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**PHYSICAL AND CHEMICAL STUDIES
OF THERAPEUTIC MUD ARASAN-KUNDYZDY FUGS**

Abstract. A brief description of the geographic position, hydro-geological conditions for the manifestation of therapeutic muds of the Arasan-Kunduzdy litter is given, cartographic coordinates of which and its identification in the satellite image were taken during the reconnaissance survey of the work area in 2018. External characters mud gray color, texture dense packed, single native structure, odorless. Humidity is an average of 28,1%. Volumetric weight in the natural state of 1,83 g/cm³. Particle density of dried mud is 2,51 g/m³. The granulometric composition of the mud varies between 0,001 and 5,0 mm. The shear resistance of therapeutic mud appreciated 1910 dynes/cm². Stickiness is 6540 dynes/cm². The volumetric heat capacity is 0,781 cal/ g·grad·cm³. The coefficient of thermal conductivity is 0,00260, heat-retaining capacity of mud is 411 seconds (with a standard of at least 300 seconds). The amount of dissolved salts (mineralization) was 5,6 g/100 g of mud. According to the physico-chemical properties, therapeutic mud of the Arasan-Kundyzdy litter refers to the mud type, confined to saline reservoirs. In the opinion of the authors, the formation of the manifestation of curative mud of the Arasan-Kundyzdy litter occurred during the interaction of highly mineralized underground thermal waters, sulfate-hydrocarbonate-sodium composition, associated with the Upper Cretaceous aquifer, having surface discharge in the zone of the Dubun tectonic fault and near-bottom silt sediments in the region of the old riverbed of the Ili River.

Key words: Arasan-Kundyzdy fugs, Panfilov district, therapeutic mud, physical and chemical properties.

Introduction. Currently, in the CIS countries, about 500 mud deposits have been explored, in which more than 100 resorts operate, where mud therapy is the leading therapeutic factor [1]. The manifestation of therapeutic mud Arasan-Kundyzdy is poorly studied. Only in 1989-1990 MPD «Kazgeokaptazhmin-water» was conducted preliminary investigation of the manifestation of therapeutic mud of Arasan Kundyzdy fugs. Samples of mud were selected for conducting preliminary studies on short and brief analysis schemes. Analyzes were conducted in the laboratory of management. According to the results research mud of the Arasan-Kundyzdy fugs is classified as highly mineralized, low-sulfide alkaline mud that meets all the requirements of therapeutic peloids used for balneological procedures. In 2012, field teams laboratory termooanomal hydrogeology LLP «Institute of Hydrogeology and Geoecology named after U. M. Akhmedsafin» conducted a reconnaissance route along Ussek area geothermal waters. During the reconnaissance survey of the work area was held cartographic coordinates portion manifestatios therapeutic mud-Arasan Kundyzdy and its identification in space image, selected mud sample [2].

In tectonic terms manifestation of therapeutic mud Arasan-Kundyzdy is located within the Zharkent depression, which is a large intermontane trough. According to hydrogeological conditions, the manifestation of curative mud is located on the area of the Zharken artesian basin, which is a second-order basin in relation to Ili, and is bounded from the buried Paleozoic shaft located west of Almaty in the Kalkan-Boghoti neck [3-5]. The study of geological and structural conditions Zharkent artesian basin allows us to consider it as an independent hydrogeological unit with the specific conditions formation of groundwater.

The manifestation of therapeutic mud of Arasan-Kunduzdy fugs is located in the Panfilov district of Almaty region on the right bank of the former riverbed of the Ili river, 45 km south-west of the city of

Zharkent. The research is carried out according to the grant financing project "Development of an innovative method for the qualitative and quantitative evaluation of therapeutic mud in southeast Kazakhstan as a hydromineral raw material" (IRN AR 05130934).

The methods of researches. In 2018 by the laboratory of industrial and geothermal water LLP «Institute of Hydrogeology and Geoecology named after U.M. Akhmedsafin» was started research work on the grant financing project «Development of an innovative method for the qualitative and quantitative evaluation of therapeutic mud in southeast Kazakhstan as a hydromineral raw material» (IRN AR 05130934).

During the reconnaissance survey of the area of work, coordinates of the site of the manifestation of therapeutic mud Arasan-Kunduzdy and its identification in a space image were mapped and were taken samples of mud.

As a result of the chemical-analytical analysis of therapeutic mud samples were established following physico-chemical properties therapeutic mud of the Arasan-Kunduzdy fugs. External signs: gray mud, consistence dense, packed, homogeneous structure, odorless. Humidity: average value $W_{180^{\circ}\text{C}}=285,2\%$. The volumetric weight of mud in the natural state: $\gamma=1,84\text{g/cm}^3$. The density particles of dried mud is $2,51\text{g/cm}^3$. The contamination with particles larger than $0,25\text{mm}$ is due mainly to fine sand and vegetation residues.

Resistance to shear of therapeutic mud is estimated at 2207dynes/cm^2 . The stickiness of the mud was $12\,500\text{dynes/cm}^2$. The volume specific heat is $0,741\text{cal/g}\cdot\text{grad}\cdot\text{cm}^3$. The coefficient of thermal diffusivity $a=0,00194\text{cal/cm}^2\text{sec}\cdot\text{grad}$. Heat-retaining capacity 519 seconds with a standard of at least 300 seconds. According to the chemical composition of mud belong to the chloride-hydrocarbonate sodium type, the mineralization of mud is $8,1\text{g/dm}^3$, pH is 9,50.

Sludge mud in assessing their therapeutic value is characterized by the presence of carbonates, as well as calcium and magnesium sulphates, which turn into solution when treated with 10% hydrochloric acid mud. Significant amounts of gypsum and limestone deteriorate the quality of therapeutic mud. In addition, these poorly water-soluble salts can be in the form of sufficiently large concretions (up to 1 or more mm), which violates the granulometric composition. The silicate-argillaceous backbone of the SAB is $50,2\%$. The total value of CO_2 was $7,55\%$ in dried mud. In terms of natural mud – $5,65\%$. The conditional content of carbonates is $17,2\%$ in the dried mud. The average content of hydrogen sulphide (H_2S) is $17,7\text{mg}/100\text{g}$ dry mud or $0,017\%$. The loss of mass during calcination of mud characterizes crystallization water, organic substances. Weight loss for dry mud is $8,57\%$. Humidity is $25,2\%$. For natural mud – $6,41\%$. For the silicate-clayey skeleton (after crumbling) of mud – $1,22\%$.

The total content of hydrogen sulphide in mud is 136mg per 100g of mud or $1,04\text{mg-eq}/100\text{g}$. The average iron content is $280\text{mg}/100\text{g}$ or $10\text{mg-eq}/100\text{g}$. The ferrum residue is $10,0 - 0,52 = 9,5\text{mg-eq}$ or 266mg of Fe^{2+} . The content of elemental sulfur: $0,031\%$. Hydrogen (pH) and redox (Eh) mud potentials mud pH = 8,47 units, pH of the mud solution = 9,50 units, pH of the water extract (1: 10) = 8,12 units. The oxidation-reduction potential of mud in connection with the rapid change in time ranges from -385 to -380mV .

The technology of preparation of mud for medical procedures sometimes involves the dilution of the concentrate with ordinary water, and not with the brine of the lake; therefore, during the study of mud, an experiment was performed to dissolve the salts contained in the mud when extracted with water (water extract 1:10 T: Zh). The amount of dissolved salts (mineralization) was $1619\text{g}/100\text{g}$ of mud. Hypothetical salt composition (% mg-eq): $\text{Mg}(\text{HCO}_3)_2$ (38,9%), Na-HCO_3 (20,6%), CaCO_3 (10,2%). With acid decomposition precipitate is a silicate-clay skeleton (coarse-dispersed silicate component). In a hydrochloric acid solution, along with a salt-soluble salt component are calcium, magnesium, sulfates, iron, aluminum, manganese, phosphates, soluble silicic acid.

Thus, an analysis of the physico-chemical properties of the original mud showed that the therapeutic mud of the Arasan-Kunduzdy fugs, refer to the type of silt mud confined to saline reservoirs. In the opinion of the authors, formation of the manifestation of therapeutic mud of the Arasan-Kunduzdy fugs occurred during the interaction of high mineralized subterranean waters of sulfate-hydrogen carbonate sodium composition associated with the Upper Cretaceous aquifer having surface discharge in the zone of the Dubun tectonic fault and near-bottom silt sediments in the region of the old riverbed of the Ili River.

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АРАСАН-КҰНДЫЗДЫ СОРЫНЫҢ ЕМДІК БАЛШЫҚТАРЫН ФИЗИКАЛЫҚ-ХИМИЯЛЫҚ ЗЕРТТЕУЛЕРІ

Аннотация. Арасан-Кұндызды сорының емдік балшықтарына қысқаша сипаттама келтірілген (Панфилов ауданы Алматы облысы). Сыртқы белгісі бойынша балшық сұр түстес, консистенциясы тығыз, нығыздалған, құрылымы біртекті, иіссіз. Ылғалдылығы, табиғи жағдайдағы көлемді салмағы, кепкен балшықтың тығыздық бөлігі, гранулометриялық құрамы, жылжу кедергісінің мөлшері, жабысқақтығы, көлемді жылу сыйымдылығы бойынша мәліметтер келтірілен. Химиялық құрамы бойынша балшықтар хлоридті-гидрокарбонатты натрийлі типке жатады, балшықтың минералдануы – 8,1 г/дм³, рН 9,50. Арасан-Кұндызды сор емдік балшығының физикалық-химиялық қасиеттері бойынша тұзды суқоймасына орайласқан, лайлы балшық типіне жатады.

Түйін сөздер: Арасан-Кұндызды соры, Панфилов ауданы, емдік балшықтар, физикалық және химиялық қасиеттері.

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ФИЗИКО-ХИМИЧЕСКИЕ ИССЛЕДОВАНИЯ ЛЕЧЕБНОЙ ГРЯЗИ СОРА АРАСАН-КУНДУЗДЫ

Аннотация. Приведена краткая характеристика лечебных грязей сора Арасан-Кундузды (Панфиловский район Алматинской области). По внешним признакам грязь серого цвета, консистенция плотная, слежавшаяся, однородной структуры, без запаха. Приведены данные по влажности, объемному весу в естественном состоянии, плотности частиц высушенной грязи, гранулометрическому составу, величины сопротивления сдвигу, липкости, объемной теплоемкости. По химическому составу грязи относятся к хлоридно-гидрокарбонатному натриевому типу, минерализация грязи – 8,1 г/дм³, рН 9,50. По физико-химическим свойствам лечебные грязи сора Арасан-Кундузды относятся к иловому типу грязей, приуроченных к соленым водоемам.

Ключевые слова: сор Арасан-Кундузды, Панфиловский район, лечебные грязи, физико-химические свойства.

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