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## Prohibited and Obsolete Pesticides in the Vorotan and Voghji Rivers in Armenia

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### ABSTRACT

In the current work the existence of chloral-organic pesticides - heptachlor and DDT - in waters of the rivers Vorotan and Voghji was disclosed through Gas Chromatographic method. It was identified that their concentration was higher than the accepted standards. Prohibited and obsolete pesticides remain beyond control in "burials" that is common in many regions of Armenia. Surveys show that some of these pesticides are also common among population. It is recommended to collect these quantities and keep them under control until the storage facility is completed.

### Introduction

The problem of prohibited and obsolete pesticides remains unresolved in the Transcaucasian region and in Armenia (Avagyan, 2016). As persistent organic pollutants (POP) these chemicals aren't decomposed or get slowly decomposed under natural conditions. Being easily volatile and resistant to photolysis, to biological and chemical destruction, their trace amounts easily spread over long distances and are continuously in a wide circulation polluting the air, water, soil, feed and agricultural products.

They are accumulated in biological tissues, appear in the food chain and cause damage to the environment and human health (Guideline P2.1.10.1920-04, 2004, Vashenko, 2005, Rostami et al., 2011). As a result of pesticides' impact on humanity oncological diseases, allergies and hypersensitivity, damage to the central and peripheral nervous systems, reproductive disorders and destruction of the immune system of several human generations, as well as irregularities in the growth and formation of children occur.

The 2001 Stockholm Convention on Persistent Organic Pollutants aims to protect public health and the environment from exposure to POPs. The following 12 POPs were originally targeted: pesticides: aldrin, dieldrin, chlordane, heptachlor, DDT, endrin,

hexachlorobenzene (HCB), mirex, toxaphene; industrial chemicals: polychlorinated biphenyls (PCBs); by-products: dioxins and furans. After 1970, the production and use of DDT, hexachlorocyclohexane and other organochlorine pesticides was banned in a number of countries, including Armenia (Sargsyan, et al. 2006).

In 1982 in the landslide zone near the Yerevan deep fault and the Jrvezh active fault, a cemetery with 110 m length and 10m–15 m width was built without the necessary preparation of the cemetery base and without a surface water drainage system (formed during precipitation and snowmelt). About 600 tons of pesticides in 60 items were buried here. As a result of landslide processes and the leaching of pesticides and their derivatives with surface waters, as well as unattended treatment and plundering by the local population, currently there are about 150 tons of toxic chemicals and derivatives resulted from their decomposition.

Nowadays, there are abandoned repositories of expired pesticides in different parts of the republic (Dvorská, et al., 2012). An informal survey among the population from different areas revealed that there are certain stocks of banned and expired Soviet-made pesticides in different localities. Literary data testify about the presence of pesticides both in surface waters and in the soils of traditional agricultural regions of Armenia (Beglaryan et al., 2016).

Pesticides penetrate into the surface waters mainly as a result of their leaching from the soil and their application in agriculture, and some of them appear as a result of chemical decomposition of the pesticides introduced into the soil. Such situation is dangerous, and the risks of environmental pollution and damage to human health are high.

The issue of recording and controlling the use and storage of pesticides in the territory of Armenia still remains particularly important; there is lack of information on the type and amount of pesticides actually used in the republic and in the literature there are only stale and brief data. The probability that prohibited and expired toxic chemicals may be used in agriculture is large. The state government does not conduct systematic research and monitoring on their presence in the air, soil, water, nor has it worked out a food safety strategy related to contamination with prohibited and expired pesticides for both imported goods and agricultural products produced in the country.

### Materials and methods

The objective of this work was to identify and quantify organochlorine pesticides- heptachlor and DDT- in the waters of Vorotan and Voghji rivers in 2017.

Sampling, preservation, extraction and concentration of organochlorine pesticides were carried out according to standard methods (Cesceri et al., 1998). Identification and quantification was performed using gas-liquid chromatography on a Varian CP-3800, capillary column VF-5ms,  $l = 30\text{m}$ ,  $d = 0.25\text{ mm}$ , electron capture detector (Cesceri, 1998, Drugov, et al., 2006).

The MPC of pesticides in surface waters is  $10\text{ ng/l}$ .

### Results and discussions

Figures below show the data on the availability of heptachlor and DDT in Vorotan and Voghji rivers for 2017.

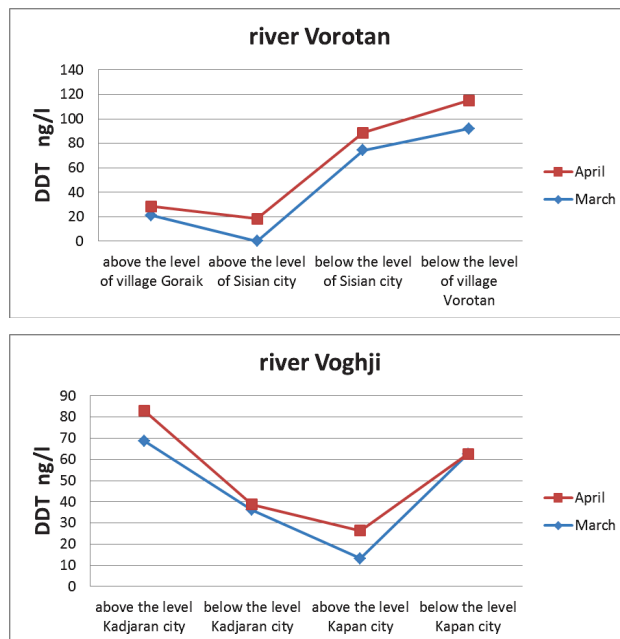
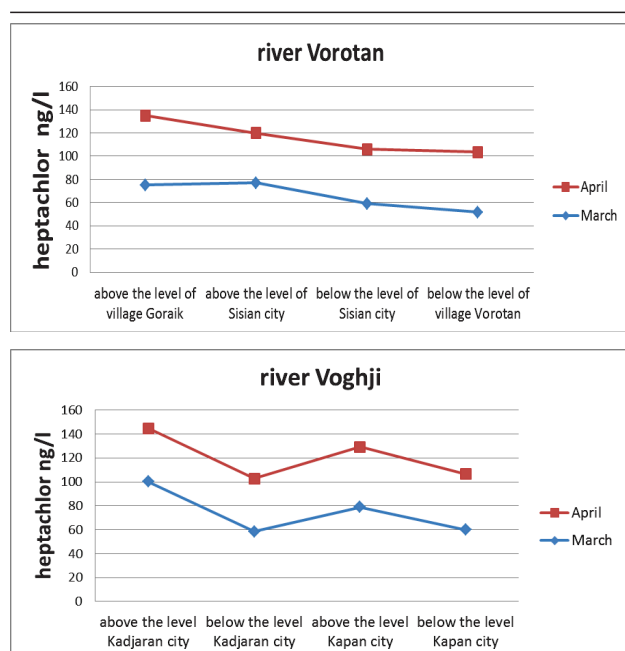


Fig. Organochlorine pesticides in the waters of Vorotan and Voghji rivers (water sampling points are given on the abscissa. Maximum permissible concentrations of pesticides in surface waters are  $10\text{ ng/l}$ ) in 2017.

Based on the data obtained in the waters of Vorotan and Voghji rivers, we can state that the concentrations of heptachlor and DDT exceed the MPCs during the snow and long rain season. It can be assumed that this is the result of leaching of pesticides from the soil.

### Conclusion

Previous studies testified on the presence of a number of organochlorine pesticides in the waters of Hrazdan and Kasakh-Sevdzhur rivers, the level of heptachlor in Hrazdan and Kasakh-Sevdzhur rivers was higher even 40-60 times than the MPCs, (Avagyan, 2010).

Our data on the availability of pesticides heptachlor and DDT in the waters of Vorotan and Voghji rivers indicate that organochlorine pesticides are widely spread in the surface waters of Armenia with quantities exceeding MPC. Similar problems have also been identified in the territory of CIS (Mamontov et al., 1998, Gravel, 2003).

The current situation requires implementation of a number of activities, the priority of which is obvious. Here are some identified ones:

- To prevent further ingress of pesticides into the soil and into surface water from abandoned storage facilities, and in order to avoid their use in the farm, it is necessary to urgently collect stocks of pesticides from both the population and from abandoned storage facilities.
- To design and arrange temporary storage of collected pesticides before the storage for expired chemicals is finally constructed.

- To apply emergency strategy to eliminate the consequences of pesticides from abandoned cemeteries throughout all regions in Armenia.
- The state is obliged to immediately organize and conduct systematic research, objective and reliable monitoring on the presence of organochlorine pesticides, as persistent organic pollutants in the air, soil and water.
- To create a system of accounting and control over the importation, use and storage of pesticides in Armenia.

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