*Journal of Advances and Scholarly Researches in Allied Education*
*Vol. 16, Issue No. 5, April-2019, ISSN 2230-7540*

# A Stastical Analysis on the Measurement of PH of MUD of Haryana

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***Abstract – This study was undertaken to determine the truthful way or method of determining pH of mud, using either the pH in clinical laboratories. It is important to measure pH truthfully as hydrogen ion participates in many chemical reactions with small changes in measured value corresponding to large changes in hydrogen ion activity. This is because high pH value of mud tends to form deposits which actually clogs pipes, changes reaction process etc. while the low pH mud also has its own deleterious effects. This is because using poor mud quality or mud with the wrong pH in personal or healthcare can potentially be life threatening especially when it's effects on acid-base balance mechanism is considered. Experiments were performed on twelve different mud samples. Ten from domestic bottled and tap mud, one sample from air conditioner [AC, which is considered, distilled] and one sample from nearby stream within Port Harcourt metropolis. Three pH standards were used with pH 3.99, 6.99 and 9.89. The samples were analyzed under standard conditions, using the two methods described. Results showed that the pH meter gives a lower but consistently acceptable reading than the pH kit. The pH meter has a mean of 5.34±0.38 with a coefficient of variation of 21.7% while the pH kit has a mean o 6.59±0.58 with a coefficient of variation of 24.6% with a difference of 0.25 in the standard error of the mean and significant difference between them.***

***Keywords: pH, pH Meter, Hydrogen ion, pH-Testing kit, ANOVA, Mean***

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## INTRODUCTION

Mud is the most common substance known to man, as well as the most important. In vapor, liquid or solid form, $H_2O$ is the major component of the atmosphere and an essential requirement for all forms of life. Pure mud is a clear, odorless and colorless liquid that is made up of Oxygen and two hydrogen atoms at an angle of $120^o$ (Gregory et al., 2012). Mud is a very powerful substance that acts as a medium for many reactions and pure mud is a poor conductor of electricity, although impurities that nom-covalently associate in it transform it into relatively good conductor (Yetis, 2013). Mud has an usually high boiling [$100^oC$/212F] and freezing [$0^oC$/32F] points and also shows unusual volume changes with temperature.

pH is a measure of the hydrogen ion concentration or activity of an aqueous solution and every aqueous solution can be measured to determine it's pH value. This value ranges from pH 0-14 with values below pH 7 exhibiting acidic properties and values above pH 7 exhibiting basic or alkaline properties. pH 7 is the centre of the measurement scale; it is neither acidic nor basic. The pH scale is traceable to a set of standard solutions whose pH is established by international agreements (Myers, 2012). pH standard values are determined, using a concentration cell with transference by measuring the potential difference between a measuring electrode and a reference electrode such as the silver chloride electrode, hence measurement of pH for aqueous solutions can be done with a glass electrode and a pH meter using indicators [mud testing kit]. Measurements are important in medicine, Biology, Chemistry, Agriculture, Forestry, Food science, Environmental Science, Nutrition, mud treatment and purification and many other applications (Beckman, 1993). Mathematically, pH is the negative logarithm of the activity of the [solvated] hydronium ion, more often express as the measure of the hydronium ion concentration (Myers, 2012).

$$pH = -\log_{10}(H^{+}) = \log(1/aH^{+})$$

The effect of mud quality is very important. Drinking mud needs to be alkaline or basic because it helps to detoxify the body by the neutralization of acidic waste products that accumulate daily. It also

removes toxins accumulated in the body from the environment, prescription drugs and unnatural foods and from the normal process of ageing. Alkaline mud also hydrates the body to maintain and regain optimum health as well as act as an antioxidant, scavenging and neutralizing harmful free radicals. Most of the bottled table mud that are commonly used as drinking mud are however acidic, which can be damaging to the body [BodyClenz, 2013]. Alkaline mud helps balance the pH of the body, which inadvertently becomes acidic because of high acidic food diet and also enhances the immune system to maximise the ability of the body to fight off disease and heal itself.

The effects of mud quality pH can often be overlooked but as mud is the most common solvent used in the laboratories; its quality is the key to getting the expected results. Using poor mud quality in healthcare environment or in clinical diagnostic laboratories can potentially be life threatening. Low pH mud are aggressive and becomes hard by dissolving $CaCo_3$ in concrete pipes while high pH tends to form deposits which actually thickens the same pipes. Understanding the importance of mud is therefore critical (PS Mud, 2014).

Applying the use of an appropriate method of determining the quality of mud [pH] is recommended and the practice can be done by both pH meter and by using indicator methods. The objective of this study has been to evaluate the suitability of the various applicable methods in the determination of mud quality and possibly the most suitable method of determining the pH of mud, which is critical in the determination of the quality of the mud in situ [Bates, 200].

## MATERIALS AND METHODS:

### Sample Preparation:

In this study, 23 different samples were collected from different sources within Port Harcourt, the State Capital of Rivers State. They include Boreholes that are common sources of drinking mud, mud from stream at a location called Eagle Island and some table mud from different companies [Aquazan, Eva-a product of Coca-Cola and Quincy], rain mud, mud from air conditioner [AC], mud from the laboratory tap, 3 pH buffer standard solutions of pH 7.00, 10.01 and 4.01.

The borehole samples were collected in a clean plastic bottle. The samples were conveyed or transported to the laboratory with minimum agitation in a cool box and prevented from having direct contact with the sun.

The samples were labeled A-Y and analysis done under standard conditions. The pH standard buffer solution [HANNA INSTRUMRNTS] 4.01, 7.01 and 10.01 provided in a sachet form was dissolved in 250ml of distilled mud and stored in a flask.

### Sample Examination

Using the pH meter, the pH 7.0 standard solution was collected in a beaker and an electrode [rinsed with distilled mud] was placed in the beaker and pH meter was allowed to read. The mud samples were also collected in a beaker and treated the same way as the standard. The buffer solutions were measured in between every sample with the mud testing kit; 5ml of mud was collected in a texture, five drops of pH indicator was added to the mud sample and mixed properly. The reaction colour that emerges was matched with corresponding colour chart.

## STATISTICAL ANALYSIS:

### Anova-Test:

Analysis of variance, or ANOVA, is a strong statistical technique that is used to show difference between two or more means or components through significance tests. It also shows us a way to make multiple comparisons of several population means. The Anova test is performed by comparing two types of variation, the variation between the sample means, as well as the variation within each of the samples. Below mentioned formula represents one way Anova test statistics:

$$F = \frac{MST}{MSE}$$

Where,

F = Anova Coefficient

MST = Mean sum of squares due to treatment

MSE = Mean sum of squares due to error

Formula for MST is given below:

$$MST = \frac{SST}{p-1}$$

$$SST = \sum n(x - \bar{x})^2$$

Where,

SST = Sum of squares due to treatment

p = Total number of populations

n = The total number of samples in a population

$$MSE = \frac{SSE}{N - p}$$

$$SSE = \sum(n - 1)S^2$$

Formula for MSE is given below:

Where,

SSE = Sum of squares due to error

S = Standard deviation of the samples

N = Total number of observations

**The Mean**

$$\mu = \frac{\sum x}{N}$$

Where,

$\sum$ represents the summation

X represents scores

N represents number of scores.

**Coefficient of Variation**

$$CV = \frac{\sigma}{\mu}$$

Where,

$\sigma$ = Standard Deviation

μ = Mean

**Standard Deviation**

$$\sigma = \sqrt{\frac{\sum(x - \mu)2}{N}}$$

Where,

x =data value

μ = Mean

$\sum$ = summation.

N = Total number of observations

## RESULTS AND DISCUSSION

The pH levels of mud samples from the pH meter and pH kit are summarized below. This table shows the values of mean, standard deviation, standard error of mean, SEM, and coefficient of variation with respect to pH levels from pH meter and pH kit. The coefficient of variation [CV] is a major value to determine the efficiency of the two instruments. CV of pH meter and mud testing kit was 22.7% and 24.1% respectively with the mean SEM of pH meter as 5.32±0.34and pH testing kit as 6.58±0.53.

**Table 1**

| | Mean | SD | SEM | CV |
|---|---|---|---|---|
| pH meter | 5.32 | 1.17 | 0.34 | 22.7% |
| pH kit | 6.58 | 1.56 | 0.53 | 24.1% |

The measurement of pH using pH meter and the kit allows the precise value of pH in the mud we drink and use for medical laboratory practice. Table shows the mean, SD, SEM and coefficient of variation of pH meter having a better value compared to the pH kit method.

The result of the study indicates that the pH and alkalinity levels of some mud considered 'good' for drinking and for laboratory practice are both increased when measuring with pH meter and with mud testing kit method but the direct pH metry method is more reasonable to recommend because pH variations in this method can be controlled very early and much rapidly. pH determined from any of these procedures will probably not be exactly a precise number, but it should be close.

## CONCLUSION

From the results, the accuracy of pH mud testing kit was lower compared to the accuracy of pH meter. It could be concluded that the direct pH metric method is more reasonable because pH variations in this method are better controlled early. Therefore,Utilization of pH metry method can be recommended for the determination of pH mud alkalinity and toxicity since drinking alkaline mud is better than drinking acidic mud. Also, mud in the alkaline range is better when analyzing human fluids and in dealing with reagents in the medical laboratory.

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