Increasing the efficiency of coagulant influence on improvement of bore mud properties

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Abstract. Because of the growing mining of raw hydrocarbon deposits one observes the increase in the volumes of bore mud accumulation. By their chemical composition and hydrophysical properties they have a range of negative characteristics, such as high alkalinity and toxicity, lack of structure, hydrophilic nature, low airing, filterability etc. The indicated characteristics of such mud pits, estimated as thousands, exclude the territories from the biogenic substance circulation in the conditions of KhMAD and YNAD. This leads to the violation of normal functioning of the northern territories ecosystems. The studies have shown that the abovementioned negative properties can be removed using coagulants, phosphogypsum, in particular – chemical industry wastes. Large volumes of phosphogypsum are located in the town of Revda, the Sverdlovsk region. A comparative study of diatomite as an ameliorant-coagulant showed its low efficiency in comparison with phosphogypsum. However, the ignition and use of diatomite allowed us to increase filterability of the bore mud up to the level of phosphogypsum or even higher. At the same time, it should be taken into account that in the north of the Tyumen region there were found enormous deposits of diatomite. Its use in the ignited form can be carried out under the production of building materials and coagulants as by-products.

1. Introduction

Currently, one of the main problems is a problem of utilization of reclamation of the bore muds. In connection with the increase of volumes of raw hydrocarbon deposits mining, this problem is aggravated constantly. Large amount of the mud pits in conditions of KhMAD and YNAD (more than 3000) excludes these territories from the biogenic circulation of substances, complicates their use as the deer pastures. Reclamation and utilization of the bore muds is complicated due to the negative physical and chemical properties. They include total lack of structure, overcrust during the moistening, low airing and filterability, high dispersiveness and hydrophilic nature, lack of physical maturity, increased alkalinity and toxicity due to the presence of water soluble salts [1-5].

The reason of unfavorable properties of the bore muds is stipulated by the extraction of ancient sea sedimentary strata with high degree of salinization equal to the chemism of sea waters, chloride, in particular [2].

Intensification of the salinization, toxicity and alkalinity is additionally contributed by the applying of caustic or soda salt into the drilling agent as one of the components. The following implementation
of the sodium of the water soluble salts into the absorbing complex intensifies and supports the solonetzicity degree of the bore mud. The indicated properties of the bore muds equal in many respects to the saline soils with only difference that the solonetzic soils and alkali soils were formed as the result of long evolution processes and the bore muds are the product of man-induced reasons. Long-standing scientific and production practice showed that the natural gypsum or waste of chemical production phosphogypsum recommended itself for the chemical amelioration of saline soils as a coagulant. Positive effect of these ameliorants has been apparent for many years. Fertility of the reclaimed solonetzic soils recover to the level of zonal black earth or grey forest soil [6-12].

Study goal: to test the diatomite as an ameliorant-coagulant for the reclamation of the bore muds as applied to conditions of Tyumen region.

Study objective: to study the efficient influence of diatomite doses on the filterability of the bore mud.

2. Materials and Methods
The toxicity of salts for the legume bacteria of melilot and medic were studied in the laboratory tests. The colonies were grown on the leguminous agar with different degree and chemism salinization. Filterability of the bore mud with the use of different doses of ameliorants was studied by the tube methods under the constant height of water column 5 cm. As a control there was used classical ameliorant widely used on solonetzic soils and positively recommended itself on the bore muds. Phosphogypsum is a waste of chemical production. It was delivered from the town Revda (the middle Urals).

The diatomite was from the town Kamyshlov of Sverdlovsk region, the discovered deposits in the north of Tyumen region haven't been exploited yet. It is sedimentary strata, mainly consisting of shells of diatoms. Usually it's friable or poorly cemented, of light grey or yellowish color. Diatomite is applied as adsorbent and filter in textile, petrochemical, alimentary industry, in production of antibiotics, paper, different building plastic materials, paints.

It's important to note that on the saline media the plants get acute deficiency of calcium. Laboratory tests have shown that applying of gypsum calcium decreases the toxicity of salts with participation of soda by 6-7 times for the seeds of phyto-ameliorants (melilot and medic) and also legume bacteria which are very necessary for the normal growth and development of leguminous crops [12-22].

The extensive use of gypsum in the Tyumen region is limited by the territorial remoteness of its deposits (Perm Krai, Kungur, Altai Territory of Lake Djira), the nearest phosphogypsum wastes are concentrated in the city of Revda, Sverdlovsk Region. In this connection there is an urgent need to search for new ameliorants-coagulants geographically close to the northern districts of the Tyumen region. Geologists found that in the northern districts of the region there are huge reserves of diatomite (figures 1, 2).

![Figure 1](image_url)

Figure 1. Change of number of the legume bacteria colonies of medic (HCP<sub>05</sub>=13,60) and melilot (HCP<sub>05</sub>=15,00) from the degree of sulphate and sodium carbonate salinization.
Our studies have shown that the use of natural crushed diatomite as coagulant-ameliorant provided poor efficacy. So its sample of 0.2 and 0.4 grams per 40 g of the bore mud did not lead to the filtration activity, here it was at the control level, i.e. was absent. The subsequent increase of diatomite weights facilitated the manifestation of filtration in an amount from 1.2 to 5.5 mm / day. It was the smallest at the weights of 0.6 and 0.8 g. With the introduction of a diatomite of 1 g and higher by 40 g of the bore mud, the amount of the filtrate was at the maximum level.

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Comparing the influence of the diatomite and phosphogypsum it’s seen that its chemical activity as coagulant-ameliorant was 3-4 times lower. This indicates at the inexpediency of use of the diatomite without additional revision for the reclamation of the bore muds. In connection with this, we have decided to carry out preliminary ignition under the temperature of 800°C.

The results of the studies have shown that the diatomite ignition improves filterability fundamentally. Thus, amount of filtrate under the equal samples testifies that the efficiency of ignited diatomite was higher by 4,4-16,6 times, than the unignited. The obtained results show the possibility to use our own deposits of the northern territories of the Tyumen region. The possibility of ignition of diatomite can be combined with the production of building materials (by the analogy with Kamyslov brick factory). Effect of ignited diatomite under the equal physical mass was as good as coagulating activity of classical ameliorant-phosphogypsum and under the small doses it even exceeded by the filtrate amount. Transfer of calcium and magnesium carbonate on the bore muds in conditions of the north of Tyumen region can be solved at the expense of diatomite ignition.
3. Conclusions
The studies have shown that the use of natural diatomite as a coagulant on the bore muds showed low ameliorative effect. Filtration activity of the diatomite in comparison with phosphogypsum (control) was 3-4 times lower. Diatomite ignition has allowed us to bring its coagulant and filtration ability to the level of phosphogypsum. The mining of own reserves of the diatomite in the north of Tyumen region for the reclamation of the bore muds can be combined with production of the building materials.

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