Microplastics in the water of the Volga River: the results of a summer 2020 field survey

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In spite of the fact that present day Russia makes only a small contribution to the global industry of polymers and polymer products, their production increases steadily, which leads to a rise in the concentration of microplastics (MP) in the surface waters including rivers, where MP enters with surface runoff and waste water.

Since the problem of microplastics pollution of freshwater bodies in Russia has not received sufficient attention, in July-August 2020 the non-profit foundation “Clean Hands, Clean Rivers” together with the Faculty of Geography of M.V. Lomonosov Moscow State University, conducted a comprehensive hydrological and environmental survey along the entire Volga river, from its source to its mouth. It included water sampling and determination of microplastics, nutrients and heavy metals. The main hydrochemical indicators of river water were also monitored.

Water samples were taken upstream and downstream of several large cities - Tver, Nizhny Novgorod, Cheboksary, Kazan, and Volgograd. To collect water samples for MP, a specialized device “manta” with nets for filtration at 300 µm was used; further analysis of MP fragments was carried out by the method of differential scanning calorimetry.

The analysis of 34 water samples allowed us to determine the average concentration of MP in the surface water layer of the Volga river which accounted for 0.901 part./m\textsuperscript{3}.

MP particles were found in all samples taken. The concentrations ranged from 0.156 to 4.100 part./m\textsuperscript{3}. The maximum MP concentrations were recorded in large cities downstream of the sewage treatment plants. For Kazan, Tver, Nizhny Novgorod and Volgograd they reached 4.100, 3.769, 1.907, and 1.344 part./m\textsuperscript{3}, respectively. The role of large settlements as sources of MP in the Volga water was revealed.

The minimum MP concentrations were recorded upstream of the large cities showing relatively stable levels of 0.25 part./m\textsuperscript{3}. The lowest MP content (0.156 part./m\textsuperscript{3}) was revealed in the downstream area of the Cheboksary reservoir near Cheboksary. The results of weighing MP particles showed that their average concentration in the Volga water is 0.212 mg/m\textsuperscript{3}.

In each of the investigated samples, particles of three determined fractions - fragments, fibers and
films - were found, however, their ratio was not constant. On average, the proportion of fragments and films in the Volga water was 41% and 37%, respectively, and share of fibers accounted for 22%.