ISSN 2229-5518

Sawdust As A Filteration Control And Density Additives in Water-Based Drilling Mud.

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Abstract- Sawdust is applicable in agricultural sector for beddings and also for production of particle board but most of it is burnt off in the developing countries. Sawdust, as a fiber, is applied as a filter loss additive in water-based mud. Three grades of sawdust were used. The 0.5mm diameter sawdust caused an increase in the mud density with increasing percentage volume of the sawdust in the mud. The 1.00mm sawdust additive caused a reduction in the density of the mud with an increasing weight of the additive. The third grade was a mixture of sawdust grade greater than 1.00mm and saw shavings. The greater than 1.0mm sawdust gave thickest mud cake while the 0.5mm gave the least mud cake thickness and highest filtration loss among the three. As a result of effect on density and viscosity an optimum weight percentage is recommended for application of the different size grades of the sawdust if they are to serve as weight control additive. These weight percentage are 5.9 % wt. sawdust for 0.5mm; 3.8 % wt. sawdust for 1.0mm and 3.5% wt. for greater than 1.0mm sawdust. If the sawdusts are to serve as filtration control additives, the sizes of 1.0mm and greater than are recommended due to excessive filtration loss for 0.5mm sawdust. Moreover, it was observed that for weight percentage higher than 5% for sawdust greater than 1.0mm, the mudcake was very unstable as it broke down easily.

Index Terms— Sawdust, filtration-control, CO_2 contamination, filtration loss, viscosity, mudcake, mud density,mud rheology

1 INTRODUCTION

The Wikipedia define Sawdust as a "by-product of cutting lumber with a saw, composed of fine particles of wood" and which present fire hazard in manufacturing industries due to its flammability. Sawdust, though a wood sawmill waste, has application in the manufacturing of particleboard and in agriculture as a poultry bedding material and as soil nutrient. Unfortunately, particle board is fast becoming a non-economic product with most of its application substituted for with magnetic board and other plastic materials. This research finds application for the wood waste, sawdust and shavings, in drilling mud.

Sawdust is a cheap organic material and contains some amount of phenol in its fresh state. When it is aged a little under rain condition or under running water, the phenol would have been leached by the rain. It is considered that sawdust is low in nitrogen nutrients when compared against products like straw or Lucerne and it helps in making the soil more friable for increased water and air holding capacity [1].

Walnut sawdust contains natural herbicide and it kills weeds especially tomatoes and other plants. Saw shavings are used as mulch for horse bedding. Walnut sawdust contains natural herbicide. Saw shavings are used as mulch for horse beddings [2].

Sawdust is applied here as a cheap additive material in order to lower the cost of expensive drilling mud while still maintaining the effectiveness of the mud functions [3].

Apart for the investigation of the effect of the sawdust as a possible filtration control additive, further studies were also carried out to investigate the effect of the addition of the sawdust on the two most important functions of the drilling mud, density and viscosity

2 METHODOLOGY

Aged sawdust was used and was collected from sawmill and it is a mixture of two most popular hard woods and soft wood; mahogany, Ipe and African

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blackwood. It was later separated into various size grades.

Fresh water-based muds were prepared and various weight of three grades of sawdust were added to the mud. The three grades of sawdust used were 0.5mm diameter, 1.0mm diameter and a mixture of over 1.0mm sawdust and saw shavings were used.

The densities and shear stress were measured for each grade of the sawdust samples. The apparent viscosity was then calculated for various values of shear stress obtained.

3 Results

The measurements of the various properties of prepared mud samples obtained were stated in Tables 1 to 5 while the graphical representations are as shown in figures 1 to 7 below.

In Fig.1, 2 and 3 below, the yellow curve indicates the density of the mud after the addition of different sizes of sawdusts. The blue curve indicates the apparent viscosity for the same

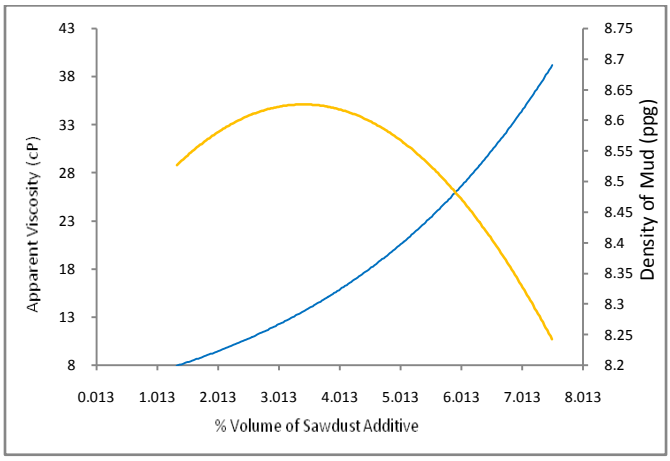

Figure 1: Apparent Viscosity and Density With Fractional Volume of 0.5mm Sawdust

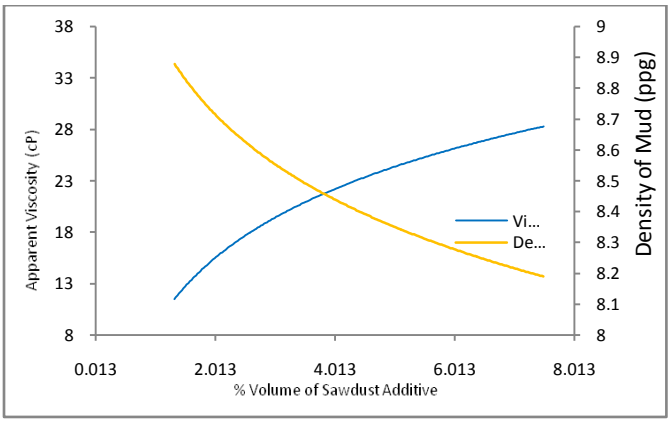

Figure 2: Apparent Viscosity And Density Variation With Fractional Volume of 1.0mm Sawdust

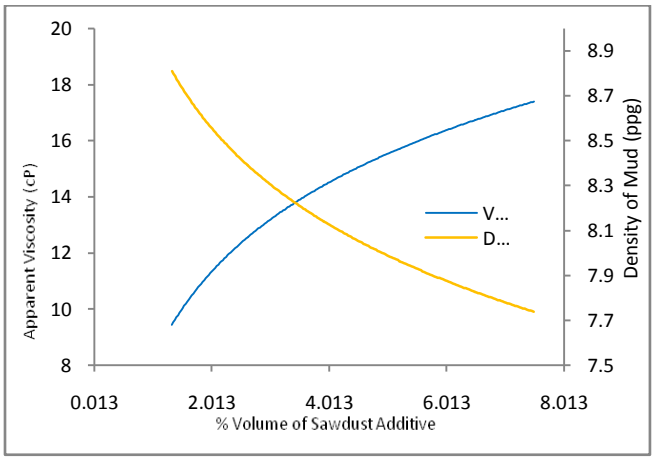

Figure 3: Apparent Viscosity and Density With Fractional Volume of Sawdust > 1.0 mm Diameter

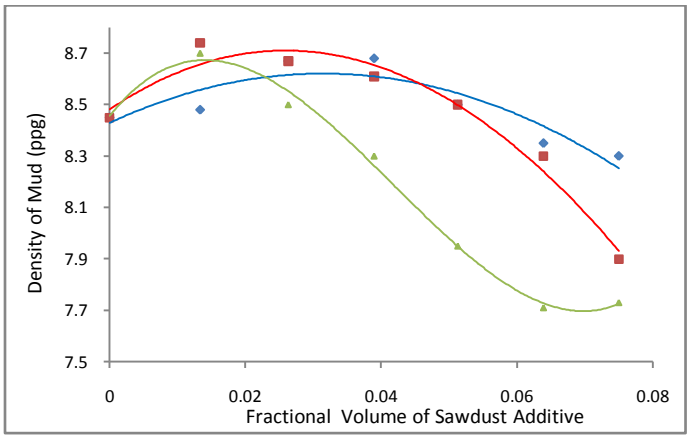

Figure 4: Density Variations With Various Sawdust Sizes

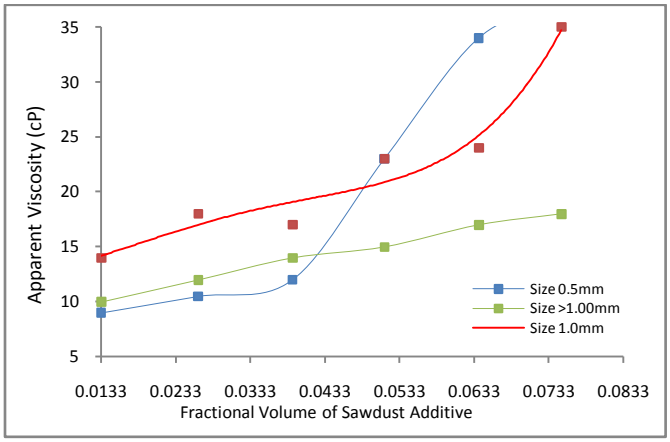

Figure 5: Apparent Viscosity Variation With Various Sawdust Sizes.

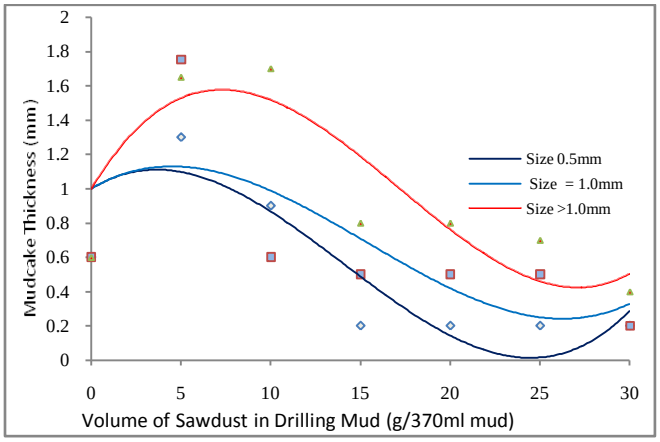

Figure 7: Mudcake Thickness For Various

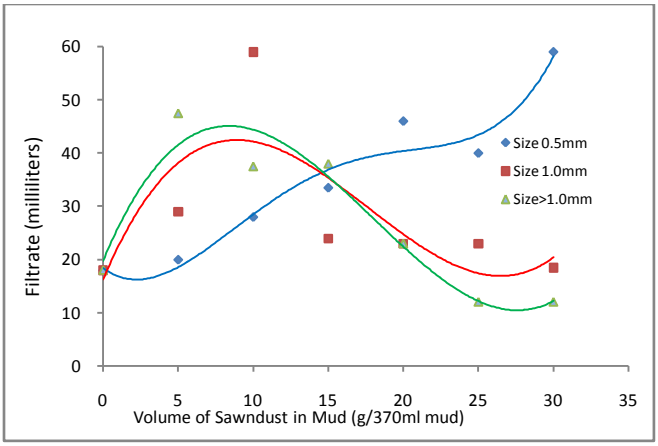

Figure 6: Volume of Filtrate For Various Sizes of Sawdust

4 Conclusions

Studies during this research also shows that sawdust has effect on both the density and the viscosity of the mud and this must be consider during application of sawdust in water-based mud. It was observed that while the two sawdusts with diameter greater than 0.5mm has reducing effects on the mud density, the 0.5mm sawdust initial caused an increase in the density of the mud up to about 3.3% weight of the sawdust after which the mud density declines with increasing weight of sawdust.

It was observed that, for all volume of sawdust added and for all sizes, viscosity increases. Since density and viscosity are interrelated, the optimum performance for the sawdust is expected to be where the density and the viscosity curves cross one another. This optimum point is 5.9 % wt. sawdust for 0.5mm; 3.8 % wt. sawdust for 1.0mm and 3.5% wt. for greater than 1.0mm sawdust. Comparing Figs. 6 and 7, sawdust of size 0.5mm gave excess filtrate and this is not a good sign. The 1.0mm and >1.0mm gave good filtrate at 15-25g/370ml mud and when compared to the mud cake thickness, a 15g-20g/370ml mud is recommended as this gave good compact mud thickness for the two; 1.0mm and >1.0mm sizes. Since the mud cake for >1.0mm breaks down beyond 20g and beyond, a weight additive of 15g is recommended for >1.0mm and 15-20g/370ml mud for 1.0mm sawdust.

References

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[3] Adebayo, Thomas A. and Imokhe Omolegho, 2011, *Tiro (Antimony-Sulphide) And Potash As Local Substitutes To Imported Barite And Lignosulphate In Drilling Mud Weighting Additives*, International Journal of Engineering and Technology, Vol.11, issue 3, June 10, pp138-142.

APPENDIX

Table 1: Filtrate Volume For Various Sizes of Sawdust

Volume of Sawdust (g/370ml Mud)	Filtrate		
	Size 0.5mm	Size 0.5-1.0mm	Size >1.0mm
0	18	18	18
5	20	29	47.5
10	28	59	37.5
15	33.5	24	38
20	46	23	23
25	40	23	12
30	59	18.5	12

Table 2: Mudcake Thickness For Various Sizes of Sawdust

Volume of Sawdust (g/370ml Mud)	Mud cake		
	Size 0.5mm	Size 0.5-1.0mm	Size >1.0mm
0	0.6	0.6	0.6
5	1.3	1.75	1.65
10	0.9	0.6	1.7
15	0.2	0.5	0.8
20	0.2	0.5	0.8
25	0.2	0.5	0.7
30	0.2	0.2	0.4

Table 3: Density, Shear stress and Gel strength For 0.5mm Sawdust

Fractional Sawdust Conc.	Density		Shear Stress		Gel Strength	
	ppg	Lb/ft^3	600 rpm	300 rpm	10secs	10mins
0	8.45					
0.013333	8.48	63.6	10.5	9	1	1
0.02632	8.67	65.0	11.5	10.5	1	0.5
0.03896	8.68	65.1	14	12	6	3
0.05128	8.5	63.8	25	23	2	3
0.06391	8.35	62.6	37	34	8	4
0.075	8.3	62.3	39	37	9	6

Table 4: Density, Shear stress and Gel strength For 1.0mm Sawdust

Fractional Sawdust Conc.	Density		Shear Stress		Gel Strength	
	ppg	Lb/ft^3	600 rpm	300rpm	ppg	Lb/ft^3
0	8.45					
0.013333	8.74	65.6	18	14	2	1
0.02632	8.67	65.0	20	18	3	2
0.03896	8.61	64.6	20	17	4	2
0.05128	8.5	63.8	25	23	5	3
0.06391	8.3	62.3	28	24	8	4
0.075	7.9	59.3	39	35	11	9

Table 5: Density, Shear stress and Gel strength For >1.0mm Sawdust

Fractional Sawdust Conc.	Density		Shear Stress		Gel Strength	
	ppg	Lb/ft^3	600 rpm	300rpm	ppg	Lb/ft^3
0		8.45				
0.013333	65.3	8.7	10	14	3	2
0.02632	63.8	8.5	12	17	5	4
0.03896	62.3	8.3	14	18	6	4
0.05128	59.6	7.95	15	19	7.5	5
0.06391	57.8	7.71	17	20	9	6
0.075	58.0	7.73	18	22	9	7

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