

SORPTION PROPERTIES OF NATURAL MINERAL SORBENTS TOWARDS SOME VIRUSES

V. Rusev, V. Eftimova, V. Gardevska, G. Kaprelian,
V. Lesichkov, N. Enchev

Water as a mineral acquires most variable properties providing for the existence of living organisms and their vital activity processes. With the ever increasing rates of industrialization and urbanization, the consumption of water is steadily augmenting, which in turn leads to an increase in the total amount of polluted sewage waters. The latter contain large amounts of unsolved substances, waste food, fecal dregs of organic and inorganic character, mineral and organic wastes resulting from the production processes in various factories and plants. The listed pollution factors exert a variety of morbi-genous and toxic actions on people, as well as on the flora and fauna of reservoirs and water basins (1, 4).

One of the ways to increase the efficacy of eliminating pathogenic micro-organisms from sewage waters is the utilization of diverse materials endowed with adsorption properties. Natural mineral sorbents play an essential role in such adsorptive processes (2, 5, 6, 7, 8).

Our task was to check the sorption ability of natural mineral sorbents from North-Eastern Bulgaria relative to some entero- and myxoviruses.

Material and methods

Natural mineral sorbent from the town of Kaolinovo was used in the experiments. In advance the sorbent underwent fractionation after the method of Sabanin (3). The size of the particles varied from 0.01 to 0.05 mm (5—10 microns). The sorbent together with the column itself underwent beforehand sterilization at 160° C for 1½ — 2 hours.

The following viruses were available as an assay model: Coxsackie B₂ and ECHO₁₉, from the Enterovirus group, and Influenza type A virus Varna (361/77) from the Myxovirus group.

The infectious titer of Coxsackie B₂ was determined on cell lines PL, cultivated at 37° C, with cytopathic effect (CPE) recorded accordingly every 3rd, 5th and 7th day. The infectious titer of Enterovirus ECHO₁₉ was determined on cell cultures of human embryonal kidney (HEK). Cultivation and assessment of the CPE was accomplished as in cell line FL. The infectious titer of Influenza virus was determined on chick embryos 9—10 days old. They were cultivated for 48 hours after the infection at 37° C. Hemagglutination titer of the latter virus was determined using the hemagglutination reaction (HAR).

A dynamic method of experimental viral suspension purification was used (2, 6). The experiments were conducted at 5° C, and 2.5 cm height of the sorbent in the column.

The passing filtrate was stored in a sterile flask daily, and then its infectious and hemagglutination titer was determined.

Results and discussion

The results are presented graphically and the kinetics of the sorption process is studied.

Fig. 1 shows the results of influenza type A virus Varna (361/77) sorption on natural mineral sorbent from the town of Kaolinovo. Using the sorption

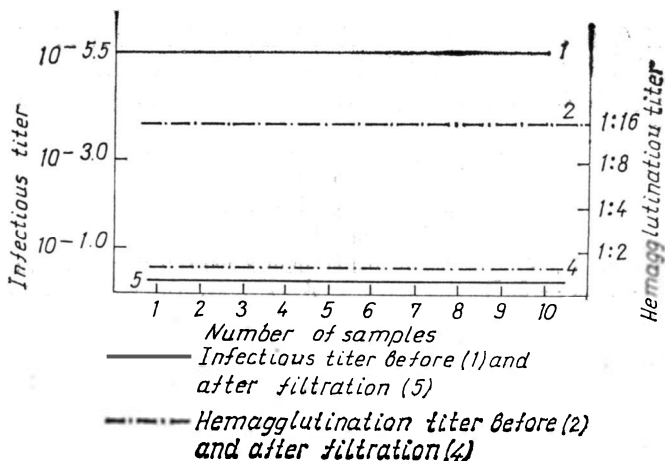
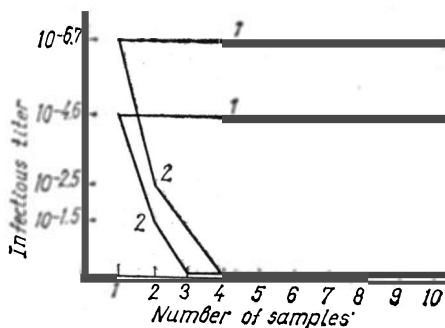


Fig. 1: Sorption of influenza type A virus Varna (361) 77 by a fractionated natural mineral sorbent.

— infectious titer before (1) and after filtration (5)
 — hemagglutinations titer before (2) and after filtration (4)

Fig. 2: Sorption of coxsackie type B₂ virus and ECHO₁₉ virus by a fractionated natural mineral sorbent.

1 — infectious titer of the basic viral suspension;
 2 = infectious titer of virus suspension after filtration



curves of the infectious and hemagglutination titers it is possible to study the dynamics of the sorption process. It varies within the limits of values lower than the normal ones for the respective titer. The quick saturation of the natural mineral sorbent, leading to an abrupt decrease in both titers immediately after the first experiment, is clearly visible.

Fig. 2 shows the results of the sorption of Coxsackie type B₂ virus and ECHO₁₉ on fractionated natural mineral sorbent from the town of Kaolinovo. Here the dynamics of the sorption process is represented by the curves of the infectious titers for either of the viruses. Also it is obvious that the natural mineral sorbent is quickly saturated, and the infectious titers of both viruses abruptly decrease.

Conclusions

The studies carried out using the fractionated form of a natural mineral sorbent from the town of Kaolinovo lead to the following inferences:

1. The dynamic sorption of Influenza-, Coxsackie- and ECHO-viruses performed points to a high degree elimination by the natural mineral sorbent made use of.
2. The Bulgarian natural mineral sorbent from the town of Kaolinovo is a valuable material for the production of fractionated forms, which could be successfully employed in the sorption purification of polluted waters from enteral viruses.

REFERENCES

1. Альбертсон, П. О. Разделение клеточных частиц и макромолекул, изд. Мир, Москва, 1974, 256—282. — 2. Воронцов, А. И., Н. З. Харитонов. Охрана на природата, изд. Земиздат, София, 1975, 69—97. — 3. Григорьева, Л. В. Энтеровирусы во внешней среде, изд. Медицина, Москва, 1963, 61—184. — 4. Ключковский, Г. И., Л. А. Мануйлов. Лабораторны практикум по общей технологии силикатов, Стройиздат, Москва, 1975, 141—146. — 5. Пейчинов, Г. М., М. Тошков, Ив. Иванов, К. Баева, П. Симеонов, Б. Панов. Проблеми по опазване на природната среда, Земиздат, София, 1974, 160—172. — 6. Цагарейшвили, Г. В. Некоторые итоги исследования и применения бентонитов Грузии в фармации и медицине, изд. Мецниереба, Тбилиси, 1974, 5—15. — 7. Gerba, C. H. P., Schreiber, G. A. Effect of particulates on virus survival in Seawater, *J. Water Pollut. Contr. Fed.*, 1975, 47, No 1, 93—98. — 8. Schaub, S. T. A., Sorber, G. W. Taylor. The association of enteric viruses with natural turbidity in the aquatic environment, *Virus survival water and Wastewater syst.*, Austin, 1974, 71—83.

СОРБЦИОННЫЕ СВОЙСТВА ПРИРОДНЫХ МИНЕРАЛЬНЫХ СОРБЕНТОВ В ОТНОШЕНИИ ВИРУСОВ

V. Rusev, V. Eftimova, V. Gardevska, G. Kaprelian,
Vl. Lesichkov, N. Enchev

РЕЗЮМЕ

Исследованы сорбционные свойства некоторых природных минеральных сорбентов из Северо-восточной Болгарии в отношении группы миксо- и энтеровирусов. Эксперименты показали, что пропускание хорион-аллантоисной или тканевой жидкости от человеческой эмбриональной почки с определенным титром исследованных вирусов приводит к уменьшению или почти полному исчезновению титра вирусов в фильтрате.

Эти данные показывают, что некоторые природные сорбенты могут найти применение при очищении сточных вод.