THE EFFECT OF ADMIXTURE ON SLURRY IN CEMENTATION OIL WELL

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Abstract: *in the process of cementation oil wells, the mixture (oil well cement slurry) is pumped into deep depths that may be exceed 6000 m and exposure to high temperatures. This depth and this temperatures effects role of the mixture during the process of cementation, especially on the flow characteristics of the mixture which included variable Yield stress ,viscosity, thixotropic and gel strength of oil well cement, therefore the chemical additives help to develop the properties of the mixture to resist these conditions to develop the properties of the mixture, In these experiments, 4 different chemical substances were used, one of which was a natural material (fly Ash) and laboratory working conditions were at different temperatures, Four different mixing ratios were used for each chemical to obtain accurate results. It was found that the properties of mixture depend on the water cement ratio (w/c) and the temperatures so this study aims to be more effective in improving the properties of oil well cement slurries at all test temperatures.*

Keywords: *cementation, yield point, apparent viscosity, admixtures, shear rate.*

ВЛИЯНИЕ ПРИМЕСИ НА СУСПЕНЗИЮ В ЦЕМЕНТНОЙ НЕФТЯНОЙ СКВАЖИНЕ

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Аннотация: *в процессе цементирования нефтяных скважин смесь (цементная суспензия нефтяной скважины) закачивается на глубины, которые могут превышать 6000 м, и подвергаться воздействию высоких температур. Эта глубина и эти температуры влияют на роль смеси в процессе цементации, особенно на характеристики текучести смеси, которая включает переменное напряжение текучести, вязкость, тиксотропную и гелевую прочность нефтяного цемента, поэтому химические добавки помогают развить свойства смеси, чтобы противостоять этим условиям. В этих экспериментах использовались 4 разных химических вещества, одно из которых было природным материалом (зольная зола), а лабораторные условия работы были при разных температурах, четыре разных соотношения смешивания были использованы для каждого химического вещества для получения точных результатов. Было обнаружено, что свойства смеси зависят от соотношения цементного раствора воды (w/c) и температур, поэтому это исследование направлено на более эффективную работу по улучшению свойств цементных растворов нефтяных скважин при всех температурах испытаний.*

Ключевые слова: *цементация, предел текучести, кажущаяся вязкость, примеси, скорость сдвига.*

Introduction

The process of cementation oil wells is one of the most important and critical drilling operations in the oil well, which depends directly on the cement material after the eruption that occurred in the Gulf of Mexico 2010 and its 2009 found that the main reason for the weakness of the process of naming and the role of cement for this to play chemicals has an important role in improving the properties Mixture and cement properties, according to the American Petroleum Institute. However, oil well cement slurry rheology is more complicated than that of cement paste [2-3-5].

In order to contend with bottom hole conditions (wide range of pressure and temperature), a special class of cements called oil well cements oil well cement slurry), specified by the American Petroleum Institute (API) (API Specification 10A, API, 2002) [4-6] and various additives are usually used in the slurry composition. Among the eight different types of available oil well cement, class G and H cements are usually specified for deeper, hotter and higher-pressure well conditions (Lafarge, 2010) [15]. A thorough review of the types of admixtures used in the petroleum industry and the rheology of OWC slurries has been provided in the literature (e.g. Guillot, 2006; Nelson et al., 2006),[6-7] but comparing the effects of different admixtures on the rheological properties of oil well slurries at different temperatures remains largely unexplored A series of Flow tests using an advanced rheometer was carried out to determine the optimum dosage of admixtures at various temperatures.

Pressure has been found to have a less significant influence on the rheological properties of OWC slurries in comparison with that of temperature (Guillot, 2006; Kellingrayet al., 1990; Ravi and Sutton, 1990) [6-7-8].

This study also describes the reactions that occur between the used cement type according to specifications of the American Petroleum Institute (API) and the chemicals used [4-5]. This study has improved the understanding of the effect of chemical additives on the oil well cement slurry, chemistry of clay at high temperature to be obtained.

The Bingham plastic model and thepower law are widely used to describe the rheological properties of cement slurries (Guillot, 2006) [6-7]. The Bingham plasticmodel includes both yield stress, ty and a limiting viscosity, finite shear rates, which the power law model fails to consider. Therefore, the Bingham plastic model was used to calculate the yield stress and plastic viscosity from the shear rate–shear stress down-curve.

The down-curve was chosen since it better fits the Bingham plastic model than the up-curve. The down-curve is normally lower in shear stress values than the up-curve because of the breakdown in the slurry structure due to shear flow. The degree of thixotropic behavior measured by the hysteresis loop, which is the area enclosed by the up and down curves (Saak, 2000) [9-10], indicates a breakdown of structure. Conversely, are verse hysteresis loop indicates that the structure of the material stiffens when sheared due to a mechanism ofthixotropy build-up (Eirich, 1960) [11]. The reverse hysterias is behavior is called anti-thixotropic or rheopexy (Ferguson and Kemblowski, 1991).

In this study, three chemicals and a natural material were used separately at the same temperature and an initial model was adopted without any additions for the purpose of approaching the final results. Tests were conducted according to the American Petroleum Institute(API). Specifications and materials according to the American Materials Institute (ASTM). Preparation of the mixture directly affects the results. Preparing the mixture according to the American Petroleum Institute (API)

Materials

1- Cement

Cement used in this study using class G (API Class G) [4] oil well cement with a specific gravity of 3.14. The chemical and physical properties of this cement are summarized in Table 2.1 accordind API. Indicated that cement used was tallying API requirements. In table 1 Test were done to check storage efficiency, small cans closed were used in the laboratory in order to avoid moisture.

Table 1. Test result Physical properties for cement G

Physical properties for cement G	Test result
Free water content with 0.4 w/c	1.2
Compressive strength at 8 hours @ 38 C and atmospheric pressure(psi)	1600 psi
Thickening Time (min)	105 min

2- The admixtures used are listed here

- Retarding admixture: according on specification of (ASTM) C494 type B only retarding , use different % By weight of cement (potion) was (0.5,1,2,2.5,3).the company product BASF. (RTD)
- Water reducing admixture: according on specification of (ASTM) C494 type A, use different % By weight of cement (potion) was (0.5,1,2,2.5,3).the company product BASF (WRTD).
- Rheoplastic admixture according on specification of (ASTM) C494, use different % By weight of cement (potion) was (0.5,1,2,2.5,3).the company product BASF (RHP).
- Fly Ash: Fly ash(CFA) is the residue from coal fired power stations. Millions of tones of the stuff is produced each year which used to all end up in landfill. Fly ash is a 'pozzolan' which is material containing silicon dioxide that, when mixed with water and lime forms a cement like material. according on specification of (ASTM) C494[4-5-7].

3-Water: use clear water not have organic materials the percentage of water on water cement ration [17-18]

Mixing and procedure

In the first, the mixture is prepared. The mixing method and the mixing time greatly affect the results of the laboratory. There are two kinds of dry and liquid additives. In the beginning, the cement is added to the water according to the quantity of the experiment. The continuous stirring by plastic shovel and removing all the feeders around the walls [4-5-6]. Determined proportions Manual mixing continues for 5 mint the temperature of the room is up to 20C and the examination is done at different temperatures (20-40-60) The speed of the drum machine 200 cycles per minute The time in all experiments is constant to avoid external variables After mixing and preconditioning, the cement slurry sample was placed in the coaxial cylinder of the rheometer. The temperature of the rheometer was adjusted to the required level. Viscosity measurements were taken at 20different shear rates starting from 5.11 to 511S^{-1} s21 after continuous rotation of 10 s at each speed. Subsequently, the data were measured at a descending shear rate from 511 to5? 11 s21 to obtain the down-flow curve. The hysteresis loop thus produced was used to characterize the thixotropic of the cement slurry (Saak, 2000) [14]. Initial model is initialized at the beginning of laboratory work of cement and water only without additives to compare the results with the new results after the addition of optimizers

Results and discussion

1- The effect of tempter and water cement ratio on yield stress and plasticity of slurry ,

In order to examine the effects of the w/c and temperature on oil well cement slurry rheology ,neat cement slurries were prepared without any chemical admixtures. Cement slurries with different w/c at various temperatures showed significantly different rheological properties. However, regardless of the w/candy temperature, used 2 (w/c).35,45.

Table2. Generated (a) yield stress and (b) plastic viscosity fromBingham model

Temp.(c)	w/c	Yield stress (pa)	Plastic viscosity(pa.s)
20	0.35	28	0.07
	0.45	28.5	0.075
40	0.35	31	0.068
	0.45	32	0.063
60	0.35	46	0.038
	0.45	48	0.037

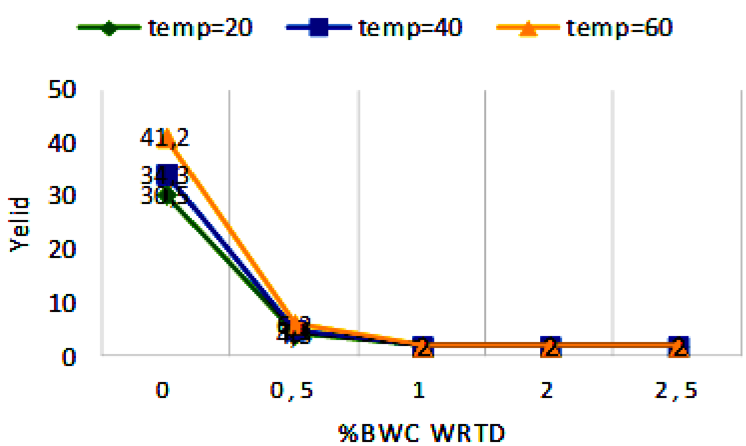

Fig. 1. Effect temp and %BWC. On yield stress (pa)

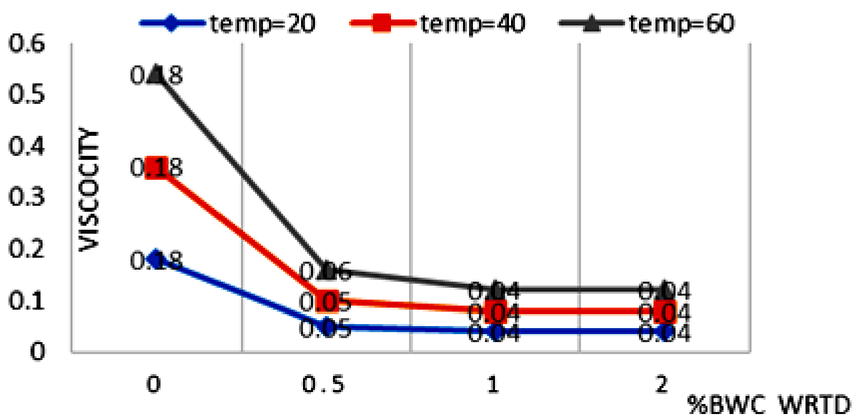

Fig. 2. Effect temp and %BWC. On Viscosity (pas)

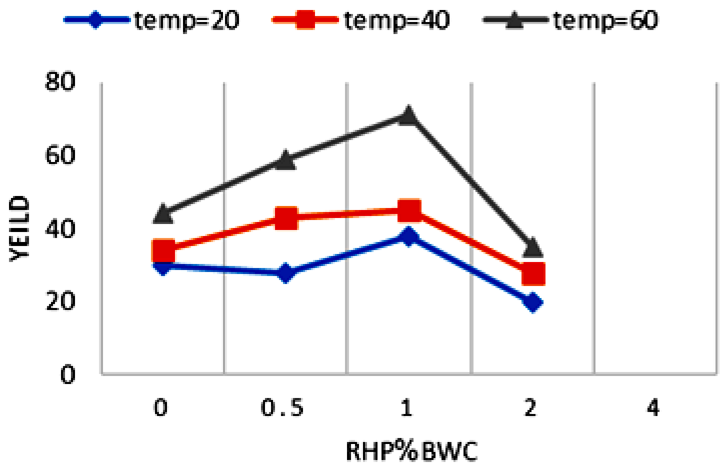

Fig.. 3. Effect temp and %RHP . On yield

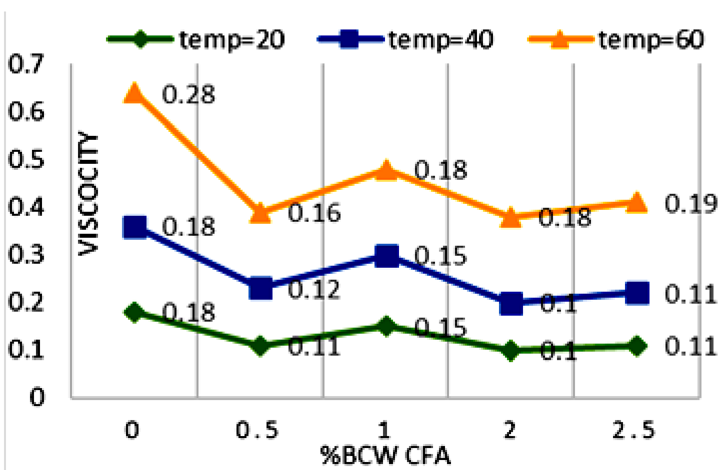

Fig. 4. Effect temp and %BWC. On Viscosity (pas)

Conclusions

There are many factors that affect the characteristics of the mixture, including temperature, type of cement used, chemical composition of cement, chemical additives, compatibility of chemical additives, cement, mixing methods, mixing time, human errors and other factors affecting the flow characteristics in this study show the effect of chemical additives, The characteristics of the flow are significantly increased, and these properties are increased nonlinearly with heat, the chemical residues significantly affect the performance of the mixture at all temperatures, super acting as a catalyst for the mixture and thus increasing the performance condition Pumping process does not continue for a long time, fly ASH was found that use gives good results and batter than chemicals and is considered a cheap material so we recommend to use it,

There are many experiments that must be done in order to have a complete picture on the subject, including the importance of the time of cohesion. The resistance to compression is presented in a later article

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