

Possible markers of aqueous aerosol of Lake Baikal in the region's atmospheric aerosol

A.N. Sergeev¹, A.S. Safatov¹, A.P. Agafonov¹, I.S. Andreeva¹, M.Yu. Arshinov², B.D. Belan², G.A. Buryak¹, V.M. Generalov¹, Yu.R. Zakharova³, N.A. Lapteva¹, S.E. Olkin¹, M.V. Panchenko², V.V. Parfeneva³, I.K. Reznikova¹, V.B. Simonenkov², T.B. Teplyakova¹ and V.A. Ternovoi¹

¹Federal State Research Institution SRC VB "Vector", Koltsovo, Novosibirsk region, 630559, Russia

²IAO SB RAS, 1, Square of Academician V. Zuev, Tomsk, 634021, Russia

³Institute of Limnology SB RAS, 3, Ulan-Batorskaya, Irkutsk, 664033, Russia

Keywords: atmospheric aerosols, bioaerosols, chemical composition, source identification.

INTRODUCTION

Atmospheric aerosols, which are simultaneously present in the region's air, usually originate from different sources and, correspondingly, have different component and chemical compositions. The analysis of its element composition and chemical and biological markers is the most informative method to determine a possible source of atmospheric aerosol. It's well known that water aerosol originates from water surface layer. The goal of the present work was to compare chemical and biological markers present in atmospheric aerosol and the surface microlayer (SML) of Lake Baikal water.

MATERIAL AND METHODS

Sampling was performed in the summer of 2008 in the vicinities of Listvyanka, Sakhuryty settlement, Peschanaya Bay and above the water area of the lake. Equipment registering hydrometeorological parameters during the experiments was installed in a central point on the bank at right angle to the wind direction: an aerosol particle counter and 3 independent devices with volumetric flow of 50 l/min for collecting air samples on filters. Identical triples of independent devices were located at the distance of approximately 100 m to the left and to the right of the central point. A research ship with 3 independent devices for air sampling on filters was located at the distance of 700 m from the bank; 200 and 1000 μm - thick samples of the water SML were collected from the ship. An Antonov-30D airplane carrying an aircraft laboratory flew above the water area of Baikal.

The concentration of different chemical elements in the samples was determined with atomic absorption method on Shimadzu AA-6300 device with a flame and a thermoelectron atomizers. A fluorescent method using the reagent described in You *et al.* (1997) was employed to determine the total protein concentration. Polycyclic aromatic hydrocarbons (PAH) in samples of atmospheric air and water SML were determined with the method of high-performance liquid chromatography.

The presence of proteobacteria in the tested samples was used as a biomarker. They usually make up a rather large portion of bacteria in water systems

(Bel'kova, 2004; Kemp & Aller, 2004). Their genetic material was detected with PCR method using primers for 16s RNA fragment described in Mercier *et al.* (1999).

RESULTS AND DISCUSSION

Atmospheric air of Lake Baikal practically does not contain particles with a diameter of more than 10 μm , and most particles were concentrated within the range of less than 1 μm . The total mass of aerosol particles does not exceed 2 $\mu\text{g}/\text{m}^3$.

The element analysis results show that all samples of aerosol and water SML contain maximal concentrations of the same chemical elements. Consequently, SML of Baikal water was the source of a portion of aerosol collected in this period. This is also confirmed by the detection of genetic material of water microorganisms in most studied aerosol samples of Lake Baikal including altitude samples collected above the water area of the lake. The total protein was found in the studied aerosols in lower concentration than in regions without a powerful water source. PAH pollutants were detected in none of the samples within the method sensitivity.

Thus, the performed work did not allow us to reveal a unique marker belonging only to aerosol of water origin in the studied region.

Acknowledgement. Работа выполнена при поддержке гранта ФЦП № 02.515.11.5087.

You W.W., et al. (1997). *Annal. Biochem.*, 244, 277-282.

Bel'kova, N.L. (2004). *Baikal water column microbiologic community's taxonomic diversity*. PhD Thesis. Vladivostok.

Kemp, P. F., & Alle,r J. Y. (2004). *FEMS Microbiol. Ecol.*, 47, 161-177.

Mercier, B., Burlot, L., & Ferec, C. (1999). *J. of Virol. Methods*, 77, 1-9.