

THE CONTENT OF THE SUSPENDED AIR PARTICLES ALONG THE BALYKCHY AND CHOLPON-ATA CITIES

Содержание взвешенных частиц воздуха вдоль трассы Балыкчы - Чолпон-Ата

Балыкчы - Чолпон-Ата жолундагы абадагы бөлүкчөлөр

Abstract: in this article, the content of the suspended particles smaller than $10 \mu m$ along the route Balykchy - Cholpon-Ata is considered. The quantitative content in the air of suspended particles (PM₁, PM_{2.5}, PM₄ and PM₁₀) in spring in the cities of Balykchy and Cholpon-Ata is shown. Data is presented on the effect of the suspended particles of less than $10 \mu m$ in size on the health of the population.

Аннотация: в данной статье рассмотрены вопросы содержания взвешенных частиц размером меньше 10 мкм вдоль трассы Балыкчы - Чолпон-Ата. Показаны количественные данные содержания в воздухе взвешенных частиц PM₁, PM_{2.5}, PM₄ и PM₁₀ в весенний период в городах Балыкчы и Чолпон-Ата. Приведены данные о влиянии на здоровье населения взвешенных частиц размером меньше 10 мкм.

Аннотация: бул макалада Балыкчы - Чолпон-Ата жолундагы абадагы 10 мкмдан төмөн болгон бөлүкчөлөрдүн камтылышын кароо маселеси каралган. Жай мезгилиндеги Балыкчы жана Чолпон-Ата шаарларындагы PM₁, PM_{2.5}, PM₄ жана PM₁₀ бөлүкчөлөрүнүн абадагы сандык камтылышы, ал бөлүкчөлөрдүн ден-соолукка болгон таасири каралган.

Keywords: suspended particle; air pollution; concentration; morbidity.

Ключевые слова: взвешенная частица; загрязнение воздуха; концентрация; заболеваемость.

Негизги сөздөр: бөлүкчөлөр; абанын булганышы; концентрация; индикатор; оорушу

Introduction

In the middle of March, the total sum of suspended PM particles and its total TSP concentration in the air were measured along the Balykchy - Cholpon-Ata route using the AEROSOL MASSMONITOR - 831. The very route was selected due to the fact that this northern region has a well-developed road system; also, in summer it is the main tourist area of Kyrgyzstan, where, along the road, there are many boarding houses and recreation areas on the coast of the Issyk-Kul Lake.

Therefore, measurement and analysis in the spring period makes it possible to assess the problems of air pollution in the wake of the winter period. It should be noted that during this period, the total duration of daylight is increased up to three hours, nevertheless, in the morning, in the evening and at night, the air temperature in this region drops to -15°C . The residents along the route use solid and partly liquid fuel for heating their houses.

Thus, during this period, a large amount of solid unburned particles (soot, ash, digging, dust), harmful gases (carbon dioxide, carbon monoxide, nitrogen oxide) and vapors, as well as other harmful to the atmosphere substances and biosphere organisms are ejected. After the usage, these substances do not enter the natural cycle. The vapors and gases form mixtures with the air, and solid and liquid particles form aerodisperse systems-aerosols.

The quality of life of the population depends on the interrelated economic, social and environmental factors, for example, the ecological situation affects the level of public health. Nevertheless, quantitative and qualitative estimation of air with the content of finely dispersed suspended particles of the Issyk-Kul basin is new for scientific researchers of the Kyrgyz Republic. According to new estimates (March 15, 2016) of the World Health Organization (WHO), in 2012, approximately 12.6 million people died of living or working in unhealthy conditions - this is almost one in four people of the total number of deaths in the world. The emergence of more than 100 diseases and injuries is facilitated by the environmental risk factors such as air, water and soil pollution, chemicals effect, climate change and ultraviolet radiation.

Therefore, the quantitative assessment of the suspended particles with diameter less than 10 microns (PM₁₀, etc.) in the air due to the combustion of hydrocarbons during winter and by transport along the Issyk-Kul Lake route is an actual and topical task.

The authors of the work [1] noted that the 1999 Gothenburg Protocol on Suppression of Acidification and Ground-level Ozone was adopted by the Executive Body of the Convention. For the first time, the revised Protocol contains commitments to reduce emissions of fine particulate matter (PM_{2.5}). In addition, black carbon or soot appears in the new edition as an important component of PM_{2.5}. Black carbon is a pollutant that has a negative impact on the health of the population.

Spring suspended particles along the Balykchy - Cholpon-Ata route

Suspended particles (PM) are a widespread air pollutant, which includes a mixture of solid and liquid particles. Indicators that are commonly used to characterize PM and are important for health include the mass concentration of particles with the diameter of less than 10 μm (PM₁₀) and particles smaller than 2.5 μm in diameter. In addition to these particles,

ultrafine-dispersed particles with a diameter of 0.1 μm to 1 μm also exist in the atmospheric air. The most common chemical PM components are sulfates, nitrates, ammonia, other inorganic ions, organic and elemental carbon, minerals of the earth's crust, water-bound particles, and metals. Also, biological components, such as allergens and microorganisms [2] of 0.1 μm to 1 μm can be in the air for many days and weeks, and their physical and chemical characteristics vary with location.

PM10, PM4, PM2.5 and PM1 can penetrate the thoracic part of respiratory system and, depending on the time of the presence of human in this environment, cardiovascular morbidity, exacerbation of asthma, etc., as well as mortality from cardiovascular and respiratory diseases and from lung cancer [2] emerge.

Measurements of suspended particles from 15.03.2017 to 17.03.2017 along the route Balykchy - Cholpon-Ata showed that, in the city of Balykchy the concentration of PM2.5 in the evening is almost two times higher than in the city of Cholpon-Ata. This is explained by the fact that the traffic flow in Balykchy is almost three times higher than in Cholpon-Ata (Fig. 1).

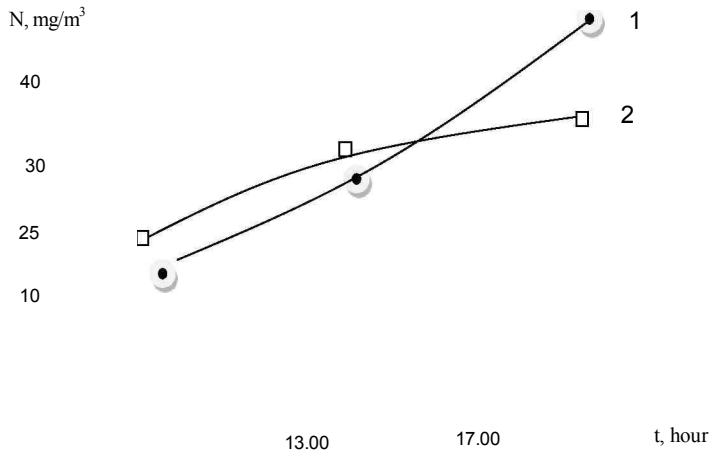


Fig.1. PM2.5 day time changes: 1 - Balykchy; 2 - Cholpon-Ata

For other values, the PM10, PM4 and TSP suspended particles in the above-mentioned cities are also not comparable in spring, this is evidenced by Fig.2-Fig.7. It should be noted that in both cities PM1 values lie at one level (Fig.8), the results of other measurements of the settlements of Sary-

Kamysh, Chyrpykty-Baet have shown that the concentration of suspended particles along the road is much lower than in the cities of Balykchy and Cholpon-Ata.

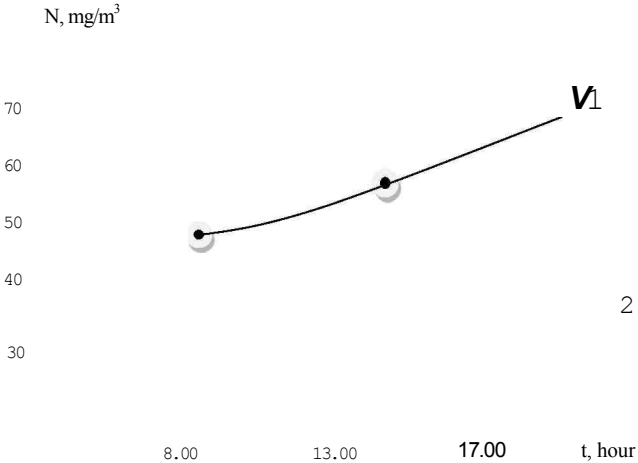


Fig.2. PM4 changes: 1- Balykchy, 2 - Cholpon-Ata.

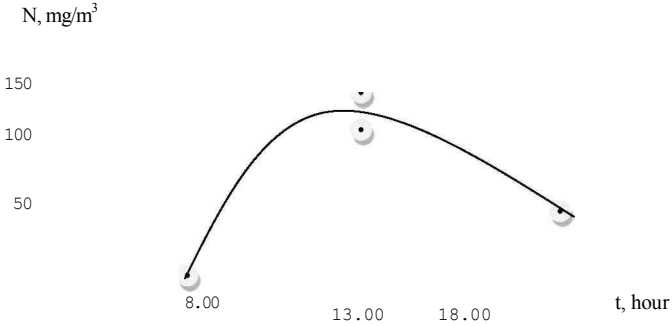


Fig.3. PM10 changes (Cholpon-Ata)

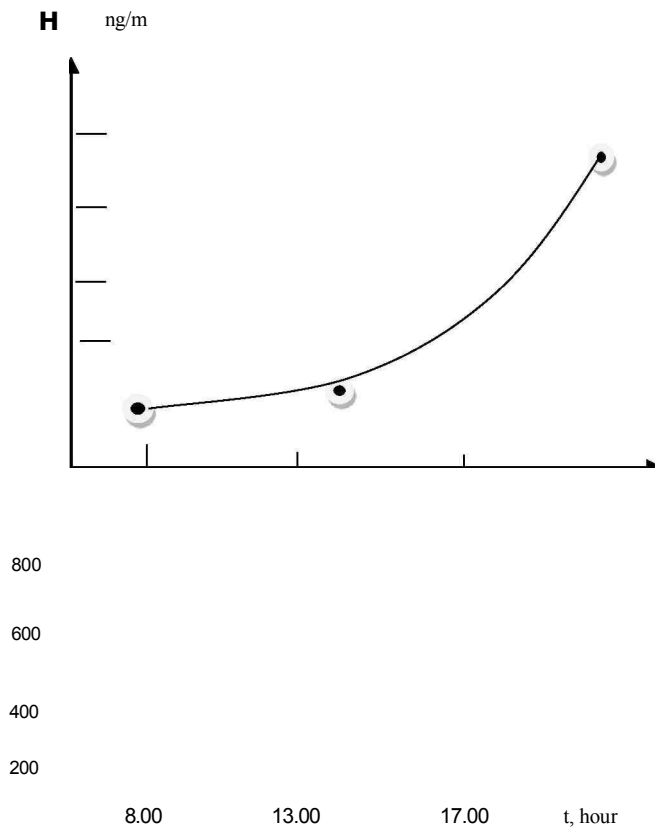
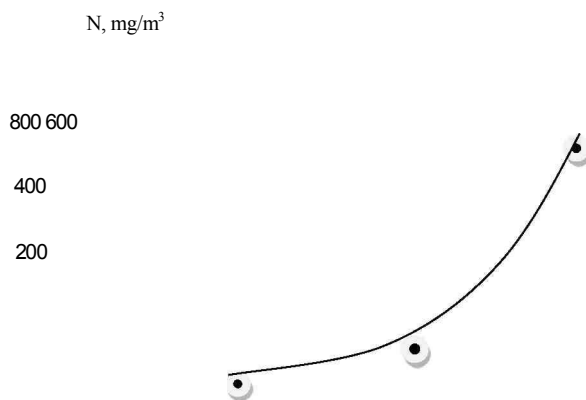


Fig.4. PM10 changes (Balykchy)



8.00 13.00 17.00 t, hour

Fig.5. PM10 changes (Balykchy)

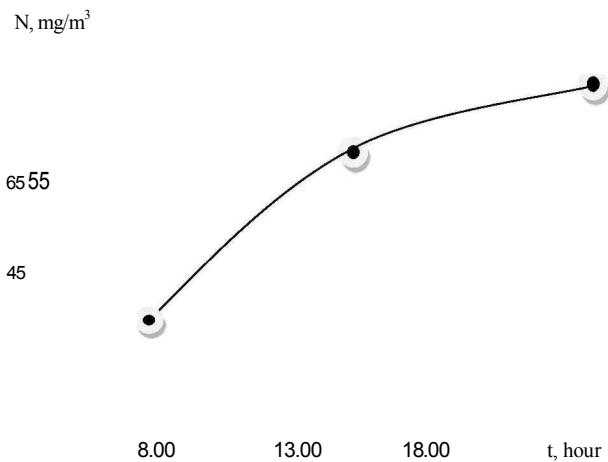
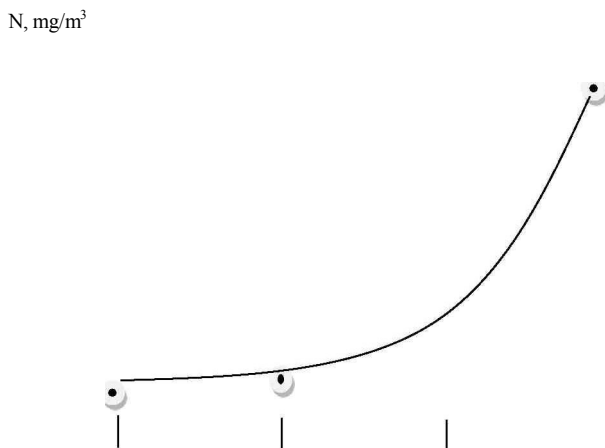


Fig.6. TSP changes (Cholpon-Ata)



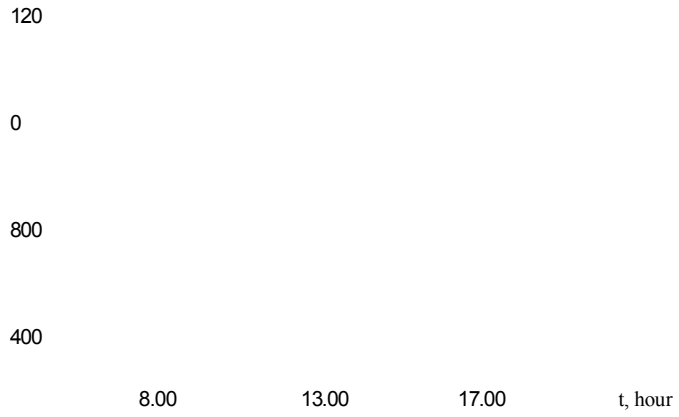


Fig.7. TSP changes (Balykchy)

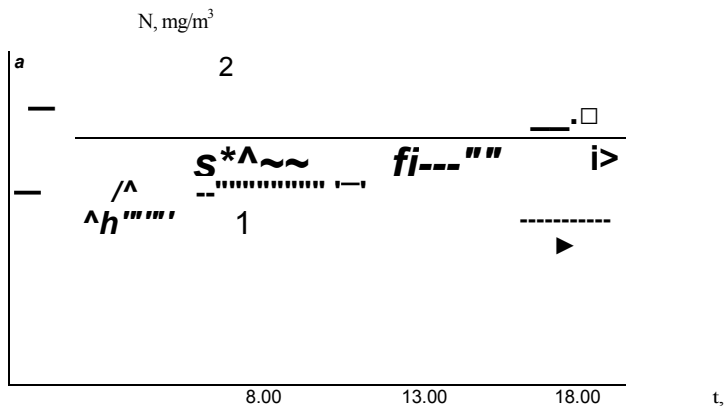


Fig.8. PM1.0 changes (1 - Balykchy; 2 – Cholpon-Ata)

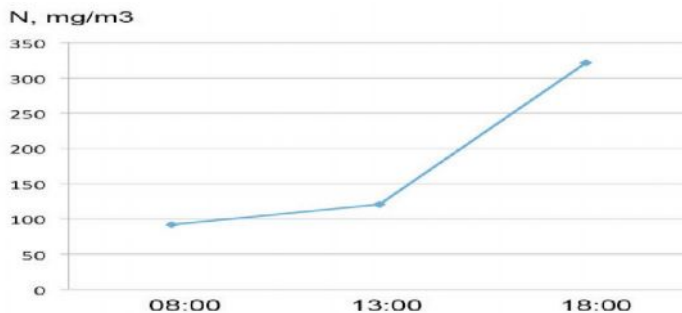


Fig.9. PM1.0 changes (Balykchy)

Conclusion

The results of the measurements showed that at certain parts in Balykchy, there is a slight excess of air pollution in both PM4 and PM10 suspended particles, especially PM10, which is a warning to the population of Balykchy about the importance of air quality, and on the impact of pollutants on the health of the urban population. The results of measurement indicate the need for an analysis in the summer, since at this time the air temperature is normalized and the release of solid fuel is completely eliminated.

Literature

1. Куленбеков Ж. Э., Асанов Б. Д., Султаналиев К. Оценка качества атмосферного воздуха в г.Бишкек, как индикатор устойчивого развития. Вестник Института сейсмологии НАН КР, №2(8), 2016г., стр.36-44.
2. Воздействие взвешенных частиц на здоровье. Значение для разработки политики в странах Восточной Европы, Кавказа и Центральной Азии. Всемирная организация здравоохранения, 2013 г. ISBN: 978 92 890 0006 2. (http://www.euro.who.int/_data/assets/pdf_file/0007/189052/Health-effects-of-particulate-matter-final-Rus.pdf).

