ISSN 2522-1841 (Online)
ISSN 0005-2531 (Print)

UDC 661.183.123.54.607

RADIOACTIVITY DEGREE DIFFERENT DEPOSITS OF BENTONITES

Z.R.Agayeva, E.E.Jabarov, A.I.Yagubov, R.N.Mehdiyeva*, N.B.Farkhatova, A.M.Gasimova

M.Nagiyev Institute of Catalysis and Inorganic Chemistry, NAS of Azerbaijan
**Institute of Radiation Problems, NAS of Azerbaijan*

agayeva-zenfira@mail.ru

Received 17.04.2017

There has been studied a degree of radiation activity of bentonite taken from deposits (Gizil Dere, Dash-salahli, Agdere and others), depending on the depth of bedding. It has been established that a degree of radioactivity bentonite rocks depends on the depth of bedding, but does not depend on amount of mont-morillonite..

Keywords: *bentonites, radiation activity, montmorillonite.*

Introduction

Protection of population health demands regular information on the content of trace elements in the environment. At present, humanity faces with the need to control consciously interaction processes of society and nature, foreseeing the nearest and remote consequences of its interference to natural processes. Our Republic is characterized with variety of relief and climate which cause different modes of emergence and migration of radioactive elements in the environment.

One of the factors effecting negatively on environment is radioactivity. The condition of environment, pollution of atmosphere, water, soil, quality of products used by the population are the basic ecological factors, which determine the health of population. Radiation background of ecosphere forms precondition for diseases, weakens immune system, increases risk of vascular heart disease, sensory organs and vision [1, 2].

When penetrating into the organism, radionuclides spread to the body with blood and lymph, and sediment in lungs, and accumulate in lymph nodes and became the source of irradiation. Radionuclides spread in the body with blood and lymph and settles in the lungs and accumulating in lymph nodes become the source of radiation. Environmental condition, pollution of atmosphere, water, soil, quality of products used by population are basic ecological factors determining health of population. Considering the above-mentioned, study of radioactivity level of bentonites is of scientific and practical interest. Uranium is also a part of multiple minerals and its mineralization is partially related to clayish and oil-shale, conglomerates of bentonite. By this way bentonites have found a wide application in many fields of industry. As a result of investigations the existence of radioactive elements U^{238}, Ra^{226}, Th^{232} and others in natural resources of the Republic were observed. Evaluation of phase loads of radioactivity is one of the most important economic tasks. For evaluation of radiation power, besides information on surface density of natural radionuclides, their reserves in the rock, it is necessary to consider also penetration of technological radionuclides. We observed in rocks some amounts of several radioactive elements (Cs^{137}, U^{238}, Ra^{226}, Th^{232} and others), which have similar physical and chemical properties. Cleavage of radioactive elements is completed by the formation of lead isotopes, which refer to the most effective toxic elements and negatively effect the living organisms [3]. Due to high content of uranium and other natural radioactive elements in rocks, the acid igneous rocks are of high radioactivity. Basic and ultra-basic rocks differ by minimum radioactivity. Radioactivity is relatively increased in sedimentary clays. Existence of Ra^{226}, Th^{282} leads to occurrence of radioactive gases (radon and thorium) in environment. In living organism some accumulation of natural radioactive elements (K^{40}, Ra^{226}) and weak U^{238} are observed [4, 5].

Experimental part

In oil production industry bentonite mud powder is widely used and its solutions on the basis of it are prepared for drilling, which covers walls of wells with quite thick layer preventing penetration of oil and gas. One of the most the demand in the industry of bentonite is a molding clay (sort of segger clay, keeps temperature up to 1580^0C). Its capacity to keep the form in raw and in dried condition, gas transmission, high binding properties and adhesive ability are widely used in metallurgy. Addition of only 5% of this mineral is enough to make a form of extra firmness. In construction the materials for which bentonite clay is used as a raw material serves as hydro and heat insulation. Solutions which are used in tunneling by the method of HDD, are prepared on the basis of bentonite. Recently bentonites have been widely used in many fields of industry.

During investigation of radioactivity degree of bentonite rocks it was established that in general the activity of radioactive elements does not depend on the depth of the deposit, but changes depending on location of fields, which have different microelement composition. Its amorphous substitution gives the various types of smectite and causes a net permanent charge balanced by cations in such a manner that water may move between the sheets of the crystal lattice, giving a reversible cation exchange and very plastic properties. Membranes of the smectite group include the decahedral minerals montmorillonite, beidellite, nontronite, bentonite, and thetrioctahedral minerals hectorite (Li-rich), saponite (Mg-rich), and sauconite (Zn-rich). The basic structural unit is a layer consisting of two inward-pointing tetrahedral sheets with a centeral alumina octahedral sheet. The layers are continuous in the length and width directions, but the bonds between layers are weak and have excellent cleavage, allowing water and other molecules to enter between the layers causing expansion in the height direction [6].

The aim of the investigations was determination of radiation activity of bentonite rocks of different samples, consisting of bentonites taken from deposits of Gizil Dere, Dashsalahli, Agdere and others depending on the depth of bedding. It should be mentioned that amount of montmorillonite mounting the main mass of bentonites strongly changes depending on the depth of bedding. In studies of bentonite the samples of Dashsalahli deposit with different amount of montmorillonite were used and that's why the study of effect of montmorillonite concentration on acceleration of radioactivity of bentonite rocks was of great importance. The activity of radionuclides in samples of bentonite rocks was determined by gamma-spectrometer (Canberra) with helium detector HPGe, the activity of uranium isotopes was determined by α-spectrometer (Canberra) "Alfa Analist". The joint presence of uranium and rhodium isotopes was detected on liquid chromatography (Perkin–Elmer) TriCab 3100 TR [6]. Analysis of obtained results enabled to conclude that radioactivity degree of bentonite clays depends not on occurrence depth, but on location of reservoir management. On the basis of long-term investigations the scientists determined a state of that amount of U^{238} in plants does not exceed its abundance percentage in earth and soils $(2–6)\cdot10^{-4}$%. Precipitation and accumulation of dissolved radioactive compounds in rocks usually are observed during evaporation and transportation of subsoil waters, particularly, under the conditions of dry climate. Environmental condition, pollution of atmosphere, water, soil, quality of products used by population are basic ecological factors determining a state of health of population. One of these factors impacting negatively on environment is radioactivity. Radiation background of ecophere forms precondition for diseases, weakens immune system, increases risk of vascular heart disease, sensory organs and vision. Radionuclides spread in the body with blood and lymph and settles in the lungs and accumulating in lymph nodes become the source of radiation.

A number of radionuclides of uranium, thorium and radon series are extracted with oil during extraction of oil and gas from the earth. Radon is 7.5 times harder than air and accumulates in lower layers of atmosphere. Analysis of radiometric background shows that uranium, thorium and radioactive potassium contribute its increase. In oil-gas development zone radiation

level usually reaches 69–450 мсR/h at norm 5.7–6.0 мсR/h. Resulting accumulation process on oil extracting areas, radiation background is observed and this is induced by flow of stratal water with radionuclides and heavy metals [7].

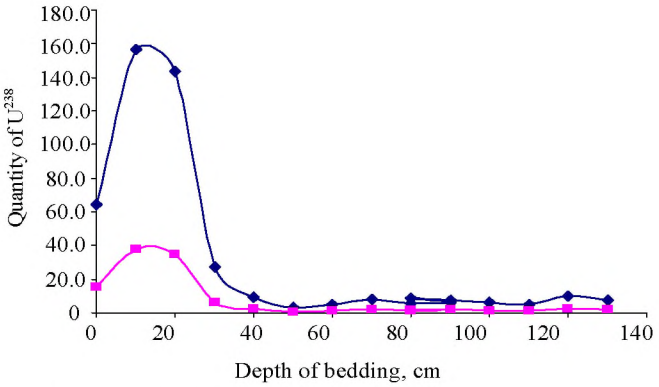
Results of reseraches were presented in the Table1.

Uranium (Figure) is also one of the multiple minerals and its mineralization is partially related to clay and bituminous shales, conglomerates of bentonites [8].

In Table 2 results of reseraches activity of radionuclides of bentonites from location of reservoir management are presented.

Table 1. Results of reseraches activity bentonites from different deposits

Radionuclides	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5
	Activity of radionuclides, Bk/kg				
Pb-210	17.1 ± 6.5	37.6 ± 6.6	74.6 ± 9.1	41.8 ± 10.9	64.6 ± 9.5
Cs-137	MDA=1.25	MDA=1.32	MDA = 2.2	MDA = 2.8	MDA = 3.9
Th-232	42.1 ± 6.5	60 ± 11	77 ± 12	58 ± 7	69 ± 12
U-235	1.2 ± 0.3	1.6 ± 0.3	2.1 ± 0.5	1.9 ± 0.4	1.6 ± 0.5
U-238	29.4 ± 4.5	42 ± 6	50.3 ± 10.6	41.4 ± 9.6	34.5 ± 6.5
Ra-226	20.3 ± 1.5	33.6 ± 2.1	57.9 ± 1.4	33.7 ± 1.8	44.5 ± 2.2
Ra-228	37.0 ± 1.8	41.5 ± 2.8	50.4 ± 1.9	47.5 ± 2.8	54.9 ± 3.8
K-40	155 ± 14	325 ± 21	139 ± 15	198 ± 19	186 ± 21
A_{eff}	88.6 ± 11.2	139.8 ± 18.3	170.6 ± 18.4	126.5 ± 12.6	150.7 ± 19.7



Dependence of quantity of uranium in bentonite on the depth of bedding of rocks.

Table 2. Dependence of quantity of radionuclides in bentonite on the depth of bedding of rocks

Depth of bedding of rocks, cm	Activity of radionuclides, Bk/kg			
	Ra-226	Ra-228	U-235	U-238
0	117.7±1.5	44.6±1.6	9.6±1.3	469±64
5	124.5 ± 1.8	23.0 ± 1.6	11.7 ± 1.3	573 ± 64
15	141.6 ± 1.9	27.3 ± 2.1	7.9 ± 1.6	384 ± 77
25	117.9 ± 1.5	28.7 ± 1.5	7.0 ± 1.3	341 ± 62
60	188.0 ± 1.8	29.8 ± 1.5	10.3 ± 1.4	504 ± 67
80	127.0 ± 1.5	27.6 ± 1.4	8.3	406
90	119.8 ± 1.4	30.9 ± 1.3	8.7	424
100	125.1 ± 2.1	15.0 ± 0.9	9.6	470
120	35.1 ± 1.7	35.1 ± 1.8	15.2	743

Conclusion

On the basis of investigations we have established that radioactive background is formed by natural radionucleides K^{40}, Tn^{232} and Ra^{226}. Effective activity of radionucleides in investigated samples (Dash Salahli, Khizi, Ali-Bayramli and other) of rocks is in allowance allocation. On surface of the earth during production of crude oil and gas some amount of radionucleides of uranium, thorium and radon-class are extracted together with crude oil. Analysis of obtained results enabled to conclude that radioactivity degree of bentonites depends not on occurrence depth, that is quantity of montmorillonite, but on location of reservoir management.

References

1. Garibov A.A, Guseinov V.I, Guliev R.I, Nagiev Dzh.A, Guliev E.G. Radioaktivnye othody v neftegazodobyvaiushchei promyshlennosti i sviazannye s nimi problemy radiatcionnoi bezopasnosti // Spravochnik: Kazakhskoe Agentstvo Pricladnoi Ekologii (KAPE). Sovremennye problemy pricladnoi ekologiiiu Almaty. 2007. S. 139–143.
2. Holbol M., Wold S., Jonson M. Colloid diffusion in compacted bentonite //Clay and clay minerals. 2010. T. 58. P. 532–541.
3. Pat. 2191794 RF. Sposob polucheniia glinoporoshkov dlia burovykh rastvorov / Eirish M.V., Trofimova F.A., Hasanov R.A. 2007.
4. Garibov A.A., Mehdiyeva R.N., Naghiyev J.A. Separation of radio-active elements (^{226}Ra, ^{228}Ra) from the radioactive coal in the territories of iodine factories / The Fifth Eurasian Conference Nuclear Sciences and its Application. Ankara. 14 October 2008. S. 153.
5. Efendiev G.Kh., Alekperov R.A., Nuriev A.N. Voprosy geohimii radioaktivnykh elementov neftianykh mestorozhdenii. Baku: Elm, 1984. 150 s.
6. Nasedkin V.V., Kvasha F.S., Stahanov V.V., Bentonity v prizvodstve Rossii. M.: GEOS, 2001. 170 s.
7. Agayeva Z.R., Jabarov E.E., Imanova N.A., Veliyeva N.V., Mammadova S.G. Study of radioaactivity degree of natural alumosilicates // Abstracts of Republican scientific conference dedicated to 80 th anniversary of M.Nagiyev Institute of Catalysis and inorganic chemistry, 20016. P. 402.
8. Garibov A., Azizov A., Alosmanov R., Naghiyev J. Soprtion of Uranyl-ions in water solutions phosphorylated wood sawdust // The Fifth Eurasian Conference Nuclear Sciences and its Application. Ankara, 2008. S. 74.

MÜXTƏLİF YATAQLARA MƏXSUS OLAN BENTONİTLƏRİN RADİOAKTİVLİK DƏRƏCƏSİ

Z.R.Ağayeva, E.E.Cabarov, Ə.İ.Yaqubov, R.N.Mehdieva, N.B.Fərhatova, A.M.Qasımova

Müxtəlif bentonit yataqlarının – Gızildərə, Daşsalahlı, Ağdərə – tərkibində aşkar olunan radioaktiv elementlərin (K^{20}, C_s^{137}, U^{238}, R^{228}, Th^{232}) aktivlik dərəcəsi suxurun dərinliyindən asılı olaraq təyin olunmuşdur. Müəyyən edilmişdir ki, Daşsalahlı yatağından göturülən bentonitin tərkibində aşkar olunan radioaktiv elementlərin aktivlik dərəcəsi montmorillonitin miqdarından asılı deyil, süxurun dərinliyindən asılıdır.

Açar sözlər: *bentonit,radioaktivlik, montmorilonit.*

СТЕПЕНЬ РАДИОАКТИВНОСТИ БЕНТОНИТОВЫХ ПОРОД РАЗЛИЧНЫХ МЕСТОРОЖДЕНИЙ

З.Р.Агаева, Э.Э.Джабаров, А.И.Ягубов, Р.Н.Мехдиева, Н.Б.Фархатова, А.М.Касимова

Изучена степень радиоактивности различных бентонитовых пород (Гызылдаре, Дашсалахлы, Агдере и др.), содержащих радиоактивные элементы (K^{20}, C_s^{137}, U^{238}, R^{228}, Th^{232}), в зависимости от глубин залегания. При изучении бентонита месторождения Дашсалахлы установлено, что степень радиоактивности бентонитов зависит от глубины залегания породы, но не зависит от количества в нем монтмориллонита.

Ключевые слова: *бентонит, радиоактивность, монтмориллонит.*