ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 1 , January 2020

Advantages of Use of Technical Phospholipides of Cotton Oils for Producing a Lubricant and Anticorrosion Drilling Mix

Sobir Urinov, DilafruzSagdullaeva, AbboskhonTuraev, SaidakbarAbdurahimov

Lecturer at the Russian State University of Oil and Gas (National Research University) named after I.M. Gubkina in Tashkent

Cand. those. sciences, doctoral student, Institute of Bioorganic Chemistry named after A. Sadikov at the Academy of Sciences of the Republic of Uzbekistan

doc Chem. sciences, academician of the Academy of Sciences of the Republic of Uzbekistan,

doc those. Sciences, Professor, Institute of General and Inorganic Chemistry at the Academy of Sciences of the Republic of Uzbekistan,

ABSTRACT: This article discusses ways to increase the mechanical strength of drilling rigs and highlights the literature on lubricants recommended for use in aqueous drilling fluids. The results of laboratory studies to study the changes in the content of cottonseed oils and phospholipids depending on the amount of hydrated water.

KEYWORDS. Drilling fluid, dispersed particles, well, lubricant, antifoam, corrosion, anticorrosion, triacylglyceride, phosphatides, phospholipids, surface active substances (surfactants), cottonseed oil.

I.INTRODUCTION

Drilling deep wells, consisting of complex strata of the foothills of the Pamir and Tien Shan ranges using traditional clay solutions based on water, is currently not effective, because bits and other elements of the installation do not withstand the pressure and load generated in these wells.

In order to increase the mechanical strength of the drilling rig, it is necessary to lubricate its moving parts with anti-corrosion oils in a timely manner. Therefore, the combination of processes for removing dispersed particles from the bottom of the well and lubricating metal surfaces with oil is certainly considered an effective way to operate a drilling rig.

A number of lubricants recommended for use in aqueous drilling fluids have been published in the literature [1-3]. According to the technology of their production, they are divided into natural and synthetic, which are carried out by processing raw materials and industrial waste.

From the point of view of environmental safety and preserving the nativeness of the products obtained, the use of natural vegetable oils and fats to lubricate the bit and other elements of the rig is rational since They contain antioxidants, defoamers and other beneficial substances.

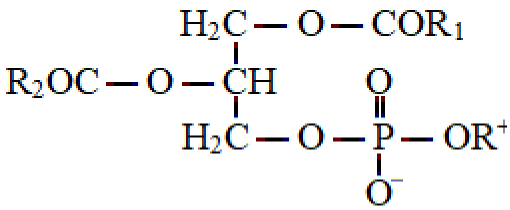
Of course, the use of triacylglycerides of vegetable oils and fats for technical purposes has certain limitations, which is associated with their nature, composition and properties [4].

Practice shows that the addition of oils and fats to aqueous solutions requires the use of surface-active substances (surfactants) to mix two or more immiscible liquids.

Unlike triacylglycerides, phospholipids of vegetable oils contain neutral oils (up to 35%), phosphatides (up to 75-80%) with high surface-active properties, etc. [5]. In the oil industry, the separation of phospholipids from light (sunflower, soybean, safflower, etc.) oils by hydration is considered mandatory in the technological scheme of refining vegetable oils. For dark (cotton, rapeseed, etc.) oils, this process is practically not used due to the presence of toxic, carcinogenic substances (gossypol and its derivatives, erucic acid, etc.) that do not allow the use of the oils extracted from them phospholipids for food purposes. Phospholipids are the most important phosphorus-containing compounds

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 1 , January 2020

of a lipid nature and can be considered as asymmetric diesters of phosphoric acid i.e. derivatives of 1,2-diacyl-Sn-glycero-3-phosphate [6]:

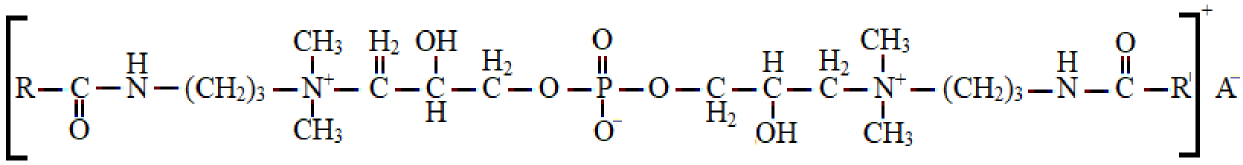


where R1 and R2 are saturated or unsaturated hydrocarbon residues of fatty acids; R + - nitrogenous bases (ethanolamine, diethanolamine, trimethylethanolamine), amino acids (serine), polyol residues (glycerol, inositol).

Molecules of phospholipids are characterized by the presence of non-polar (hydrophobic) and polar (hydrophilic) parts, which determines their behavior in aqueous solutions. Various ordered structural elements are formed depending on the concentration of the phospholipid molecule: at a low concentration, spherical molecules are formed in which the polar parts of the molecules make up the outer layer and the hydrophobic inner one; at an increased concentration, micelles are grouped into long cylinders, and then a specific type of liquid crystal structure is formed - laminar (layered), consisting of biomolecular layers of lipids separated by layers of water. Moreover, the transition from one form of micelle to another is due to the composition of the aqueous phase and phospholipids, as well as temperature [7].

Natural phospholipids isolated from vegetable oils are amorphous substances; on the contrary, synthetic ones form crystals that are clearly visible under a microscope. In this case, phospholipids containing saturated fatty acids have a buttery consistency, and saturated - solid. They have mutual solubilizing ability and are hydrolyzed by solutions of alkali and acids with the formation of certain components [8].

In expanded form, phospholipid compounds have the following chemical structure [9]:



where R and R^l are hydrocarbon groups C6 - C25; A is the anion that compensates for the cationic charge of the conjugated base of a strong acid.

As can be seen from the structure, phospholipids are similar to triacylglycerides, with the exception of the first hydroxyl group in the glycerol molecule, which has a polar phosphate-containing group in place of a fatty acid. Moreover, phospholipids have a hydrophilic head and a hydrophobic tail, which forms a bilayer in water. Therefore, phospholipids added to drilling fluids should be water soluble, compatible with divalent cations like Ca2 + or Mg2 + and not forming soap in seawater, as well as increasing their density to prevent back impact and gushing. In order to isolate phospholipids from raw cottonseed oil, we hydrated it with water according to the VNIIZh method [8]. In a hydrator with a capacity of 0.8 l was poured 500 g of crude unrefined cottonseed oil obtained by the press method.

In the table. 1 shows the basic contents of cottonseed oils and isolated phospholipids.

Table 1

Changes in the content of cottonseed oils and phospholipids depending on the amount of hydrated water

Amounts of hydratable water,%	Cottonseed oil content,%			Phospholipid content *,%		
	Trigl-Iceride	residualphospholipids	gossypol and its prod.	Trigl-Iceride	phospholipids	gossypol and its prod.
initial	97,5	1,5	1,2	-	-	-
1,0	96,8	0,8	0,8	27,6	71,9	1,5
2,0	96,4	0,7	0,9	27,7	72,0	1,3
3,0	96,1	0,6	0,8	26,8	72,4	1,2
4,0	95,7	0,5	0,7	26,2	72,8	1,0

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 7, Issue 1 , January 2020

Note: * separation of phospholipids from cottonseed oils was carried out at 40-50 ° C using microwave radiation with a frequency of 2450 MHz for 3 minutes.

From the table. 1 shows that with an increase in the amount of hydrated water from 1.0 to 4.0%, the content of triglycerides in cottonseed oil decreases by 18%, phospholipids by 1.0%, gossypol and its derivatives by 0.5%. In the isolated phospholipids, triglycerides are reduced by 1.4%, gossypol and its derivatives by 0.5%. At the same time, phospholipids increase by 0.9%.

The content of phospholipids in cotton (press or extraction) oils varies widely and depends primarily on their total amount in seeds, which varies from 1.0 to 1.8%. Cottonseed oil contains hydratable and non-hydratable phospholipids (Table 2).

Table 2

Indicators of hydratable phospholipids of cottonseed oil

Thenameofindicators	Units	HydratableCottonPhospholipids
Content:		
- ash	%	1,52-3,25
- nitrogen	%	1,15-1,27
- phosphorus	%	3,61-3,89
- carbohydrates (total)	%	3,51-4,15
including		
- free	%	1,32-1,63
- related	%	2,31-2,68
unsaponifiable lipids	%	4,35-4,95
- gossypol and its produced	%	2,31-3,16
Acid number	KOH/r	9,85-15,52

From the table. 2 shows that hydrated cotton phospholipids contain free and bound carbohydrates, as well as unsaponifiable lipids.

Traditionally, surface-active substances (surfactants) are organic compounds. Therefore, cotton phospholipids belong to surfactants forming micellar solutions [9].

In terms of surface activity, cotton phospholipids are arranged in the following descending order: phosphotidylcholines> phosphatidylethanolamines> phosphatidylserines>phosphatidylinositols> phosphatidic acids, which is also similar to their hydratability.

The polarity and polarizability of phospholipids determine their bulk and surface properties, which explain the mechanism of dissolution and behavior of phospholipids in vegetable oils [10]. Here, the relative polarity (OD) is calculated by the following formula:

$$\text{ОП} = \frac{(\epsilon_1 - \epsilon_b) \cdot 100}{\epsilon_b}$$

where ϵ_1 and ϵ_b is the dielectric constant of a benzene solution of phospholipids of a certain concentration and pure benzene, in fact.

Cotton phospholipids under the influence of electromagnetic polarization change their polarities due to an increase in their dipole moment. Therefore, they are classified as ionic surfactants, antioxidants, and inhibitors [11]. The latter properties are justified by the presence of tocopherols, amino acids and melanophosphatides.

Gossypol in cottonseed oil can form mono- or disubstituted gossyphospholipids, which in the process of its hydration becomes a nonionic surfactant.

By adding phospholipids to water-based clay muds, it is possible to obtain emulsions with increased density, reduced friction coefficient (relatively without phospholipids) and to achieve an increase in their lubricating properties. The maximum addition of surfactants to water-based drilling fluids is up to 10% of the total weight of the emulsion.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 1 , January 2020

High density drilling fluids are used to prevent back impacts and gushing in wells, and also provide safe work in the rig. At the same time, it is advisable to select additives depending on the nature of the rock to be drilled. Moreover, the rheological properties of drilling fluids are also considered important indicators of this process. As the depth of the well increases, the temperature of the drilling fluid rises, and thereby its viscosity and rheological properties change significantly.

Lubricants in the metal-to-metal system were studied on a Fan EP / Lebricity tester instrument taking a metal block to a rotating ring.

Phospholipids have been found to significantly reduce torque compared to untreated saline.

Another advantage of phospholipids compared to other surfactants in drilling fluids is their resistance to salt aggression. In salt fluid, phospholipids do not reduce their surface-active properties, which is due to their molecular structure and colloidal chemical properties.

Drilling fluids are characterized as thixotropic fluid systems i.e. they exhibit low shear viscosity. This achieves the removal of unwanted solid particles from the bottom of the wellbore to its surface.

The introduction of phospholipid surfactants enhances the lubricating ability of the drilling fluid, prevents clogging of the drill string and reduces the time required to unfasten the sticking of the column pipes.

As you can see, the composition and properties of the drilling fluid are selected based on the features of the formations and the depth of the well, which require the use of heat and salt-resistant chemicals, including surfactants. Phospholipid surfactants related to non-ionic surfactants perform a number of tasks in drilling fluids: emulsification, viscosity reduction, foaming, etc.

Therefore, its use in drilling fluids significantly reduces the traditional consumption of chemicals.

We have studied water-based drilling fluids with the addition of phospholipids and local clays. The results are presented in table. 3.

Table 3

Change in the main indicators of drilling fluids obtained from local clays with and without phospholipid surfactants

Name of clay	without the addition of phospholipids		with the addition of phospholipids	
	Viscosity, s (according to SPV-5)	Lubricity,%	Viscosity, s (according to SVV-5)	Lubricity,%
Navbahar alkaline bentonite	28,0	84,5	19,5	96,5
NavbakharBonatePalygorskite	30,5	86,2	18,0	98,2
Katta-Kurgan bentonite (control)	34,2	81,3	29,7	90,4

From the table. Figure 3 shows that with the introduction of phospholipid surfactants in the composition of drilling fluids obtained on an aqueous basis from local clays, the viscosity of the fluids significantly decreases. Moreover, the greatest decrease is observed in the solution obtained from the Navbakhar carbonate palygorskite and vice versa, the smallest - Katta-Kurgan bentonite.

The increase in lubricity with the introduction of phospholipid surfactants in the composition of drilling fluids can be explained by the presence of neutral fats in them, which form stable emulsions. Thus, the studies showed the effectiveness of the use of phospholipid surfactants in clay drilling fluids obtained on an aqueous basis. This allows us to solve a number of technological problems to improve the technology of drilling deep wells with various layers of minerals and waters with a high concentration of salts. High lubricity of drilling fluids containing phospholipids provides the necessary lubrication of the installation elements, the acceptable foaming of the emulsion and the temperature in the bit. The presence of triglycerides in phospholipids reduces the viscosity of drilling fluids obtained from various local clay minerals.

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 7, Issue 1 , January 2020

REFERENCES

1. Bulatov A.I., Makarenko P.P., ProselkovYu.M. Drilling flushing and grouting solutions. Textbook manual for universities. - M .: Nedra, 1999- 424 p.
2. Andreson B. A., Maas A. Mud drilling fluid of a new generation. // Oil and capital. M. - 1997 - p. 93-94.
3. BasaryginYu.M., Bulatov A.M., ProselkovYu.M. Technology of drilling oil and gas wells: Textbook. for universities. - M .: Nedrabusinesscentre LLC, 2001. - 679 p.
4. Mikheev V.A. Technological properties of drilling fluids. - M .: Nedra, 1979 - 239 p.
5. RyazanovYa.A. Encyclopedia of drilling fluids. - M .: Nedra, 2004 - 490 s.
6. Yarov A.N. Drilling fluids with improved lubricating properties. - M .: Nedra, 1975 - 143 p.
7. Ryabchenko V.I. Management of drilling fluid properties. // M .: Nedra, 1990 - 230 s.
8. Ovchinnikov V.P., Aksenova N.A. Drilling fluids for opening productive formations // News of universities. Oil and gas, 2000, No. 4, p. 21-26.
9. Bazarov G.R., Abdurakhmanov S.A. Waste greasy clay is a valuable raw material for drilling fluids. The Uzbek Journal of Oil and Gas, 2005, No. 3, p. 36-37.
10. Kolesnikova T.I., AgaevYu.I. Drilling fluids and boreholes. - M .: Nedra, 1975 - 128 p.
11. Bazarov G.R. The technology for producing effective drilling fluids based on local and spent greasy clays. Abstract. dis. Cand. tech. sciences. Tashkent, IONH AN RUz, 2006 - 26 p.