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Comparative Analysis of the Use of Banana Peels and NaOH in Ph Control In Nigerian Clays

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Abstract

This paper documents an investigation into the control of pH in drilling mud. The experiments were designed using local and imported additives, namely banana peels and NaOH, KOH. The clays used in the experiment were sourced locally from two Nigerian towns.

Ash produced from burnt banana peels were used as a substitutive for the industrial sodium hydroxide (NaOH) and potassium hydroxide, (KOH). The negative adverse effects of mud cuttings with inorganic additives on the environment have been demonstrated.

The ash were observed to be environmentally more friendly and readily degradable. It also showed an appreciable improvement of the pH of the drilling fluid from 5.0 -7.9 to 11.3.

Keywords: Nigeria, clay, biodegradable additives

1.0 Introduction

Much damage has been done to the environments with the use of inorganic additives. The negative adverse effects of mud cuttings with inorganic additives on the environment have been demonstrated [1-3]. This paper discusses the use of a local material often considered a "waste" as a pH treatment and maintenance additive. Present practice in the industry involves the use of $NaOH, Ca(OH)_2$ .These chemicals are used to raise the pH to 8.0 -10.5

Figure 1: Map of Nigeria

The pH of the drilling fluid is of paramount importance to the drilling crew. When the pH is low (acidic) there is the danger of corrosion of the downhole equipments.

2.0 Material and Method

2.1 Experiment

The experiment involves the addition of the ash from the banana peel to prepared mud samples of known pH. The volumes were closely monitored to ascertain the effect(s) of increasing concentrations of additives on the clay.

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The following equipments were used in the experiment (Table 1).

Table 1: Equipments Used in the Investigation

1.	pH universal indicator
2.	Beakers
3.	Electric weighing balance
4.	Multi-mixer and cup
5.	Mud cup
6.	Measuring cylinder
7.	Spatulas and stirrers
8.	Electric sieve
9.	Mud balance

2.2 Sample Collection

Several clay deposits abound in Nigeria [4].This article however is limited to clays from Umutu (Figure 2, Table 2) and Emevor (Figure 3, Table 3) in Delta State, South Nigeria.

Courtesy: ©Google map [5]

Figure 2: Map of Umutu, Nigeria

Table 2: Geographic location of Umutu, Nigeria

Latitude	5.9167	**Longitude**	6.2333	**Altitude(feet)**	383
Lat(DMS)	5^{0}55'0N	**Long(DMS)**	6^{0}13' 60E	**Altitude(meters)**	116

Courtesy: www.fallingrain.com [6]

Courtesy: ©Google map [7]

Figure 3: Map of Emevor, Nigeria

Table 3: Geographic Location of Emevor, Nigeria

Latitude	5.5122	**Longitude**	6.1202	**Altitude(feet)**	141
Lat(DMS)	5^{0}30' 44N	**Long(DMS)**	6^{0} 7' 13E	**Altitude(meters)**	42

Courtesy: www.fallingrain.com [8]

The clays were collected from the sub-surface and their pH noted(Table 4).

Table 4: Locations of clay samples

S/N		LGA	Town/Village	Original state
1	Mud1	Ukwani LGA	Umutu	Acidic (5.0)
2	Mud 2	Isoko south LGA	Emevor	Slightly alkaline (7.9)

From the pH of the original mud it was observed that Mud from Ukwani LGA with a pH of 5.0 was very unacceptable for use downhole without conditioning as it posed a potential danger to the equipments which may become corrode. On the other hand, mud2, although slightly basic (7.9) in nature, was "too close to the borderline" that the scale maybe tipped during the introduction of various other additives during drilling; it was therefore desirable toalkalinise the muds.

The industrial practise is to use inorganic pH additives such as sodium hydroxide (NaOH) and potassium hydroxide, (KOH). With this the pH is maintained at an approximate value between 10.5- 11.7 [9]

2.3 Preparation of Clay

The raw clay was harvested from their respective locality, room-dried and pulverised. After drying the clays were sieved and packaged for use in the experiments.Sieve size 200 micron was used.

2.4 Preparation of Banana Peels

Banana peels from the banana plants (*musa sapientum*) was obtained from a plantation in Delta state. The mineral compositions are shown in Tables 3 and 4. The peels were harvested from the fruit and sun-dried. After drying the peels were burnt, pulverized, sieved and packaged for use in the experiments. The use of kerosene, petrol and other hydrocarbons was avoided in the combustion of the dried peels to prevent contamination. Sieve size 200 micron was used. The prepared banana peels were stored in polythene bag.

Table 5: Mineral Composition of banana

Minerals	Concentration (mg/g)
Potassium	78.10
Calcium	19.20
Sodium	24.30
Iron	0.61
Manganese	76.20
Bromine	0.04
Rubidium	0.21
Strontium	0.03
Zirconium	0.02
Niobium	0.02

The percentage protein crude lipids carbohydrates and crude fibres were:

Table 6: The percentage protein crude lipids carbohydrates and crude fibres

	% concentration
Protein	0.9
Crude lipids	1.70
Carbohydrates	59.00
Crude fibre	31.70

3.0 Formulation of Drilling Mud

The muds were prepared using 350ml of fresh water and 24.5 g of clay. Each formulation was thoroughly mixed to obtain a homogenous mixture before the introduction of any pH additives. Additives used in the various mud blends are shown in table 5.

Table 7: Additives used in mud blends and quantities

S/N	Material	Research Code	Quantity Used (g)	Comment
1	Banana peel	ABPS	0.2-2.0	Local pH enhancer/ additive
2	Caustic soda (NaOH)	CS	0.2-2.0	comparator
3	Caustic Potash (KOH)	KOH	0.2-2.0	comparator

The characteristics of the samples were determined and recorded before and after the additions of the additives:

Table 8: The pH before benefication

Before beneficiation of Umutu Mud (Spud mud 1):

The pH of water	6.9
The pH of water + clay	5.0
Weight of clay used (g)	17.5

Table 9: Beneficiation of Umutu Mud (Spud mud 1)

Concentration of Additives (g)	The pH of the drilling fluid after addition of the additives		
	Banana ash	NaOH	KOH
0.2	6.5	7.4	7.6
0.4	8.2	8.4	8.9
0.6	9.1	9.7	9.9
0.8	10.3	11.0	11.3
1.0	11.1	12.2	12.8
1.2	11.1	12.8	12.9
1.4	11.1	12.8	12.9
1.6	11.1	12.9	12.9
1.8	11.3	13.0	12.9
2.0	11.3	13.0	13.0

Table 10: The pH Beneficiation of Emevor Mud (Spud mud 2)

Before beneficiation of Emevor Mud (Spud mud 2) :

The pH of water	7.1
The pH of water + clay	7.9
Weight of clay used (g)	17.5

Table 11: Beneficiation of Emevor Mud (Spud mud 2)

Concentration of Additives (g)	The pH of the drilling fluid after addition of the additives		
	Banana Ash	NaOH	KOH
0.2	8.3	8.9	9.2
0.4	9.2	10.1	10.4
0.6	10.3	11.3	11.5
0.8	11.1	12.4	12.7
1.0	11.2	12.8	12.9
1.2	11.2	12.9	12.9
1.4	11.2	12.9	12.9
1.6	11.2	13.0	12.9
1.8	11.3	13.0	13.1
2.0	11.4	13.2	13.2

4.0 Conclusion

The pH of the local clays was observed to appreciably improve on the introduction of the different additives (ABPS, KOHand NaOH). The responses of the muds to different concentration of additives were however not the same; this is to be expected. (Figures 4, 5)

The responses of the Umutu clay to the additives tend to peak at approximately 1.0 – 1.2 g, after this the responses to the respective additives slows down and greater concentration/ volume of additives need to be added to achieve a change in pH. (Figure4, Table 9) the same trend was observed for the Emevor clay. (Figure 5, Table 11)

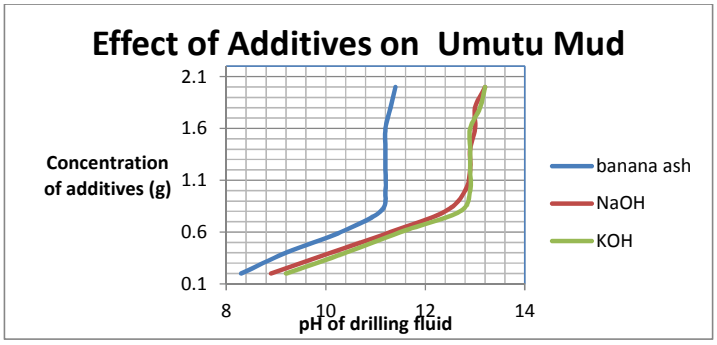

Figure 4: Effect of Different Additives on Umutu Mud

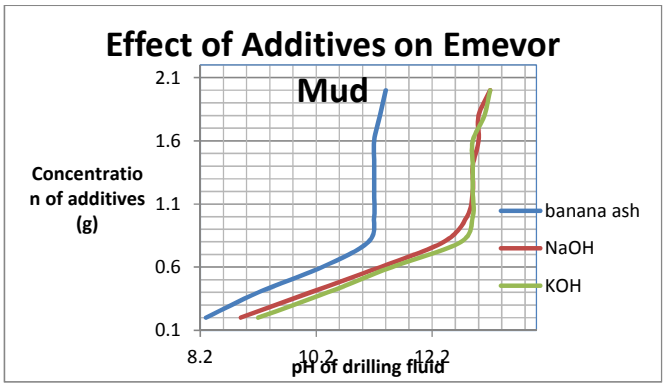

Figure 5: Effect of Different Additives on Emevor Mud

The ABPS imparted an increment from 5.0 and 7.9 to 11.3 and 11.4 respectively, this is comparable to the addition of 40 gram or 39 grams of NaOH and KOHrespectively. The pH of drilling fluids are often kept at a range of 11.3 -11.4 hence ABPS can be considered for field trial.The imported NaOH and KOH showed more significant improvement during the test from an initial mud pH of 5.0 and 7.9 to 13.0 and 13.2 respectively.

Abbreviations used in text

S/N	Words	Meaning
1	ABPS	Ash , Banana peels powered & sieved
2	KOH	Potassium hydroxide
3	NaOH	Sodium hydroxide

5.0 Reference

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