Chemistry of ground water and surface water under development of potash salt deposit (Urals, Russia)

[a]Khayrulina E A, [b]Maximovich N G

Upper Kama potash salt deposit is one of the biggest potash salt deposits. Development of the field for 80 years has led to different environmental issues.

The specificity of potash production is the accumulation of large amounts of waste. Currently on the territory of the Upper Kama potash salt deposit more than 270 million tons of halite wastes have accumulated [1]. Heap drainages are the main source of pollution on this region. From one side it is source of readily soluble components (potassium chloride, sodium, and magnesium). These components are actively involved in the surface and subsurface runoff, forming a zone of salinity of surface water and groundwater.

From another side it is source of trace elements. As a result of enrichment processes the waste is characterized by significant concentrations of trace elements in mobile form. Strontium, manganese, nickel, cobalt, chromium, zinc are the most migration-capable.

This work presents our research of water migration of pollutants in affected zone of salt heap. For this purpose a chemistry of heap drainages, ground water and surface water were analyzed.

Heap drainages is an Cl – Na+K hydrochemical facies at pH 6,6. Water soluble components in high concentration are presented by SO_4 (6,9 g L^{-1}), Cl (255,8 g L^{-1}), K+Na (174,8 L^{-1}), with mineralization of about 440 g L^{-1}. Chemical analysis by emission spectrophotometry of trace elements showed that concentration of Sr reached up to 24,6 mg L^{-1}, Mn – 2,5 mg L^{-1}, Cr – 0,33 mg L^{-1}, Zn – 0,08 mg L^{-1}, Li – 0,05 mg L^{-1}.

Heap water without any treatment enters into the surrounded territory and then into ground and surface water. Analysis of ground water in the heap affected zone showed that hydrochemical facies was changed from HCO_3-Ca (background state) to Cl-Ca at pH 7,1. Mineralization is about 17,2 g L^{-1}, concentration of Cl is 10,0 g L^{-1}, K+Na – 2,6 g L^{-1}l, SO_4 – 0,6 g L^{-1}, Sr – 10,6 mg L^{-1}, Zn – 0,06 mg L^{-1}, Mn– 0,05 mg L^{-1}, Ni – 0,05, Cr – 0,007 mg L^{-1}.

In surface water concentrations of main pollutants increased greatly: Cl is up to 12,8 g L^{-1}, SO_4 – 0,5 g L^{-1},

Na+K – 8,2 g L^{-1}, Sr – 4,9 mg L^{-1}, Mn – 0,02 mg L^{-1}, Ni – 0,02 mg L^{-1}, Zn – 0,004 mg L^{-1}, Cr – 0,004 mg L^{-1}). Mineralization grew from 0,3 g L^{-1} (background state) to 22 g L^{-1}. These waters are characterized by Cl – K+Na hydrochemical facies at pH 8.

The study of heap drainages, ground water and surface water chemistry has showed that the main pollutants under potash salt deposit development are as soluble components (chloride, potassium, sodium) and trace elements (strontium, zinc, nickel, manganese, chromium). They actively migrate in water and then capable to accumulate in soils and bottom sediments.

References

[1] Bachurin B.A., Baboshko A.J. Ecological and geochemical characteristics of waste of potash production / / Mining Journal. - 2008, № 10. – P. 88-91.

[a] *Institute of Natural Sciences of Perm State University (elenakhay@gmail.com)*
[b] *Institute of Natural Sciences of Perm State University*