temperature with a saturated vapor pressure of more than 133.32 Pa and a boiling point between 50 °C and 260 °C and at room temperature in the form of steam. There are many types of volatile organic pollutants, and the total can be divided into two categories, organic pollutants composed of pure carbon and hydrogen, and hydrocarbons with hetero atom substitution. The sources of volatile organic pollutants in the atmosphere are both man-made and natural sources. For natural sources, they are biological sources, including microbial sources and animal and plant sources. The anthropogenic source

contains a fixed source of mobile sources. These volatile organic pollutants are not very high in the atmosphere, but they have many kinds of species and pose a great threat to human health.^[1] In the current wave of global economic development, the problem of air pollution has become more and more serious. It is necessary to speed up the pace of air pollution control, strengthen the detection of atmospheric volatile organic pollutants, and lay a solid foundation for handling air pollution problems.

3. The Hazards of Volatile Organic Compounds in the Atmosphere and the Current Status of Determination Methods

3.1 Hazards of Volatile Organic Compounds in the Atmosphere

The harmful effects of volatile organic pollutants in the atmosphere are enormous. They are toxic, carcinogenic, and produce photochemical smog, which can cause great harm to indoor and outdoor air quality and human health. However, due to the high variety of volatile organic pollutants, the specific impact on human health is not clear. The concentration of volatile organic pollutants in the air is relatively low. The indoor source contributes a lot to the individual exposure. In the exposed atmosphere and the indoor environment, the volatile organic pollutants in the atmosphere are the specific impact of the research work has increased the difficulty.^[2] From the results of the actual research, it can be found that the harmful effects of volatile organic pollutants in the atmosphere are mainly direct and indirect. In terms of direct harm to humans, VOCs are mainly characterized by infiltration and volatilization and fat solubility. Therefore, if people do not take effective protection measures for a long time and they are connected with pollutants, they will be seriously damaged. Human internal organs as well as the central nervous system and immune system directly cause human poisoning. Common symptoms include phobia and memory and dizziness and headache. Formaldehyde in volatile organic pollutants is an important part. It is also a volatile pollutant that people are familiar with in life. It is a serious carcinogen in the human respiratory system and is a suspected carcinogen. According to the World Health and European Affairs Bureau, the following data can be used as a reference for the hazards of VOCs in the air to human health. In the case of different concentrations of total volatile organic pollutants, the harm to humans is also different. For example, when the total concentration is less than 0.2 mg/m^3 , no effect has been found on humans, but at the total concentration. It may have an effect at $0.2\text{-}0.3 \text{ mg/m}^3$, but the effect is relatively small. When the concentration is between 0.3 and 3 mg/m^3 , there will be inflammation and uncomfortable conditions. When the concentration reaches $3\text{-}5 \text{ mg/m}^3$, there will be odor, and the resident will have a strong reaction. The concentration is $5\text{-}8 \text{ mg/m}^3$ will have a significant impact on human physiology, which will cause inflammation of the eyes, eyes and throat. When the concentration reaches $8\text{-}25 \text{ mg/m}^3$, headache and dizziness will occur, and when it

is greater than 28, headache and poisoning will occur.^[3] A serious anemia can cause aplastic anemia and so on.

The indirect hazards caused by volatile organic pollutants in the atmosphere to human health are also prominent. They are not only harmful to individuals, but also cause great harm to people's living environment. From the current concentration of volatile organic pollutants in the atmosphere, it is relatively low and will not cause harm to humans, but most of the pollutants have photochemical reactivity, and will be in the atmosphere under ultraviolet light. Nitrogen oxides react to cause secondary pollution and ozone and high oxides are generated. And eventually the formation of photochemical smog, which will have a great impact on the atmospheric environment, especially in densely populated cities and industrial areas, where the concentration of volatile organic pollutants will increase, and the resulting photochemical smog pair. The toxic effects of the human body are even more pronounced.^[4] Photochemical smog can not only cause human death, but also cause color changes in plants and direct effects on their growth, as well as increase the incidence of livestock, and damage to various utensils and materials.

3.2 Status of Determination Methods of Volatile Organic Compounds in the Atmosphere

The determination of volatile organic pollutants in the atmosphere is more important. This is an important task to solve this type of air pollutants. There is currently no standard method for determining volatile organic pollutants in the atmosphere in China, and some volatile organic compounds are determined. The component method of pollutants mainly includes the hygienic standard of p-dichlorobenzene in indoor air, which is determined by gas chromatography.

There is also a standard method for the hygienic inspection of benzene toluene and xylene in the atmosphere of residential areas, which is determined by gas chromatography, as well as air quality benzene series measurement, which is a method of carbon disulfide desorption gas chromatography by activated carbon adsorption. With the rapid advancement of science and technology in China, the measurement technology for volatile organic pollutants in the atmosphere is constantly being upgraded and diversified.

The gas chromatography and liquid chromatography and gas chromatography-mass spectrometry methods for the separation and analysis of complex organic pollutants in the atmospheric environment have been widely used in practical measurement work and the effects of each method are different. Different, such as the application of the combination of gas chromatography and pristine, can effectively identify complex natural products and play a positive role in the determination of volatile organic pollutants.

4. Application of GC/MS Method for Determination of Volatile Organic Pollutants in Atmosphere

4.1 Application Points of GC/MS Methods for Determination of Volatile Organic Compounds in the Atmosphere

At present, the protection of the atmospheric environment is more and more important, and the application of the GC/MS method can timely and effectively analyze the composition of volatile organic pollutants, so as to take a targeted approach to deal with it. When the amount of volatile organic pollutants exceeds a certain concentration, it will directly harm human health and form secondary pollution caused by photochemical smog. This requires deepening the application of the GC/MS measurement method. The measurement and analysis of volatile organic pollutants in the atmosphere is mainly applied by the normal temperature Tenax-GR sampling tube, sampling volatile organic pollutants, and then heating them. The application of GC/MS measurement technology is applied. Perform qualitative analysis and apply quantitative analysis to GC/FID assays.^[6] When conducting relevant operational tests, it is necessary to pay full attention to the improvement of the preparatory work, prepare the appropriate instruments for use, and operate according to standard methods. The application of the GC/MS measurement technology involves gas chromatography and mass spectrometry, as well as quantitative analysis equipment. After the basic equipment is prepared, the sampling tube and the trap tube are self-contained with sixty to eighty mesh Tenax-GR adsorbents. The furnace must also be prepared, which can be obtained by self-made methods, mainly for desorption of the sample tube and the thermal desorption operation of the supplemental tube. Corresponding equipment such as temperature controllers and atmospheric samplers, as well as all-around all-glass syringes and quartz wool are also required. After these devices are ready, the corresponding reagents will be prepared, mainly including ethylbenzene, toluene, benzene, o-xylene and other chromatographic reagents.^[7] For the configuration of Volkswagen VOC samples, we must also take eight air samples of benzene series. We need three syringes of 100 ml. We must cover the clean air with 60 ml and put a rubber cap. Then use a microliter micro-syringe to sequentially add styrene and o-xylene and meta-xylene from the outside of the syringe A gel cap, and control the amount in 0.7 μl , for each of benzene and toluene 0.3 and 0.5 μl , in each. After the components are vaporized, it is necessary to be able to mix 100 ml of clean air. Then, 5 ml of the mixer was taken through a 5 ml syringe to inject into the syringe B, and a fixed volume of 100 ml was mixed by clean air. Then, 1 ml of the mixer was taken from B through a 1 ml syringe and injected into the syringe C for mixing, and then the gas in the syringe C was all pushed to the sampling tube. In the actual measurement work, it is necessary to pay full attention to the safety corresponding measurement conditions, and the conditions of the sample introduction device and GC/MS and GC/FID operation must be in accordance with the standard.

4.2 Application Steps and Effects of GC/MS Methods for Determination of Volatile Organic Compounds in the Atmosphere

The application of GC/MS measurement method in the determination of volatile organic pollutants in the atmosphere must be carried out according to the corresponding steps to ensure the scientific specifications of each operation step, so as to help to accurately determine the volatile organic pollutants in the atmosphere. . First, in the sampling process, the sampling tube is connected to the atmospheric sampler, and the real-time sampling processing is performed through 0.4L/min flow. The sampling amount for quantitative analysis of volatile organic compounds in the atmosphere should not exceed 10 liters, and the qualitative analysis should not exceed 50 liters. After sampling the organic pollutants, they should be safely stored through the back cap. Then, the trapping operation is performed, that is, after the sampling tube and the collecting tube are connected to the sampling device, the six-way valve is placed at the trapping position, and the temperature of the sampling tube is doubled to 200. The Celsius heating furnace turns on the blower and purges it for four minutes at a flow rate of 50 ml per minute, thus closing the valve, thus completing the entire trapping operation. After that, it is necessary to carry out the injection operation. When the six-way valve is still in the trapping position, it is necessary to move the furnace to the trap tube, and after two minutes, the valve is screwed to the injection. Position, after twenty seconds, re-rotate and take off the furnace. After these operations, the injection operation is completed.^[8]

Finally, qualitative and quantitative analysis is performed to characterize volatile organic pollutants in the atmosphere. The analytical work is the GC/MS measurement method used, and the quantitative analysis is performed by the GC/FID measurement method. For example, during the qualitative analysis operation, the total ion chromatogram is drawn by GC/MS, and the memory is searched by probability according to the 49,000 standard spectra of the memory, and finally confirmed. In the quantitative analysis, the eight material standard curves of this test were drawn by GC/FID, and the correlation coefficient was greater than 0.9997, which was quantified by the single-point calibration method.

According to the analysis of volatile organic pollutants in the atmosphere, benzene, toluene, ethylbenzene, p-xylene, m-xylene, cumene, o-xylene, styrene, in precision and recovery rate can be seen. The same sample was repeatedly measured six times, and the average values were benzene 1.32, toluene 2.17, ethylbenzene 3.05, p-xylene 3.03, m-xylene 3.06, cumene 3.04, o-xylene 3.12, and styrene 3.12. The standard deviations were benzene 0.04, toluene 0.07, ethylbenzene 0.09, p-xylene 0.11, m-xylene 0.11, isopropylbenzene 0.16, o-xylene 0.26, and styrene 0.12. After the experimental application of the GC/MS measurement method, the determination of volatile organic pollutants in the atmosphere is relatively good and the accuracy is relatively high.

5. Conclusion

In summary, China's sludge treatment is still in the process of continuous exploration, and the widely used dry incineration sludge treatment method has certain advantages, helping to reduce the amount of sludge while protecting the environment. The toxic gases contained in the burned exhaust gas and the polluting organic matter is greatly reduced. However, dry incineration also has certain shortcomings. For example, dust explosion may occur during the drying process, 'combustion of combustible gas', high temperature steam damage, etc., so this requires researchers in China to continue to conduct further research on the treatment of sludge to achieve environmental protection.

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