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# Water Qualities as Affected By Rice Mill Processing Wastes in Abakaliki Southeastern Nigeria

Njoku C., Nwali, C.C. and Ajana A.J.
*Department of Soil Science and Environmental Management, Ebonyi State University P.M.B. 053 Abakaliki, Ebonyi State Nigeria*
*Corresponding Author: Njoku C*

**Abstract:** *This study was conducted at Iyi-Udele stream to determine water qualities as affected by rice mill processing wastes in Abakaliki Southeastern Nigeria. Four replicate water samples were collected from $T_1$ – 1 m away from unburnt rice husk disposal site; $T_2$ – 200 m away from unburnt rice husk disposal site; $T_3$ – 400 m away from unburnt rice husk disposal site and $T_4$ – Control (Non-dumpsite). The samples collected were used for the determination of water properties. Data collected were analyzed using analysis of variance and differences between means dictated using F-LSD. The result showed significant ($p<0.05$) changes in total dissolved solid, total suspended solid, total solid, colour and heavy metal concentrations (Pb, Mn, Cd and Zn) within the various locations studied. Total dissolved solid, total suspended solid, total solid, colour, Pb, Mn and Cd in water studied were above acceptable level for drinking water. Total dissolved solid, total suspended solid, total solid and colour in Iyi-udele stream decreased with an increase in distance to the rice husk dumpsite whereas Pb, Mn, Cd and Zn decreased with an increase in distance to the rice husk dumpsite up to 200 m. Therefore, the water studied must be treated before using for drinking purposes.*

**Keywords:** *Drinking, human, pollution, standard, treatment*

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## I. Introduction

Water is a common liquid necessary to living things for diverse uses and activities which include drinking, cooking, industrial processes, agricultural uses, waste disposal and human recreation (Adeniyi, 2004). In concept of water existence and spreading design, water is not clearly obtainable to man in the advantageous volumes and standard. Water quality is the language that most people often use; the standard of water has no firm or definite, but seemingly well accepted by users. The standard of water depends on the origin of territory and the actions of man, including the usage. Furthermore, the advantageous properties of water standard include, sufficient volume of disintegrated oxygen at all time, a comparatively small organic matter, pH importance near neutrality, average temperature, and independence from immoderate quality contagious agents, poisonous materials, mineral occurrence and free of heavy metals (Adeniyi, 2004). So many circumstances are accountable for water impurity and which makes it quite unwanted for portability. They are factors that affects water quality which include; Sewage release, and this supply to oxygen demand and nutrient loading to undermine aquatic ecosystem (Sharma and Reddy, 2004), industrialization and agricultural practices. Pollution simply emerges when society development outmatches availability of good water due to insufficient urban disposition procedure.

Water is the origin of life and can be consider as the most necessary of natural resources. Water widely shield about 98%, and out of this water is seawater and is not fit for drinking purposes because of high absorption of salt. Good water that is free of harmful chemicals and pathogens are necessary to human well being and it surroundings. Contamination of water is a huge disturbs subsequently a natural tragedy, Natural tragedy such as floods, and volcanoes can have effects on the quality of water on a main scale (Schwarzenbach *et al.* 2006). Trace metals such as lead, cadmium, zinc, and manganese generated from different origin may eventually extend to top soil. These metals are undiluted in the tissues of plant and then move across the food chains into human beings. A study has shown that cadmium, locate in wastes of industries that is melting zinc, was put into rivers where it was transferred into soil and groundwater and it then into the agriculture crops. These boast the environmental pollution which had poor influence on the agriculture leading to growing rate of infertility within young newly-wed couples (Sonja *et al.* 2002) In the world that we live in, rice waste disposal involves collecting and removing and relocating it to where it suppose to be or be recycled. The rice husk waste that is been generated can be harmful to the environment and again their method of disposal depends on how they affect the environment in general. These wastes often contain a considerable amount of toxic compound and metals, which always contaminates the soil and water.

The rice husk dust pose a serious risk to the ground water contamination due to the runoff water. The toxic materials found in waste streams can lead to ground and surface water contamination (Olatunji and Ayuba 2011). When these toxic materials enter into the surface water, aquatic organisms in that water will be at risk. These can lead to metals poisoning to human that consumes contaminated sea foods. Dumping of rice waste close to streams and rivers affects aquatic habitants. The high nutrient content in rice husk suspended and dissolved in water can deplete dissolved oxygen in the water which can lead to the death of aquatic organisms (United State Environmental Protection Agency, 1999). The objective of this work was to determine the qualities of Iyi-Udele stream as affected by rice mill processing wastes in Abakaliki Southeastern Nigeria.

## II. Materials And Method

### 2.1 Study Area

The study was carried out at Iyi-Udele stream at Abakaliki. Abakaliki the capital city of Ebonyi State lies within latitude $6^0$19'N and longitude $8^0$ 06'E in the derived savannah of the southeast agro-ecological zone of Nigeria. The rainfall pattern is bimodal (April to July and September to November), with a quick dry spell in August normally referred to as "August Break". It has annual rainfall of 1700 to 2000mm and annual mean of 1800mm. The study area has a high temperature of 27$^o$C and the topmost mean daily temperature of 31$^o$C that is within the year. The humidity is about 80% rainy season and 60% during dry season. As stated by Federal Department of Agriculture and Land Resources (1987), Abakaliki remains within 'Asu River group' and made up of olive brown sandy shale, small particles of mudstones and sandstone.

### 2.2 Field Method

A reconnaissance survey of the study area was carried out and Iyi-Udele stream which passes through rice husk dumpsite were chosen to study. Water samples from Iyi-Udele stream were collected as follows:
$T_1$ = 1 m away from the unburnt rice husk disposal site.
$T_2$ = 200 m away from the unburnt rice husk disposal site.
$T_3$ = 400 m away from the unbunt rice husk disposal site.
$T_4$ = control (Non-dumpsite)

### 2.3 Water Collection and Sampling

Sterilized and cleaned Ivy bottle water was used to collect four replicate water samples in each location for three months intervals in 2016.

### 2.4 Laboratory Analysis

The following water physical parameters were determined:

a. Total solids, Total dissolved solid and total suspended solid were determined using methods described by American Public Health Association (1998).
b. Colour of the water sample was determined in terms of percentage transmittance of light. The instrument used was photo-electronic colorimeter, model AE-IM. The instrument was initially calibrated by using distilled water and transmittance of each sample read and digitally and recorded in percentage as reviewed by Njoku and Ngene (2015).

The heavy metals {Lead (Pd), Cadmium (Cd), Zinc (Zn) and Manganese (Mn)} were determined using atomic absorption spectrometer (Clayton and Tiller 1979).

### 2.5 Data and Analysis

The data obtained from this research was analysed using analysis of variance (ANOVA) for RCBD and the differences between means were dictated using F-LSD at P=0.05 (SAS Institute Inc., 1999).

## III. Result

### 3.1 Water Physical Properties as Affected By Rice Mill Processing Wastes

Table 1 shows a significant ($p<0.05$) changes among different locations with respect to total dissolved solid, total suspended solid, total solid and colour of water studied. $T_4$ recorded the lowest total dissolved solid of 455.34 mgL$^{-1}$. This observed total dissolved solid in $T_4$ was lower than total dissolved solid in $T_1$, $T_2$ and $T_3$ by 37, 37 and 36%, respectively. The order of increase in total suspended solid was $T_2 > T_1 > T_4 > T_3$. On the other hand $T_4$ (control) recorded the lowest total solid value of 910.69 mgL$^{-1}$. This observed lowest total solid in control was lower than total solid in $T_1$, $T_2$ and $T_3$ by 19, 19, and 18%, respectively. The order of increase in colour transmittance was $T_1 > T_2 > T_4 > T_3$.

### 3.2 Water Heavy Metal Concentration as Affected By Rice Mill Processing Wastes

Table 2 shows the result of water heavy metal studied. There was a significant ($P<0.05$) changes within the treatments in water heavy metals studied. The order of increase in Pb was $T_1 > T_2 > T_4 > T_3$. Lowest Mn value of 6.65 $mgL^{-1}$ was observed in $T_3$. This observed Mn in $T_3$ was lower than Mn observed in $T_1$, $T_2$ and $T_4$ by 21, 15 and 5%, respectively. Similarly, $T_3$ and $T_1$ recorded the lowest and highest Cd values of 0.30 and 0.34 $mgL^{-1}$, respectively while control had 0.31 $mgL^{-1}$. The order of increase in zinc concentration was $T_1 > T_2 > T_4 > T_3$.

**4.1 Water Physical Properties**

It was found that the values of total dissolved solid, total suspended solid and total solid of all the four samples collected were above the acceptable level for drinking water as suggested by World health organization (1996) indicating the health risk for the dwellers of the surrounding environment who are using Iyi-Udele stream for drinking purposes. The excessive total dissolved solid can minimize the cleanliness of water, obstruct photosynthesis, and lead to growth of temperatures of water. The Total dissolved solid quantities noted in all the samples were higher than world health organization recommendation of 1000 $mgL^{-1}$ for the safety of the environment such as aquatic life, fisheries and for domestic use.

Total suspended solid in $T_2$ has the excessive quantities of 458.85 $mgL^{-1}$ which was observed, and it has the smallest worth of 454.35 $mgL^{-1}$ which was detected at point $T_3$. Total Suspended Solids found in Iyi-Udele stream was an outcome of the washing and carrying of rice husk from rice husk dumpsite by runoff water to Iyi-Udele stream. When the quantities of total suspended solid goes high, the water body starts to depreciate its potentials to help the change of aquatic life (Chapman, 1993). Total suspended solids gain heat from sunlight that stimulates the temperature of water and reduces the quantities of dissolved oxygen.

Excessive total solids make water unpleasant for drinking and the consequences can last for a very long time on people and aquatic animals that uses the water.

**4.2 Heavy Metals**

Manganese (Mn) concentration was highest at $T_1$ (8.04 $mgL^{-1}$), while $T_3$ shows the lowest value of 6.65 $mgL^{-1}$. The manganese mixture can be use in the production of fertilizers, varnish and fungicides and they can also be used as livestock feeding supplements. These may also become very high beneath organisms such as algae, phytoplankton, likewise some fishes though cannot be in higher organisms, the biomagnifications in food chains suppose not be really important (Abbasi, *et al, 1998*). The concentrations of manganese from the analysis exceeded the acceptable limit of 0.05 $mgL^{-1}$ set by World health Organization (2004). Cadmium present in the water samples collected was higher at $T_1$. Studies have shown that excessive absorption of cadmium can be extremely dangerous and very harmful to fish populace. The outcome of this on the development has been detected even for the absorptions between 0.005 and 0.01 $mgL^{-1}$ (Green *et al., 1986*). The measures of cadmium that is found in water samples from the study site were higher than World Health Organization Standard (World health Organization, 2004) quality values of 0.01 $mgL^{-1}$ for the existence of the aquatic organisms. The concentration of lead found in Iyi-Udele stream varies between 1.82 to 2.22 $mgL^{-1}$ which exceeded the acceptable level of 0.05 $mgL^{-1}$ set (World health Organization, 2004). Zinc concentration was highest at $T_1$, when compared to other locations. Zinc takes part in biochemical process of life of all aquatic plants and animals and as well as surrounding environment, they are very necessary to the aquatic habitat when detectd in some quantities. Zinc is very important in the development factor for plants and animals however when zinc is in excess measure it is dangerous to some kind of aquatic life (World health Organization, 2004). More also zinc is complex in a variation of enzyme process which donate to the metabolism, transcription and translation of energy. Zinc can also be unsafe and immoderate absorptions in soil lead to phytotoxicity (Anglin-Brown *et al.*, 1995). Lead when is above the maximum permitted levels in water causes cancer, interferes with vitamin D metabolism, changes the intellectual progress in the babies and is dangerous to central and peripheral nervous system; excess Mn in water causes neurological disorder; excess Cd result to kidney toxicity while none was associated with Zn (Alloways, 1996).

## IV. Conclusion

The result of this study showed that rice husk should not be disposed near a source of water. This is because the qualities of Iyi-Udele stream were reduced as a result of rice husk dumpsite situated near to it. Also, any water close to dumpsite should not be use for any purposes without treatment as contaminants from dumpsites can be transferred through the water via food chain to human.

**Table 1:** Water Physical Properties as Affected By Rice Mill Processing Wastes

| Treatment | TDS ($mgL^{-1}$) | TSS ($mgL^{-1}$) | TS ($mgL^{-1}$) | Colour (%trasmittance) |
|---|---|---|---|---|
| $T_1$ | 624.74 | 458.35 | 1083.09 | 0.08 |
| $T_2$ | 623.74 | 458.85 | 1082.59 | 0.07 |
| $T_3$ | 620.74 | 454.35 | 1075.09 | 0.04 |
| $T_4$ | 455.34 | 455.35 | 910.69 | 0.05 |
| FLSD (P<0.05) | 51.43 | 2.39 | 1.63 | 0.001 |
| Acceptable level | 500 | 150.00 | 500 | 500 |

Where: $T_1$ = 1 m away from the unburnt rice husk disposal site; $T_2$ = 200 m away from the unburnt rice husk disposal site; $T_3$ = 400 me away from the unburnt rice husk disposal site; $T_4$ = control (sample collected in non-dumpsite);
TDS = Total dissolved solid, TSS =Total suspended solid, TS= total solid. Acceptable level according to Alloways (1996)

**Table 2:** Water Heavy Metals as Affected By Rice Mill Processing Wastes **($mgL^{-1}$)**

| Treatment | Pb | Mn | Cd | Zn |
|---|---|---|---|---|
| $T_1$ | 2.22 | 8.04 | 0.34 | 2.80 |
| $T_2$ | 2.12 | 7.62 | 0.33 | 2.70 |
| $T_3$ | 1.82 | 6.65 | 0.30 | 2.40 |
| $T_4$ | 1.92 | 6.97 | 0.31 | 2.50 |
| FLSD (P<0.05) | 0.001 | 1.29 | 0.001 | 3.16 |
| Acceptable level | 0.01 | 0.2 | 0.003 | 3.00 |

Where: $T_1$ = 1 m away from the unburnt rice husk disposal site; $T_2$ = 200 m away from the unburnt rice husk disposal site; $T_3$ = 400 m away from the unburnt rice husk disposal site; $T_4$ = control (sample collected in non-dumpsite). Acceptable level according to Alloways (1996)

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