

Scientists to Create Inexpensive Drilling Fluids Based on Wood Waste

Scientists of Siberian Federal University together with colleagues from the Institute of Chemistry and Chemical Technology of SB of RAS studied the effect of chemically modified additives made from wood waste — lignins — on the properties of drilling fluids used for drilling oil and gas wells.



The researchers revealed that the characteristics of the solutions significantly depend on the type of chemical modification to which the lignins were subjected — it allows to effectively control the properties of drilling fluids, influence their viscosity and fluidity. The concentration of toxic elements in such solutions does not exceed the norm, so manufacture of these solutions helps use such a difficult-to-recycle material as lignin avoiding environmental damage and at the same time solve the problem of soil pollution by forest industry waste.

Russian Federation ranks first in the world in terms of forest resources. Tens of millions of tons of wood waste are generated annually during harvesting and processing wood, — it's bark, sawdust, technical lignins, etc. About half of such waste is incinerated, the other part is taken to stockpiles, which pollute the soil and often cause summer fires. To this day there are practically no high-tech methods of disposal of large-tonnage waste from wood processing enterprises, including lignins. SibFU scientists have proposed using its derivatives as additives that improve the properties of drilling fluids.

"Technical lignins formed during chemical processing of wood at pulp and paper enterprises are hardly recyclable materials. At the same time, there is a huge amount of technical lignins waste in Russia, hundreds of millions of tons. No more than 1-2% of them are used. Wood briquettes and pellets, compost, adsorbents, natural leather tanning agents substitutes, fertilizers, etc. can be made from lignins," co-author of the study, researcher at SibFU Laboratory of



Physico-Chemical Technologies for the development of hard-to-recover hydrocarbon reserves **Vladimir Zhigarev** said.

Additives of lignosulfonates are already used in drilling fluids. Lignosulfonates modified with chromium salts are the most effective. However, due to the high toxicity of these salts, scientists are working on replacing them in drilling fluids with chromium-free compounds. Solutions based on modified natural reagents can become environmentally friendly and non-toxic substitutes. For example, hydrolyzed lignin — the waste of biochemical plants that produce ethanol out of wood raw materials. SibFU scientists investigated the effect of the addition of such lignin on the basic properties of drilling fluids — what viscosity, fluidity, etc. they acquire.

Hydrolyzed lignin is a complex mixture of products of hydrolyzed decomposition of wood, which consists of modified vegetable fiber lignin, polysaccharides, mineral and organic acids, ash constituents and a number of other substances.

"As a result of studying the hydrolyzed lignin of the Kirov Biochemical Plant, it was found out that, firstly, samples converted to sodium form have the best quality. Secondly, thanks to checking the viscosity and rheology of solutions using the OFITE 900 viscometer, it turned out that the more lignins added, the higher the flow behaviour index and plastic viscosity of drilling fluids," co-author of the study, junior researcher at SibFU Laboratory of Physico-Chemical Technologies for the development of hard-to-recover hydrocarbon Reserves **Angelika Skorobogatova** said..



"Additives of modified lignin in shale-laden drilling fluids have a thinning effect. The maximum effect on the fluidity of drilling fluids is exerted by samples of oxidized hydrolytic lignin NO3 and NO 4. It is enough to add them at a mass concentration of 2% to reduce the effective viscosity of the fluid by more than 5 times at low shear rates. When mass concentration of additives is higher than 2%, complete dilution of drilling fluids is observed. We believe that the use of hydrolyzed lignin is a good operational practice that allows us to obtain inexpensive and environmentally friendly components of drilling fluids and at the same time dispose of "difficult" waste from the timber industry," the head of the study, School of Engineering Physics and Radio Electronics director **Andrey Minakov** said..



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