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Effect of Drilling FluidAdditives to Dispersion of Nano ParaffinEmulsions

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ABSTRACT

Studied the effect of conventional drilling fluid additives on nanoparaffin emulsions properties, Including tackifiers, viscosity reducers, fluid loss control agents and inhibitors. First, measured the different concentrations of nano paraffin emulsion particle size distribution by Laser particle size analyzer. Then measured the particle size distribution of nanoparaffin emulsion which have join different kinds and concentrations of the drilling fluid additives. After that, measured the stability of nanoparaffin Emulsions with kinds and concentrations of the drilling fluid additives.Finally, nanoparaffin emulsion sedimentation stability analyzed by TLAB dispersion stability analyzer. The results showed that different concentrations of nano-emulsion wax particle size distribution very similar, and the average diameter is 65nm. Most of the drilling fluid additives have little effect on nano paraffin emulsion particle size distribution. Inhibitors like hydrolyzed polyacrylonitrile ammonium salt and viscosifier like xanthan gum causes a substantial increase in nanoparaffin emulsion particle size. After joining the preferred drilling fluid additives, sedimentation stability of nano paraffin emulsion no significant change, from the result of the TLAB dispersion stability analyzer can be seen that after standing 24h, nanoemulsion paraffin show great sedimentation stability.

Key words: Nano paraffin emulsion; drilling fluid additives; particle size distribution; dispersion stability.

INTRODUCTION

With the progress of the exploration and development of unconventional oil and gas, petroleum geology and global oil and gas exploration targets from micron - one source storage reservoir or source symbiosis continuous hydrocarbon accumulation mm pore throats new conventional oil and gas fields to trap nano-pore throats the field of development [1]. During drillingprogress, the hole for the formation of nano appear throat, conventional drilling fluid solid component in particle size between 0.1-100μm, can not form a dense cake prevent liquid intrusion, so how to solve the drilling fluid sealing, permeability and inhibition the problem of inadequate practical significance and urgency [2-3]. Particle size distribution of nano-materials at the nanoscale, evenly distributed, easy to enter the nanopore formation throat, play a role in filling reinforcing and better sealing cracks to

form a dense sealing layer, to prevent the filtrate invasion [4-7].

Conventional drilling nano materials can be divided into inorganic nano-blocking agent, nano-polymer system, the nano emulsion system, the organic / inorganic nanocomposites [8-9]. As a water-based drilling fluid additives, nanoemulsion compared to other nano-blocking agent with high dispersion stability, anti-collapse, lubrication and so on, and low toxicity, non-fluorescent, to meet environmental protection and drilling requirements [10-11] . Li Chao [12], LanQiang [13] think that nano-micro emulsion has good inhibition, lubrication, reservoir protection effect in drilling fluids, oil-based drilling mud cake removal and other aspects of the effect is obvious, application promising. Chen Jun [14], etc. by adding drilling fluid nanoparaffin emulsion, in Jiangsu Oilfield ensure the smooth construction of two horizontal wells. However, for compatibility experiments done nanometer paraffin emulsion drilling fluid with each processing agents work even less, nanoparaffin emulsion added to drilling fluids whether to keep the nanometer scale still needs further study.

In order to study nano paraffin emulsion compatibility with conventional drilling fluid additives, this paper systematically studied conventional drilling fluid additivesfor nano-particle size distribution of the paraffin emulsion, centrifugal stability, sedimentation stability and other properties. It has been selected paraffin treatment agent for nanoemulsion influence law, how to choose when nanometer paraffin wax emulsions used in drilling fluid drilling fluid to provide a reference.

MATERIAL METHOD

Experimental equipment and materials

Nano wax emulsions, Huawei oil Technology Co., Ltd. Chengdu, China; fluid loss additive, temperature resistant starch (DFD-140), Chongqing Synthetic Chemical; polyanionic cellulose (PAC-LV), Xuzhou King Mountain gas plant. Thickening agent, low viscosity carboxymethyl cellulose sodium salt (LV-CMC), Xuzhou King Mountain gas plant; xanthan gum (XC), New River County, Hebei plant biochemistry. Inhibitors, hydrolyzed polyacrylonitrile ammonium (NH4-HPAN), Cangzhou petroleum additives plant; acrylamide sodium acrylate copolymer (80A-51), Southwest Petroleum University oilfield chemicals service center.Viscosity reducer, multi-copolymer of vinyl monomer (XY-27), the fourth Xinxiang Chemical; sulfonated tannin (SMK), Chengdu grilled glue factory.

Laboratory Instrument

Laser particle size analyzer, Japan HODIBA / LA-950A; centrifuge, Dongtwang TD5K-Ⅱ; near-infrared scanning TLAB dispersion stability instrument, Beijing LangdiSen Technology Co., Ltd.

Experimental Procedure

First, measured the different concentrations of nano paraffin emulsion particle size distribution by laser particle size analyzer, determine the optimal concentration. Then added in different kinds and doseof dispersants,measured theparticle size distribution after mixing the mixed solution. Select a smaller particle size distribution solution, centrifugation stability analysis. Finally, test the effect of time to stability of nano paraffin emulsion by near-infrared scanning.

RESULTS AND DISCUSSION

Different concentrations of nano paraffin emulsion particle size distribution

Measured 500mL water, configured concentrations 1%, 3%, 5%, 7%, 10% none paraffin emulsion, then test the particle size distribution.

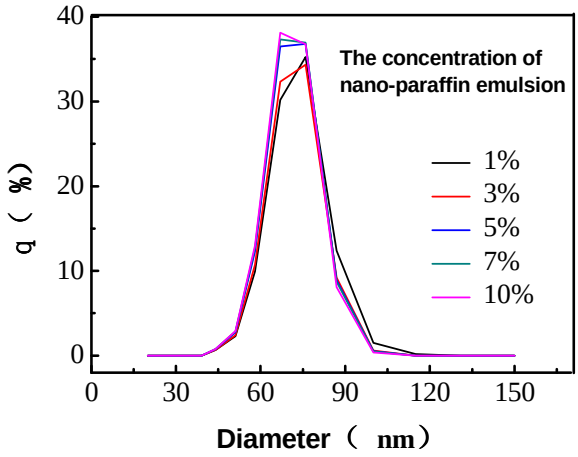


Fig 1 Different concentrations of nano paraffin emulsion particle size distribution

As it can be seen from Figure 1, the particle size distribution of nano paraffin emulsion does not substantially change with paraffin emulsion concentration change, and the particle size distribution substantially normal distribution, laser particle size analyzer test average diameter of 60nm-70nm in between. Description thenanoemulsified paraffin emulsion droplets stability, physical or chemical does not react with water. This is because the nanoemulsified paraffin prepared by the method of allyl polyether nonionic monomer grafted in the modified polyethylene wax of molecular side chains introduced ethoxy, greatly improves the modified polyethylene wax self-emulsifying ability and water-soluble, so that the wax emulsion can be prepared with water miscible in any proportion, without affecting the structural changes.

Effect of drilling fluid additives on thenano paraffin emulsion particle size distribution

From the distribution of different concentrations of nanoparaffin emulsion,the concentration has little effect on droplet size, so when analysis the effect of drilling fluid additiveson the nano paraffin emulsion particle sizedistribution, according to Chen Jun ' s research ,we choose the concentration ofnano paraffin emulsion is 1%.After you configure the nano paraffin emulsion, adding different drilling fluid additives, stirring until the emulsion particle size distribution after sufficiently dispersed.

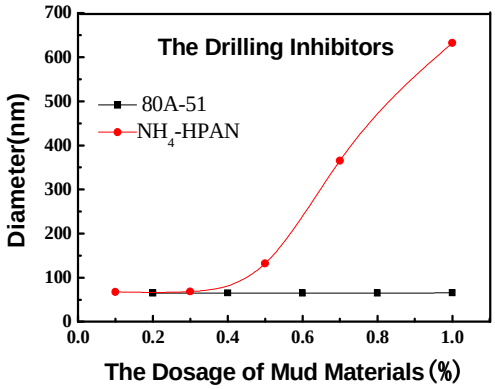


Fig 2 Different concentration of nano

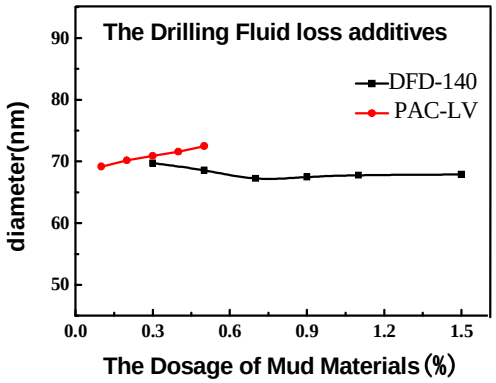


Fig 3 Different concentration of nano

paraffin emulsion particle size distribution

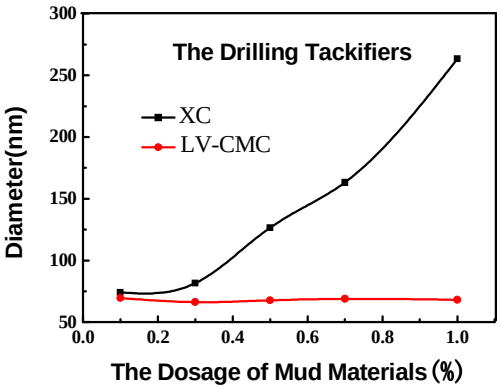


Fig 4 Different concentration of nano paraffin emulsion particle size distribution

paraffin emulsion particle size distribution

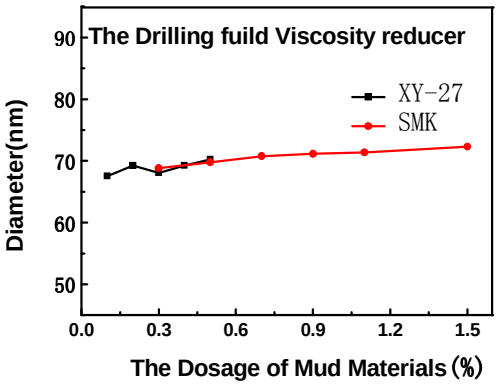


Fig 5 Different concentration of nano paraffin emulsion particle size distribution

According to the experiment, the selection of drilling fluid loss agent and viscosity reducer have little effect on the paraffin emulsion dispersed in water, tackifiers and inhibitors in the treatment agent is dispersed in water emulsified paraffin influence of relatively large. The inhibitor NH_4-HPAN and tackifier XC makes the average particle size of nanoparaffin emulsionmore than 100nm, and inhibitor80A-51 and tackifier LV-CMC have little effect on nanoparaffin emulsion dispersed in water. Therefore, during configuration of the drilling fluid, and for the use of nanoemulsified paraffin to blocking, the inhibitors and thickening agent selection need attention.

Effect of drilling fluid additives to the centrifugal stability of the nanoparaffin emulsion

Add the drilling fluid additives which preferably by the experiments to 25mL nanoparaffin emulsion solution, the concentration of the nanoparaffin emulsion is 1%, placed in a centrifuge tube and centrifuged stability test. Wherein the centrifugation time is set to 15min, rotational speed is set to a 1500r / min, until the end of the experiment, the solution was transferred to a centrifuge tube graduated cylinder, the cylinder cases observed layers were separated. 1 # tube for drilling inhibitor 80A51,2 # tubes for drilling fluid loss additive DFD-140,3 # tube drilling fluid thickening agent LV-CMC, 4 # tube drilling fluid viscosity reduction agent XY-27, the concentration of drilling fluid additiveis 0.3%.

Fig 6 Nano paraffin emulsion after centrifugal

As can be seen from the experiment result, after the rate is 1500r / min, time of 15min of centrifugation, the nanoparaffin emulsion with drilling fluid additives basic non-hierarchical, emulsion particle size is maintained at about 65nm, the choice of drilling fluid additives on the stability of the emulsion centrifugation are not large, indicating nanoemulsified paraffin have good centrifugal stability. This is because the introduction of the side chains of the molecule modified polyethylene wax is a non-ionic ethoxylate groups to enhance the water-soluble emulsion, while allowing paraffin emulsion has good acid and alkali resistance, electrolyte performance.

Effect of drilling fluid additives to the sedimentation stability of the nanoparaffin emulsion

Configuration1 #, 2#, 3#, 4# emulsions, determination of emulsion sedimentation stability by near infrared scanning dispersion stability instrument. Scan time is set to 24h, scanning frequency scan hourly.

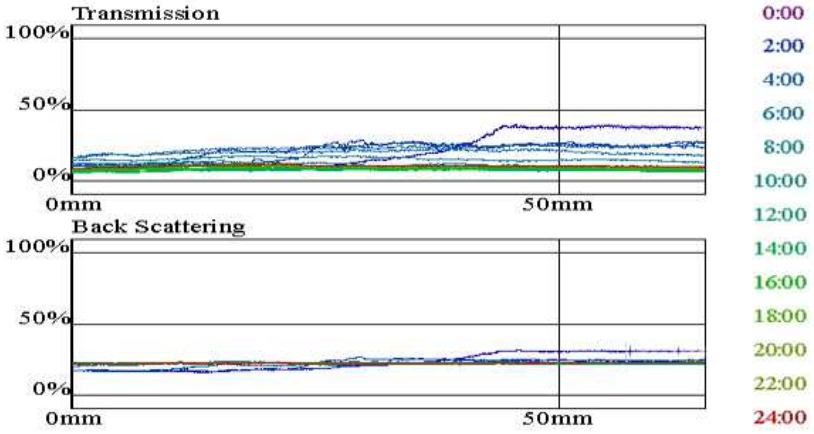
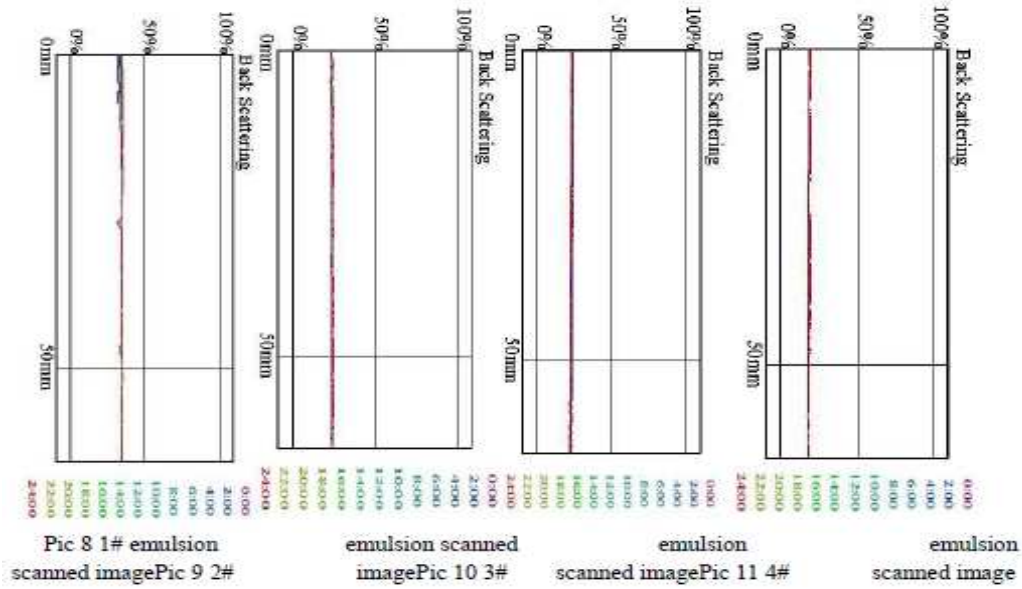


Fig 7 Nano paraffin emulsion scanned image

Figure 7 is a concentration of 1% nano paraffin emulsion reflection spectrum transmission scan when no drilling fluid additive is added. As can be seen from this figure nanometer paraffin emulsion after placing 24h, at the bottom of the tube slight subsidence occurs.



As can be seen from the four types of nano paraffin emulsionwith different drilling fluid additives, four kinds of emulsions similar to the amplitude of the reflected light changes, described in test tubes of different heights emulsifying wax settling and aggregation was similar. Due to the addition of the drilling fluid additives, solid particles content increases, making the 1#, 2#, 3#, 4# set of experiments in the reflected light intensity increases, comparison the reflected light intensity with the Fig. 7 show that adding drilling fluid additives for sedimentation stability emulsified paraffin changed little, indicating nano paraffin emulsion and drilling fluid additives good compatibility.

CONCLUSION

(1) Nano paraffin emulsion particle size does not change with the concentration changes, and the average diameter of emulsion particle size is about 65nm, it is suitable for blocking the formation of nano pore throats.

(2) When need adding nanoparaffin emulsion in drilling fluid,drilling fluidadditives should be selected. Drilling fluid additives such as NH_4-HPAN and XC enables nano paraffin emulsion particle size from 65nm to 300nm or more, the nano paraffin emulsion particle size distribution is not in nanometer size range.

(3) Has good compatibilitywith the paraffin emulsion drilling fluid which contain or contains a small amount of –H,has little effect on the dispersion properties ofnano paraffin emulsion.When placed 24h,nano paraffin emulsionsedimentation rate of about 5%.

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