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THE METHODOLOGY FOR USING A PM1-PM10 COLLECTION DEVICE IN UZBEKISTAN IS RELEVANT TO THE CLIMATIC CONDITIONS

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Abstract
A number of factors are important in increasing the relevance of the issue of creating a PM1 and PM10 particle collection device in the climatic conditions of Uzbekistan. The arid and semi-arid climate of Uzbekistan leads to an increase in the concentration of dust and particles in the air. As a result of climate change, industrial development and urbanization processes, the level of air pollution is increasing, which requires monitoring of PM1 and PM10 particles. These particles can negatively affect human health, cause the development of respiratory and cardiovascular diseases.
The growth of industry and the increase in vehicles increases the amount of PM1 and PM10 particles in the air. Monitoring and collecting particles allows the state and the public to assess the level of air pollution. With the help of modern technologies, the processes of detecting and collecting PM1 and PM10 particles are being improved. By creating innovative devices, it is possible to develop effective solutions that are suitable for climatic conditions. This study aims to analyze the relevance of creating a PM1 and PM10 particle collection device in the climatic conditions of Uzbekistan.

Keywords: PM1, PM10, climate conditions, air pollution, environmental monitoring, industrial development, urbanization, particle collection, health, innovative technologies, monitoring system, air quality, dust concentration,

Introduction

The issue of creating a device for collecting PM1 and PM10 particles in the climatic conditions of Uzbekistan is of great importance in solving environmental problems today. The arid and semi-arid climate of Uzbekistan leads to an increase in the concentration of dust and particles in the air. As a result of climate change, industrial development and urbanization processes, the level of air pollution is increasing, which requires monitoring of PM1 and PM10 particles. These particles can have a negative impact on human health, for example, they can cause the development of respiratory and cardiovascular diseases.
PM1 and PM10 particles are present in the air, and their sizes are smaller than 1 micrometer and 10 micrometers. These particles can remain in the air for a long time and enter the human body. Therefore, implementing their detection and collection processes can help reduce health problems. Growth in Uzbekistan's industrial and transportation sectors increases the amount of PM1 and PM10 particles in the air. Construction activities can also cause air pollution [1-5].

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Particulate matter monitoring and collection processes enable governments and the public to assess air pollution levels and take action to improve them. Such devices can also be integrated into environmental monitoring systems, which play an important role in assessing air quality and ensuring ecological balance [6].

Modern technologies are improving the detection and collection of PM1 and PM10 particles. By creating innovative devices, it is possible to develop effective solutions that are suitable for climate conditions. Such devices are also expected to help reduce air pollution and play an important role in protecting public health [7].

The purpose of this study is to analyze the relevance of creating a PM1 and PM10 particle collection device in the climatic conditions of Uzbekistan. The study will consider the effectiveness of particle collection technologies, device design in accordance with climatic conditions, and the possibilities of improving air quality using these devices[8-9].

At the same time, the increase in air pollution levels due to climate change and urbanization processes makes monitoring PM1 and PM10 particles even more urgent. In such conditions, the creation of effective devices for collecting and controlling particles will be of great importance not only for solving environmental problems, but also for protecting human health[10].

MATERIALS AND METHODS

This study describes the materials and methods required to create a PM1 and PM10 particle collection device in the climatic conditions of Uzbekistan. The main goal of the study is to improve the processes of determining, collecting and monitoring the concentration of particles in the air. The use of modern technologies and methods for these processes is important [11].

2.1. Density and measuring instruments

The tools and materials needed for particle collection include the following .

Particulate matter collectors: Devices specifically designed to collect PM1 and PM10 particles. These devices are equipped with sensors to determine the particle size and concentration.

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Figure 1. PM2.5 SAMPLE COLLECTION DEVICE

A high-precision sampling device for airborne particulate matter (PM) with an aerodynamic diameter of 1 micrometer (PM1) to 10 micrometers (PM10) suitable for dry climates, in which PM samples are collected using filters and cyclones.

Cyclones can collect airborne particles with an aerodynamic diameter of up to 150 nanometers, which increases the accuracy and reduces costs of PM toxicity assessment analysis in dry climates.

Filters: High-quality filters, such as PTFE (polytetrafluoroethylene) or N95 filters, are used to collect particles. They allow for effective particle capture [12].

Figure 2. Appearance of the RTFE filter

Measuring instruments: Laser measuring instruments, gravimetric methods, and other analytical methods are used to determine the concentration of particles in the air.

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Figure 3. Device for measuring air and dust levels in the enterprise

3. Methods

3.1. Particle collection process

Device preparation: First, a particle collection device is prepared. The device is equipped with measuring instruments and filters. The filters are placed to trap particles during the collection process.

Determining monitoring conditions: The location and conditions where the research will be conducted are determined. Monitoring will be conducted in various regions of Uzbekistan (industrial zones, transport corridors, rural areas).

Figure 4. Particle collection process:

Particle collection: The device is started and begins collecting PM1 and PM10 particles in the air. During the collection process, the particles pass through the filter and are retained [13-14].

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3.2. Analysis methods

The following methods are used to analyze the collected particles:

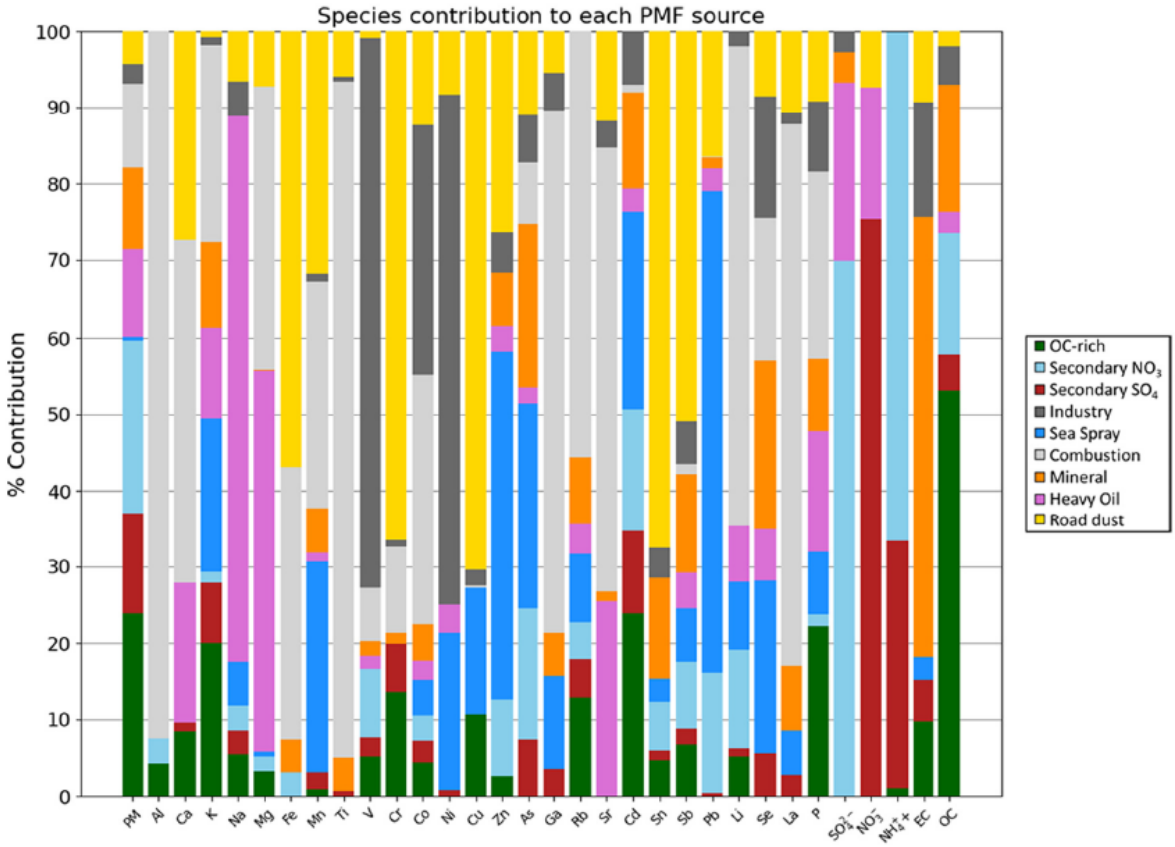

Figure 5. Chemical speciation and source contribution to total mass of particulate matter (PM), according to the multisite multisize Positive Matrix Factorization (PMF) solution.

Gravimetric analysis: After the filters are collected, their weight is measured. The weight of the filter before and after particle collection is measured, from which the particle concentration is calculated [15].

Spectroscopy: Spectroscopic methods, such as UV-Vis spectroscopy or atomic absorption spectroscopy, are used to determine the chemical composition of particles.

3.3. Data analysis

The collected data is analyzed using statistical analysis methods. The following methods are used to analyze the data:

Descriptive statistics: The mean, variance, and standard deviation of the particle concentration are calculated based on the data obtained.

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Regression analysis: Regression analysis is used to determine changes in the concentration of airborne particles. This method examines the dependence of particle concentrations on time or other factors [16-19].

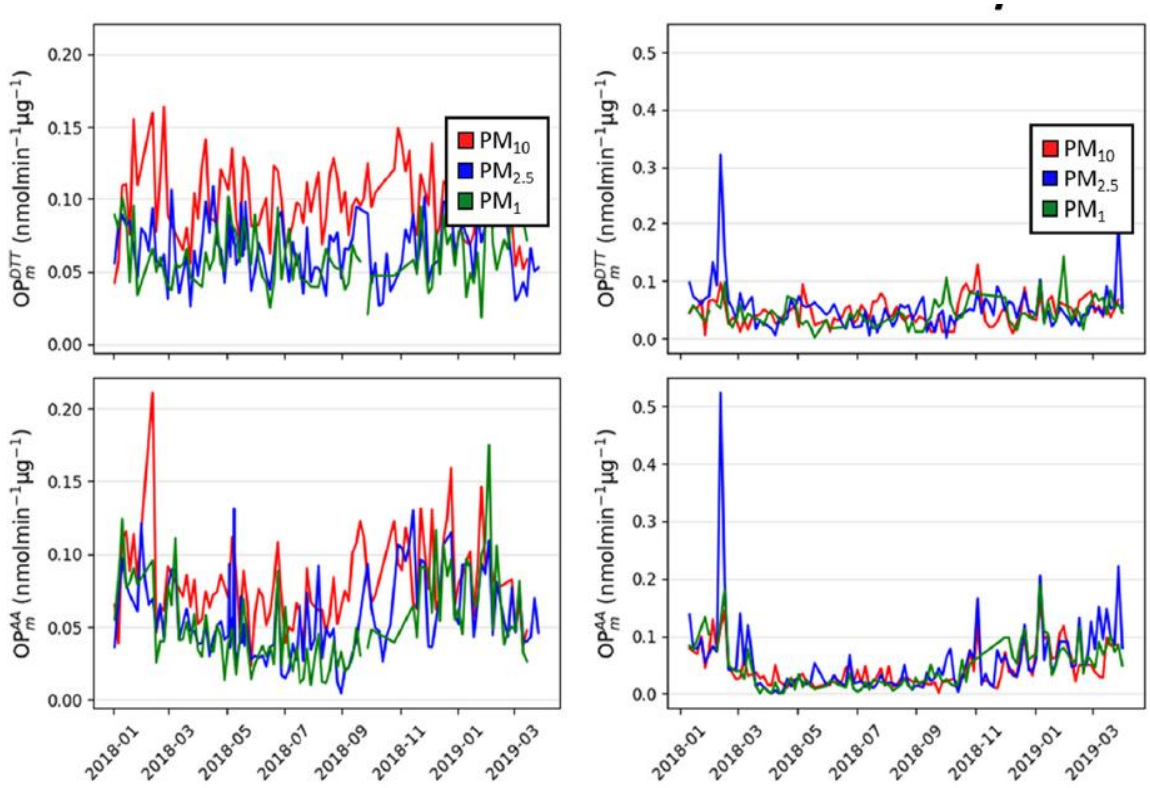

Figure 6. The data obtained is presented in a graphical format, which visually shows the change in particle concentration over time.

4. Results and Discussion

The results obtained during the study and their discussion are presented in a separate section. In this section, the efficiency of the particle collection process, the results obtained, and their significance in the climatic conditions of Uzbekistan are analyzed.

Factor	PM_{10}	$PM_{2.5}$	PM_1	PM_{10}	$PM_{2.5}$	PM_1
OC-rich	0.473	0.066	0.063	0.049	0.044	0.065
Sec. NO_3	−0.016	0.011	−0.021	−0.019	0.002	−0.005
Sec. SO_4	0.106	0.132	0.067	0.043	0.059	0.023
Industry	−0.007	−0.003	0.228	−0.002	−0.030	0.015
Sea Spray	0.104	0.053	−0.009	0.020	−0.019	−0.012
Combustion	0.363	0.100	0.057	−0.061	0.055	−0.016
Mineral	0.188	0.000	0.001	0.047	0.048	−0.008
Heavy Oil	0.200	0.060	0.103	−0.017	0.015	0.022
Road dust	0.172	0.341	0.016	0.121	0.032	0.031

Figure 7. The results of two installed devices are compared with each other.

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Conclusion

The development of a PM1 and PM10 particle collection device in Uzbekistan is a critical response to the escalating air quality issues exacerbated by climate change, urbanization, and industrial growth. As outlined in this study, the arid and semi-arid climate of Uzbekistan contributes significantly to the accumulation of dust and particulate matter in the atmosphere. These particles pose serious health risks, including respiratory and cardiovascular diseases, making their monitoring and collection imperative for public health and environmental sustainability.

The innovative device designed for this purpose utilizes advanced technologies for detecting and collecting particulate matter, ensuring that it is tailored to the specific climatic conditions of Uzbekistan. By employing high-precision sampling methods, such as cyclones and quality filters, the device enhances the accuracy of air quality assessments. This not only allows for effective monitoring of PM1 and PM10 concentrations but also provides valuable data that can inform policy decisions aimed at reducing air pollution.

Furthermore, the integration of this device into broader environmental monitoring systems can significantly improve the ability of government and public health officials to assess air quality trends and implement timely interventions. The statistical analysis methods employed in this study, including regression analysis and descriptive statistics, will facilitate a deeper understanding of the factors influencing particulate matter levels, enabling targeted strategies for pollution control.

The implications of this research extend beyond environmental monitoring; they also encompass public health protection and the promotion of sustainable industrial practices. As Uzbekistan continues to develop economically, the establishment of effective air quality management systems becomes increasingly essential. By prioritizing the creation and implementation of innovative particle collection devices, Uzbekistan can take significant strides toward addressing air pollution and safeguarding the health of its citizens.

In conclusion, the development of PM1 and PM10 particle collection technology represents a vital step in combating the environmental challenges faced by Uzbekistan. It underscores the importance of integrating scientific research with practical applications to foster a healthier, more sustainable future for the nation. Continued investment in such technologies will be crucial for achieving long-term improvements in air quality and public health.

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