Conclusion :

- SSA & WSA can be used for treatment of hard water with hardness removal efficiencies of 41.8% and 53% respectively which makes WSA is more effective than SSA
- The optimum dosages for WSA and SSA of 20mg/l and 22.5mg/l.
- WSA & SSA with time increased the pH, colour, TDS and turbidity. Colour exceeded the acceptable limits earlier than all these parameters that is 28 days for WSA and 25 days for SSA .

- The ashes are chemically stable when kept in airtight containers and can therefore be kept for use even when the wheat and sorghum are out of season

Recommandations and future considérations :

Further studies be done on investigating straw ashes burnt under controlled burning and the effect of the temperatures of burning on treatment of hard water. These ashes can be used in increasing pH of water.

(Images)

This project is implemented by Musoki Kedress Blessed from Kabale University

Equipment and reagents

- ◊ Beakers and test tubes
- ◊ sieves
- ◊ Weighing scale
- ◊ MS excel
- ◊ Photometer
- ◊ Turbimeter
- ◊ EC and pH meters
- ◊ Palintest kit tablets
- ◊ XRF machine
- ◊

This project is funded by Conrad N. Hilton Foundation-

An African Water and Sanitation Association (AfWASA) Initiative

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African Water and Sanitation Association

KABALE UNIVERSITY
"Knowledge is the future"

SMALL GRANTS FOR THE AFRICAN YOUNG WATER AND SANITATION PROFESSIONALS (AFYWSP)

25th September,2024

Project Title :

INVESTIGATION OF PERFORMANCE AND LONG -TERM STABILITY OF OPEN AIR-BURNT SORGHUM AND WHEAT STRAW ASHES IN HARDWATER TREATMENT

Background & Introduction :

Water is a vital resource for the general sustainability of life. However, for water to be safe for human use, it should be of a quality acceptable by different standards.

The situation is even worse in developing countries like Uganda in particular where many people especially the poor have opted to using underground drinking water sources like boreholes, springs, shallow wells as a source of drinking water and for other domestic use (Lukubye & Andama, 2017).

These underground water sources often encounter significant levels of hardness due to the dissolved polyvalent metallic ions from sedimentary rocks, and seepage from soils.

The available water hardness removal techniques are expensive and thus unaffordable to majority of the Ugandans.
However, people in the village up to now still use ash to wash these utensils and it removes the stains effectively from the utensils. It's from this that I picked the idea to investigate if these ashes (*sorghum and wheat straw ashes)* can be used for softening hard water.

Purpose and Objective :

To investigate the possibility and evaluate the performance of softening hard water using wheat straw ashes (WSA) and sorghum straw ashes (SSA).

Specific objectives

To characterize the ashes for determination of its chemical constituents.

To determine the effectiveness of ash in removing hardness.

To establish the long-term stability of the water quality after treatment with WSA and SSA

Summary of main achieved activities (

1) **Reviewing previous studies on effectiveness of ash to soften hard water**
2) **Collection of raw materials and preparation of ashes**

The sorghum and wheat straw from the field was collected.
The sorghum and wheat straws were oven-dried and then air-burnt.
The ashes were sieved through a 300mm sieve

3) **X-ray Fluorescence analysis**

The chemical composition of both ashes was found out using the XRF analysis

4) Preparation of water samples

Three water samples, one from Koranorya (Rukungiri), Bwerere (Rukungiri) and Kyezimbire (Isingiro) were obtained and tested for hardness.
The samples had hardness of 196mg/l, 197mg/l and

Summary of main achieved activities

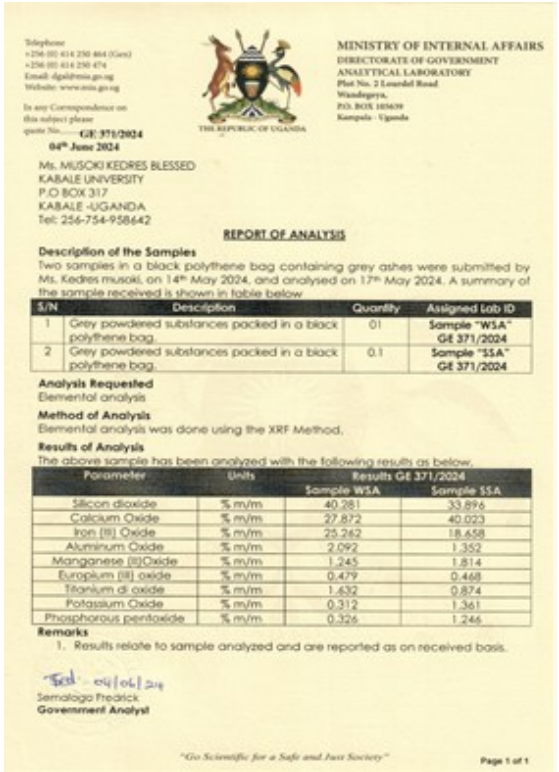
330mg/l respectively. The sample with the highest hardness (330mg/l) was used for the entire research.

5) **Hardness removal experiment**

The water was treated with different dosages of the ashes until the optimum dosage was reached

6) **Establishing the long-term stability of the water quality after treatment with WSA and SSA**

The two samples of optimum dosages were then tested for the effect of the ashes on other parameters of water in relation to the recommended standards
These parameters were also each monitored for a period of 35 days to establish the water's stability



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In any Correspondence on this subject please quote No. GE 371/2024

04th June 2024

Ms. MUSOKI KEDRES BLESSED
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REPORT OF ANALYSIS

Description of the Samples
Two samples in a black polythene bag containing grey ashes were submitted by Ms. Kedres musoki, on 14th May 2024, and analysed on 17th May 2024. A summary of the sample received is shown in table below

S/N	Description	Quantity	Assigned Lab ID
1	Grey powdered substances packed in a black polythene bag	01	Sample "WSA" GE 371/2024
2	Grey powdered substances packed in a black polythene bag	0.1	Sample "SSA" GE 371/2024

Analysis Requested
Elemental analysis

Method of Analysis
Elemental analysis was done using the XRF Method.

Results of Analysis
The above sample has been analyzed with the following results as below.

Parameter	Units	Results GE 371/2024	
		Sample WSA	Sample SSA
Silicon dioxide	% m/m	40.281	33.896
Calcium Oxide	% m/m	27.872	40.023
Iron (III) Oxide	% m/m	25.262	18.658
Aluminum Oxide	% m/m	2.092	1.352
Manganese (II)Oxide	% m/m	1.245	1.814
Europium (III) oxide	% m/m	0.479	0.468
Titanium di oxide	% m/m	1.432	0.874
Potassium Oxide	% m/m	0.312	1.361
Phosphorous pentoxide	% m/m	0.326	1.246

Remarks
1. Results relate to sample analyzed and are reported as on received basis.

04/06/24
Semalogo Fredrick
Government Analyst

"Go Scientific for a Safe and Just Society"

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Outcomes:

Effect of the ashes at 0 days

Parameter	Raw water	Treated with SSA	Treated with WSA
Hardness	330	192	155
Turbidity	18.3	11.4	10.8
pH	5.59	6.8	6.12
Colour	50	43	39
EC	750	>1500	>1500
TDS	480	532	512
TSS	272	105	53

Effect of the ashes over 35 days

TIME(DAYS)		pH	TURBIDITY	COLOUR
0	SSA	6.8	11.4	43
	WSA	6.12	10.8	39
7	SSA	6.92	15.3	30
	WSA	6.67	12.7	29
14	SSA	7.54	18.6	28
	WSA	7.03	15.2	25
21	SSA	8.36	20.4	45
	WSA	8.07	17.7	40
28	SSA	8.49	22	52
	WSA	8.3	21.2	49
35	SSA	9.29	25.3	65
	WSA	9.02	22.3	56

It was observed that at a dosage of 20g/l, the hardness had been reduced to 155 mg/l for WSA and at 22.5g, it had been reduced to 192 mg/l for SSA representing a removal efficiency of 53% and 42% respectively.
After the hardness removal experiment, at each point of the maximum hardness removal, the other parameters that were further analysed to ascertain the effect of ash on them. It was found out that the turbidity reduced by 37.7% and 41% for SSA and SSA respectively, pH increased by 21.6 % and9.5% for SSA and SSA respectively, colour reduced by 14% and 22% for SSA and SSA respectively. All these parameters were increased but remained within the acceptable standard limits.