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Corrosivity extents of Ogogoro (locally brewed gin) to aluminum and steel metals and human health implications

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ABSTRACT

Ogogoro, a popular, palm wine-distilled, high-alcohol indigenous beverage in many West African nations, may be sufficiently corrosive to cause rapid and expensive deterioration of materials and bodily organs. This article intends to raise safety awareness about the corrosivity of pure ogogoro and its popular palm wine-admixed variants to commonly used metals in contact with them and the implications for human health. Weight losses and corrosion rates of mild steel, stainless steel and aluminum metal samples in ogogoro variants that contained 0–25% palm wine was determined in laboratory tests. The variants' pH, chloride content and electrical conductivity values were measured. The collected and analyzed data indicate that pure ogogoro is tolerably corrosive to mild steel but negligibly corrosive to aluminum and stainless steel and its corrosivity diminishes with increasing palm wine content. Aluminum, sulfur trioxide and chlorine are the only significant components of pure ogogoro, which could be inimical to human health or corrosive to metals. An analysis of the components, however, shows that they pose minimal corrosivity or health risks.

Keywords: Palm wine, Distillation, Ogogoro, Corrosivity degree, Metals, Human consumption, Risks, Safety-awareness.

1. INTRODUCTION

A corrosive material is one that, by coming into contact with another material, destroys or deteriorates the surface of the other material by chemical reaction or corrosion (Brandeis University, 2023; EHS, 2023). The other material could be metal, stone, human body tissue, etc. Any state of matter other than a vacuum, including liquid, solid, gas, mist, or vapor, can be corrosive. Corrosive materials are noteworthy in their ability to destroy or harm engineering materials and people, depending on their corrosivity extents, the duration of exposure to them, the things that are exposed to them and the morphological characteristics of things exposed to them. Corrosive materials are important because they are destructive or harmful to metals (Brandeis University, 2023; EHS, 2023). In addition, corrosive materials can harm or destroy human body parts such as the digestive system, respiratory system, eyes and skin. Examples of corrosives to a wide range of engineering metals include nitrogen dioxide, ammonia, sulfur dioxide, acids, low or high pH fluids, alkalis, hydrogen chlorides, amines and hydrogen peroxide. Common corrosives are either strong acids, strong bases, or concentrated solutions of certain weak acids or weak bases, but any other substance can be corrosive to metals and human body parts. A substance, fluid, or environment may be insignificantly corrosive to one material but very corrosive to another material (Brandeis University, 2023; EHS, 2023).

Ogogoro is a popular, natively and commonly produced alcoholic beverage throughout west Africa, particularly in Nigeria. It is made from fermented raffia palm tree juice, the distillation of palm wine and sugar cane (Egoro et al., 2018; Eshemokha, 2021). Ogogoro has been used as a local hand sanitizer, especially in the era of coronavirus and for relieving sore throats. It is also used in social gatherings and libations (Egoro et al., 2018; Eshemokha, 2021). It has economic importance in West Africa and most importantly, it is used in the preparation of many herbal concoctions in the region. As an alcohol, it is a type of organic compound that carries at least one hydroxyl (-OH) functional group bound to a saturated carbon atom. It contains ethanol (C_2H_5OH). Ethanol is a corrosive substance. The alcoholic content of *ogogoro* can range from 30–70% (Egoro et al., 2018; Adakpori, 2021; Moritiwon et al., 2021). It is associated with many health problems in humans, depending on the quantity taken in. This has resulted in the hypothesis in this study that ogogoro can be very corrosive to human body systems and metals. Several liters of ogogoro are often distilled in appreciable contact with metals that can include steel and aluminum. There is also the possibility of processing ogogoro into other products using machineries or equipment that are made of these metal type (Idonije et al., 2012; Adakpori, 2021).

High chloride media, alkaline and acidic environments with pH values outside the 4–9 range and media of high electrical conductivity are reportedly corrosive to many metals (Idonije et al., 2012; Adakpori, 2021). A concern for the ogogoro beverage, whether in its pure form or other variants, is that, if it is highly corrosive by pH, electrical conductivity, chloride content, components and corrosion capability values, it can damage or deteriorate metal structures that are in associated contact with it and cause them to leach substances that are risky to human health. The aim that underlies this paper is to determine and present the corrosivity extents of pure ogogoro and its palm wine-admixed variants to mild steel, stainless steel and aluminum metals, as well as the corrosivity extents' implication for human health, using laboratory tests and analyses of basic corrosivity properties and components of the ogogoro variants.

2. MATERIALS AND METHODOLOGY

Materials

The materials used for the research were mild steel, aluminum, stainless steel, pure ogogoro and pure palm wine. The mild steel, stainless steel and aluminium were procured in rod forms of diameters 10 mm from reputable dealers in the steel and aluminium markets in Kaduna. The pure ogogoro and pure palm wine used for the study were got at different Mammy markets in army barracks in Kaduna, Jos, Warri and Port-Harcourt. Nigeria, from well-known dealers and with the assurances by the dealers and customer friends that the products were pure.

Methodology

Production and cleaning of the metal samples

The Shimadzu PDA-7000 optical emission spectrometer metal analyzer, developed in Japan, was utilized to determine the nominal chemical compositions of the procured aluminum, mild steel and stainless-steel rods. The ascertained metal rods were cut into samples of 20 mm length with a mechanically powered cutting tool. Grease and natural corrosion products formed on the samples, and machining burrs on them were removed by abrasive brushing. The samples were polished manually using 400, 600 and 800-grit abrasive papers. After that, the samples were rinsed under running cold tap water, cleaned with acetone, rinsed in distilled water, wiped of any moisture on them with a lint-free towel, dried in the air and kept in moisture-free desiccators with all handling done with clean gloved hands to avoid surface undesirability on them. in accordance with the ASTM G1-03-2003 accepted procedure for producing, cleaning and corrosion-testing specimens. The samples' dimensions, surface areas and average surface areas were measured using an extremely precise scale to the nearest 0.0001 mm^2.

Preparation of the Test Media

The pure ogogoro was gotten in a 1.5-liter plastic jar from each source and admixed in a 10-liter plastic container to have a representative pure ogogoro for the study. The pure palm wine was also obtained in 1.5-liter plastic jars from the sources and similarly admixed to have a representative pure palm wine for the study. The obtained representative pure ogogoro and representative pure palm were meant to represent the average quality of the product types from the different sources due to any differences in their production materials or processes.

The pure representative ogogoro was poured into six dry and clean plastic jars to about half their capacity. The content of the first jar was not mixed with anything, while the contents of the other jars were separately admixed with 2, 5, 10, 15 and 25% of the pure representative palm wine by volume. This was done to simulate the way in which ogogoro is sometimes unscrupulously admixed with palm wine by some of its distillers and sellers to increase its quantity for their greater profitability or due to improper distillation.

pH, Chloride, Electrical conductivity and physicochemical composition of the Ogogoro Forms

The pH value of each prepared ogogoro variant was determined by dipping the electrode of a digital pH meter in the ogogoro and reading the pH value directly from the meter. This was done after the meter was properly calibrated using a standard solution (Guma et al., 2020). The electrical conductivity of each prepared ogogoro variant was determined in the laboratory by passing an electric current through the variant. The current flow through the ogogoro variant was monitored with an ammeter and the voltage drop in the current flow by a voltmeter. The conductivity in Siemens (G) was determined as I/V (Control Automation, 2023).

The chloride content of each prepared ogogoro variant was determined by the electrical conductivity method using potentiometric conductivity sensors and a digital electrical conductivity meter with inbuilt capability to display the percentage chloride content of the ogogoro variants (Guma and Aliyu, 2021). The physicochemical composition of the most corrosive ogogoro variant was determined using an XRF spectrometer made by Skyray Instruments USA Inc (Guma and Abubakar, 2020).

Corrosivity assessment by immersion test

The produced and cleaned mild steel, stainless steel and aluminum samples were weighed to the nearest 1 mg as W_1 in each case. The samples were immersed in the pure representative ogogoro, which was admixed with 0, 2, 5, 10, 15 and 25% of the representative pure palm wine. The immersions were made in different plastic containers for 30 continuous days at ambient laboratory temperature. After the immersion duration, the samples were removed and rinsed under running tap water to remove any residual test solution and any loose chemical reaction or corrosion products on them. This was followed by cleaning them with acetone, drying them in the oven at 52°C and individually reweighing them to obtain the weight W_2 in each respective case. The weight losses of respective samples and their corrosion penetration rates in the pure representative ogogoro and its palm wine-admixed variants were used to determine the corrosivity levels of the ogogoro variants. The respective weight loss (W) was determined in milligrams in each sample case and ogogoro variant as $W = (W_1 - W_2)\,mg$. The corrosion penetration rate (CPR) was also evaluated for each case according to equation 1, given by as (Guma et al., 2019),

$$\text{CPR} = \frac{87.6W}{DAT} \quad \ldots\ldots\ldots\ldots 1$$

Where D = density of sample metal type in g/cm^3, A = total surface area of the sample in cubic centimeters and T = the sample's immersion exposure time of 720 hours in the ogogoro variants. For mild steel and stainless-steel materials, the average D was taken as 7.75 g/cm^3 and for aluminum materials, the average D was taken as, 2.7 g/cm^3. The total surface area of each cleaned metal sample with a solid cylindrical diameter of 1cm and length of 2cm was evaluated to be 785 cm^2 (Guma et al., 2019).

3. RESULTS AND DISCUSSION

Results

Tables 1, 2 and 3 show the analyzed nominal compositions of mild steel, stainless steel and aluminum, which confirmed the three procured metals as the correct types for the study. Figures 1, 2 and 3 depict, respectively, the measured pH, electrical conductivity, and percentage chloride content values, as corrosivity factors of the pure representative ogogoro and its admixed variants with 0–25% pure representative palm wine. Figures 4 and 5 depict the respective 30-day immersion corrosion weight loss (W) and the determined CPR values for the three metal samples in the pure ogogoro and its palm wine-admixed variants. Tables 4 and 5 show the XRF-analyzed composition of the admixed pure representative ogogoro, in which the three metal samples were separately soaked for 720 hours.

Table 1 Nominal composition of the procured mild steel

Element	Si	C	Al	S	Mg	Zn	Fe
Wt (%)	0.075	0.232	0.156	0.051	0.182	0.113	99.148

Table 2 Nominal composition of the procured stainless steel

Element	Ni	Mn	N	Cr	Si	C	Fe
Wt (%)	7.162	10.137	0.143	16.171	0.581	0.151	65.653

Table 3 Nominal composition of the procured aluminum

Element	Ti	Mg	Cu	Cr	Si	Fe	Al	Others
Wt (%)	0.089	0.864	0.301	0.251	0.645	1.137	96.587	Balance

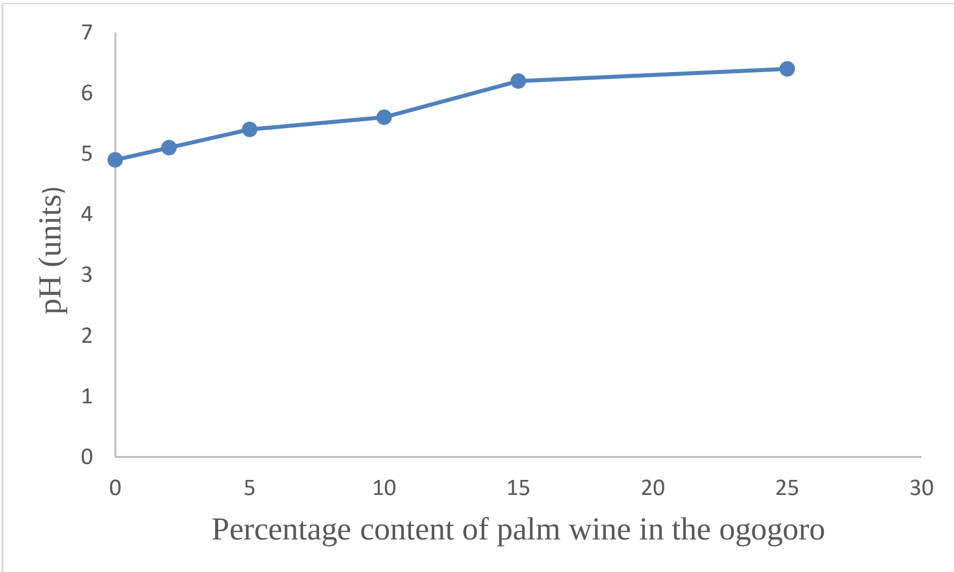

Figure 1 The pH values of the pure ogogoro containing 0-25% palm wine

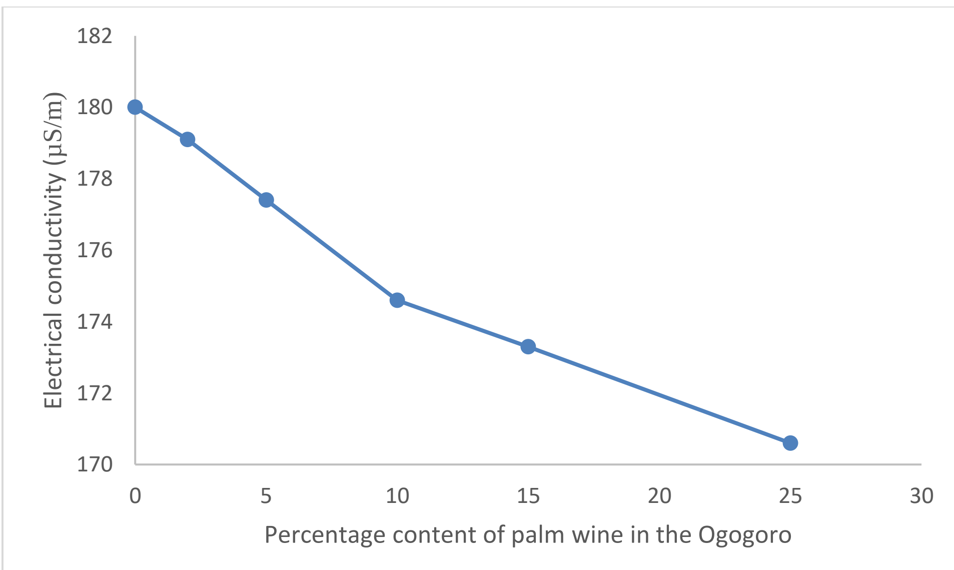

Figure 2 The electrical conductivity values of the pure ogogoro containing 0-25% palm wine

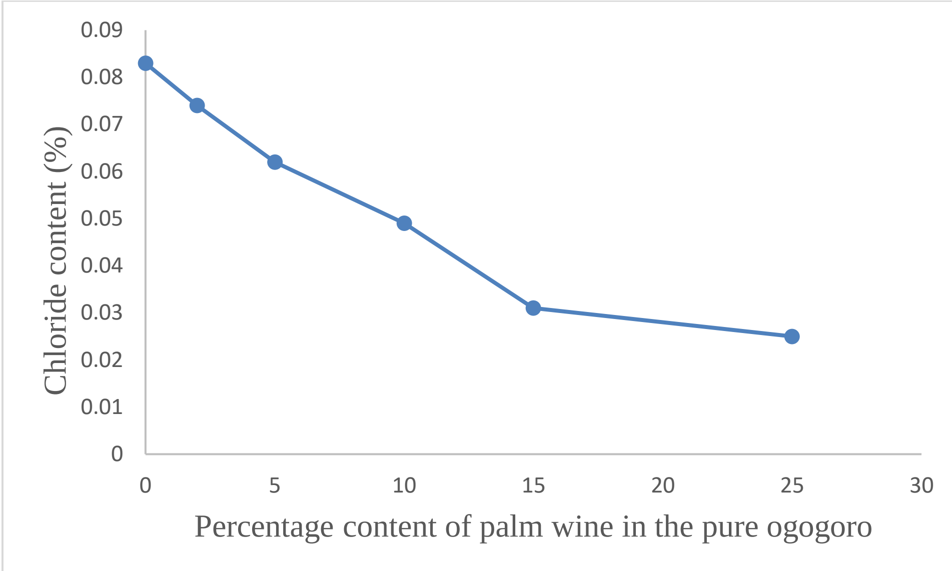

Figure 3 The percentage chloride contents of the pure ogogoro containing 0-25% palm wine

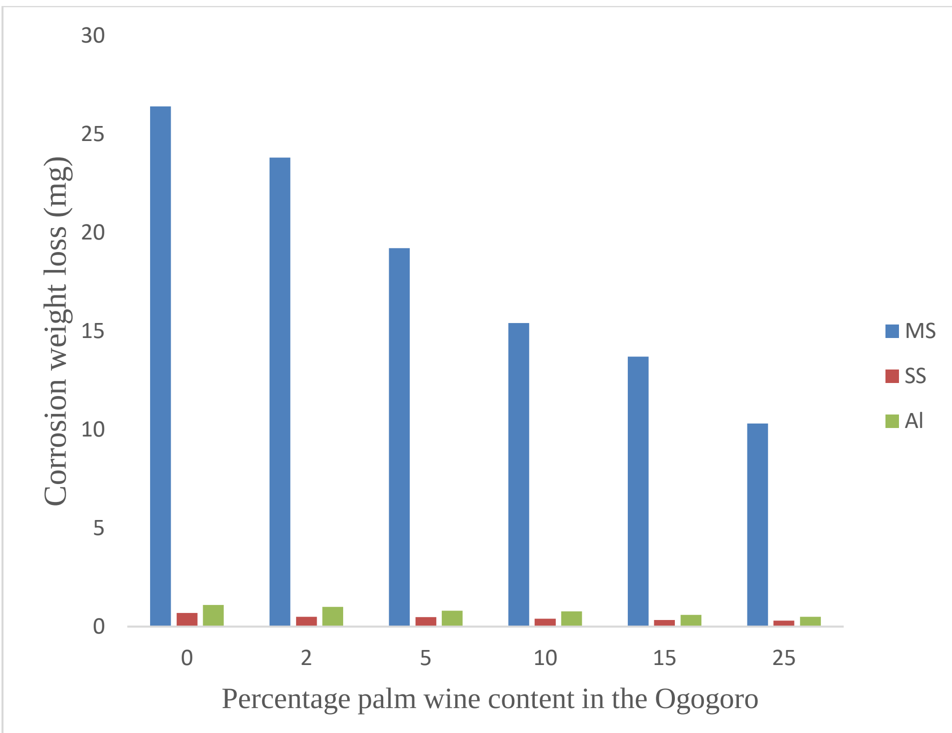

Figure 4 Immersion corrosion weight losses of the test metal samples in pure ogogoro containing 0–25% palm wine

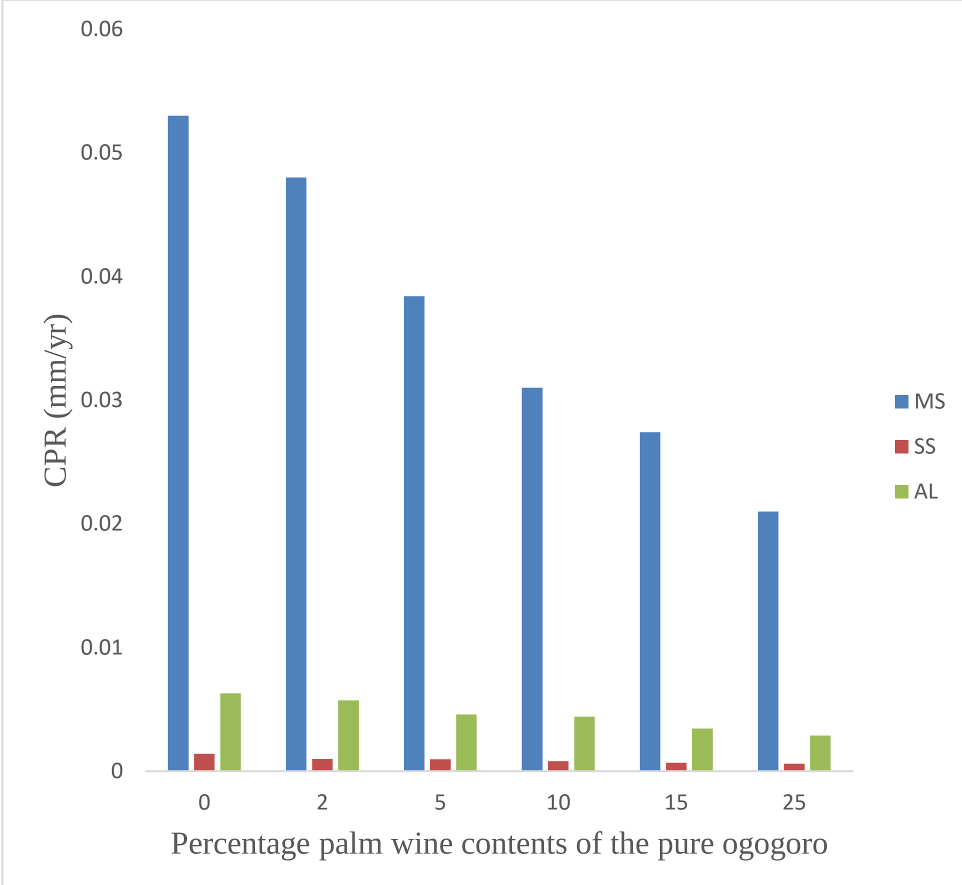

Figure 5 Immersion CPRs of the test metal samples in the pure ogogoro containing 0–25% palm wine

Table 4 XRF-analyzed mineral components found in the pure ogogoro

Layer	Component	Type	Conc.	Error	Units	Moles%	Error
1	SiO2	Cal.	22.560	4.484	wt.%	21.461	4.266
1	V2O5	Cal.	0.074	0.233	wt.%	0.023	0.073
1	Cr2O3	Cal.	0.102	0.167	wt.%	0.038	0.063
1	MNO	Cal.	0.148	0.128	wt.%	0.119	0.103
1	FE2O3	Cal.	0.920	0.141	wt.%	0.329	0.051
1	Co3O4	Cal.	0.051	0.106	wt.%	0.012	0.025
1	NiO	Cal.	0.035	0.096	wt.%	0.027	0.073
1	CuO	Cal.	1.479	0.107	wt.%	0.063	0.077
1	Nb2O3	Cal.	0.154	0.091	wt.%	0.038	0.022
1	WO3	Cal.	0.209	0.376	wt.%	0.052	0.093
1	P2O5	Cal.	0.000	0.000	wt.%	0.000	0.000
1	SO3	Cal.	3.253	1.078	wt.%	2.322	0.769
1	CaO	Cal.	1.763	0.444	wt.%	1.796	0.453
1	MgO	Cal.	16.612	63.986	wt.%	23.557	90.738
1	K2O	Cal.	0.000	0.000	wt.%	0.000	0.000
1	BaO	Cal.	0.081	0.674	wt.%	0.030	0.251
1	Al2O3	Cal.	32.971	12.808	wt.%	18.482	7.180
1	Ta2O5	Cal.	0.000	0.000	wt.%	0.000	0.000
1	TiO2	Cal.	0.153	0.264	wt.%	0.110	0.189
1	ZnO	Cal.	0.176	0.083	wt.%	0.124	0.058
1	Ag2O	Cal.	0.263	0.501	wt.%	0.065	0.124

1	Cl	Cal.	18.793	0.983	wt.%	30.298	1.585
1	ZrO2	Cal.	0.041	0.089	wt.%	0.019	0.041
1	SnO2	Cal.	0.000	0.000	wt.%	0.000	0.000
1	Rb2O	Cal.	0.016	0.062	wt.%	0.005	0.019
1	Cs2O	Cal.	0.144	0.708	wt.%	0.029	0.144

Table 5 XRF-analyzed elemental components in the pure ogogoro form.

Element	Line Code	Cond Code	Ratio Method	Intensity (c/s)	Error (c/s)	Intensity Method	Conc.	Conc. Method	Calib. Coeff.
Z	Ka	0	None	0.000	0.000	Gaussian	37.493	None	0.000
Mg	Ka	1	None	0.467	1.7982	Gaussian	10.019	FP	0.000
Al	Ka	1	None	7.408	2.8778	Gaussian	17.450	FP	0.000
Si	Ka	1	None	18.874	3.7517	Gaussian	10.546	FP	0.000
P	Ka	1	None	0.000	2.4739	Gaussian	0.000	FP	0.000
S	Ka	1	None	13.559	4.4913	Gaussian	1.303	FP	0.000
Cl	Ka	1	None	231.754	12.1248	Gaussian	18.793	FP	0.000
K	Ka	1	None	0.000	10.5300	Gaussian	0.000	FP	0.000
Ca	Ka	1	None	27.291	6.8759	Gaussian	1.260	FP	0.000
Ti	Ka	1	None	4.405	7.5961	Gaussian	0.092	FP	0.000
V	Ka	1	None	2.712	8.5617	Gaussian	0.041	FP	0.000
Cr	Ka	1	None	5.945	9.7718	Gaussian	0.070	FP	0.000
Mn	Ka	1	None	12.475	10.7710	Gaussian	0.115	FP	0.000
Fe	Ka	1	None	85.348	13.12061	Gaussian	0.643	FP	0.000
Co	Ka	1	None	5.948	12.3657	Gaussian	0.038	FP	0.000
Ni	Ka	1	None	4.902	13.3701	Gaussian	0.028	FP	0.000
Cu	Ka	1	None	240.570	17.4148	Gaussian	1.181	FP	0.000
Zn	Ka	1	None	32.235	15.2121	Gaussian	0.142	FP	0.000
Rb	Ka	1	None	3.732	14.1126	Gaussian	0.015	FP	0.000
Zr	Ka	1	None	5.676	12.3732	Gaussian	0.030	FP	0.000
Nb	Ka	1	None	20,288	12.0340	Gaussian	0.122	FP	0.000
Ag	Ka	1	None	3.806	7.2430	Gaussian	0.245	FP	0.000
Sn	Ka	1	None	0.000	8.7155	Gaussian	0.000	FP	0.000
Cs	Ka	1	None	1.388	6.8189	Gaussian	0.136	FP	0.000
Ba	Ka	1	None	0.863	7.1339	Gaussian	0.073	FP	0.000
Ta	Ka	1	None	0.000	18.0111	Gaussian	0.000	FP	0.000
W	Ka	1	None	9.906	17.7759	Gaussian	0.166S	FP	0.000

Analysis Conditions

#	Target	Filter	Thick. mg/cm[2]	kV	µA	…. Detector …. Type	Filter	Thick. mg/cm[2]	Atm Preset Time (s)	Actual Time (s)
1	Rh	None	0.00	30.0	50.0	SDD	None	0.00	Air60.0	20.0

Processing Conditions

#	No. Smths	Escape Peaks	Sum Peaks	Back Type	C/R Ratio	Blank ……… Rem. ………	Blank ……. File …….
1	1	Yes	Yes	Auto	No	No	

Discussion

Figure 1 shows that the pH value of pure ogogoro increased gradually from a value of 4.9 to a value of 6.4 as its pure palm content increased from 0 to 25%. The pH of G7 Gabernet Sauvignon red wine manufactured by Vicar S.A. in Chile with an alcoholic content of 13% is 3.54 ± 0.01, The pH value of Hite commercial beer manufactured by Hite Brewery Co., Ltd. in Korea with an alcoholic content of 4.5% is 4.05 ± 0.02. The pH value of Mimong commercial Makgeolli manufactured by Kooksoondang Brewery Co., Ltd. in Korea with 7% alcoholic content is 3.81 ± 0.00, The pH value of Cheoumcheoreom Premium Commercial Sojus manufactured by Lotte Liquor BG in Korea with a 20% alcoholic content is 8.33 ± 0.07 (Shim and Song). The average pH values of red and white wines with alcoholic contents of 5 to 13.5% produced in South Korea by different manufacturers range from 3.34 ± 0.19 (Shim and Song). Gin has a pH value of 4.5 and brandy has pH value of 3.5 as other types of alcoholics. The pH values of a good number of local beverages produced in Nigeria, including ogogoro, range from 4.2 to 6.3 with an average of 5.2 (Adeleke and Abiodun, 2010). From these, it can be seen that pure ogogoro with a pH of 4.9 is comparable in corrosivity to many other alcoholic beverages around the world, the only difference is that its alcoholic content is higher.

Figure 2 shows that the electrical conductivity of the pure ogogoro decreases from 180 to 170.6 μS/m as it is admixed with pure palm wine up to 25%. As the electrical conductivity of the ogogoro variants decreases, the degrees of their corrosivity decrease. The electrical conductivity of sea water ranges from 3 to 6 S/m and that of drinking water, which is much less corrosive than sea water, ranges from 200 to 800 μS/m (BYJU'S, 2023). The electrical conductivity of pure ethanol is 55.4 μS/m (Personal et al., 2023). It is thus inferable from these information that pure ogogoro and its palm wine-admixed variants have lower corrosivity ethanol and even drinking water.

Figure 3 shows that pure ogogoro and its palm wine-admixed variants naturally contain chlorides that decrease from 0.083% content in the pure ogogoro to 0.025% content in the ogogoro variant with a 25-percent palm wine admixture. The average chloride content of the sea is about 3.5% and it is considered to be a corrosive environment. Chlorides have the capability to aggressively attack and corrode metals, preferentially along their grain boundaries or surface defects or irregularities, at rates that depend on their concentrations (Malik et al., 1992; Praweto et al., 2009). They have the capability to even break down or prevent the formation of passive protective films formed on the surfaces of many metals, such as mild steel, stainless steel and aluminum, with the continual attack of metals. This is because chloride ions are small in size and highly mobile, so they are far more capable of easily penetrating the protective oxide film formed on metal surfaces or grain boundaries and other areas of defects than other ions (Malik et al., 1992; Praweto et al., 2009).

Malik et al., (1992) observed that stainless steel and some other metals generally corrode at rates that increase linearly in environments whose chloride contents increase in the range of 0.01–0.5% (Malik et al., 1992). Prawoto et al., (2009) found that corrosion rates of various metals under 3- and 6-day exposure durations to media of 3.15–5.95 pH containing various individual chlorides or their combinations with acids at concentrations of 1–10% were in the range of 0.0868–6.7230 mm/yr, respectively. This shows that decreases in the chloride concentration of the prepared ogogoro variants decrease the corrosion rates of the metal samples immersed in the variants. The corrosion rates are however comparatively minimal because the concentrations of 0.025-0.083% chlorides in the ogogoro variants are much smaller compared to the 1–10% concentration range.

From Figures 4 and 5, it is clear that mild steel had far greater weight losses that decreased in the range of 26.4 to 10.3 mg under the immersion tests in pure ogogoro and its palm wine-admixed variants than stainless steel and aluminum. This corresponds to the decrease in corrosion rates of mild steel in the range of 0.053 to 0.021 mm/yr in the Ogogoro variants. Under the same immersion test, stainless steel samples had corrosion weight losses of 0.7 to 0.3 mg and corresponding corrosion rates of 0.0014 to 0.0006 mm/yr, while aluminum samples had weight losses of 1.1 to 0.5 mg and corresponding corrosion rates of 0.00631 to 0.00287 mm/yr. As a guideline for mild steel, corrosion rates can be interpreted as follows: 0–051 mm/yr as excellent corrosion control; 0.051–0.076 mm/yr as generally acceptable; 0.076–0.127 mm/yr as fair corrosion control; and above 0.127 mm/yr as unacceptable corrosion control for all systems. For aluminum, corrosion rates are acceptable if less than 0.0051 mm/yr, marginal if from 0.0051 to 0.0064 mm/yr and unacceptable if greater than 0.0064 mm/yr for both evaporative and closed water systems.

For stainless steel, corrosion rates are acceptable if less than 0.00254 mm/yr but unacceptable if greater than the 0.0025 mm/yr value for both evaporative and closed water systems (Bond, 2023; Barkauskas, 2023). From the foregoing discussion, it is clear that the pH, electrical conductivity and chloride content values of the pure ogogoro and its variants point to the same pattern of their corrosivity levels. Finally, the immersion corrosion test results show that both stainless steel and aluminum have negligible corrosion in pure ogogoro and its palm wine-admixed variants, while mild steel tolerably corrodes in the ogogoro variants.

From the XRF-analyzed mineral components found in the palm wine-admixed pure ogogoro variant in which the metal samples were immerse-exposed for 30-days shown in Table 4, it can be seen that most of the components found in the pure ogogoro are metallic oxides. Such oxides are generally known to be negligibly corrosive to materials because of their spent energy levels. As can be seen from Table 4, the only corrosive components in the ogogoro are sulfur trioxide (SO_3) and chlorine (Cl), but even then, their concentration levels in the ogogoro are very small, to the tune of only 3.352% and 18.793%, respectively, as can be observed from the Table. This is because SO_3 can react with any water in the pure ogogoro to form sulfuric acid, which is very corrosive to many materials, including steel and aluminum (Guma and Abubakar, 2020).

Chlorine can be ionized into chloride ions, which can be very corrosive to metals depending on the quantity. Table 5 shows that pure ogogoro contains many elements, but only O, Mg, Al, Si, P, S, Cl, K, Ca and Cu have concentrations greater than 0.17 percent; the rest are less than this. All these elements are health-beneficial to the human body system except when they are frequently in-taken above certain levels. Aluminum and chlorine can however be health-hazardous to the human body system, but even then, most of the elements could be naturally found in the ogogoro, so be safe for the human body compared to corrosive chloride ions and leached aluminum ions (Guma and Maikudi, 2023). From all these discussions, it can be seen that ogogoro is not significantly corrosive to aluminum, stainless steel, or mild steel to call for concern. It also does not contain sufficient quantities of chemical elements that may be health risks to the human body. Most of the health issues attributed to drinking ogogoro could be due to its high alcohol content, frequent overconsumption amidst abnormal health or feeding conditions of its drinkers and some health-hazardous bacteria growth in it due to poor storage conditions but not its corrosivity and composition.

4. CONCLUSION

The corrosivity indices of pure ogogoro and its popular palm wine-admixed variants were determined. Weight losses and corrosion rates of mild steel, stainless steel and aluminum metals in the ogogoro variants were also determined. The collected and analyzed test information indicates that pure ogogoro is tolerably corrosive to mild steel but negligibly corrosive to stainless steel and aluminum metals and its corrosivity decreases with an increase in its palm wine contents. An XRF analysis of the admixed quantity of pure ogogoro in which the metals were soaked revealed that aluminum, sulfur trioxide and chlorine are its only significant components that could be detrimental to human health or corrosive to metals. The components are, however, found to pose minimal corrosivity or health risks.

Ethical issues

Not applicable.

Informed consent

Not applicable.

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This study has not received any external funding.

Conflict of Interest

The author declares that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

REFERENCES AND NOTES

1. Adakpori KAO. Physicochemical Analysis of Locally Brewed Gin (Ogogoro). Int J Sci Res 2021; 10(7):984-990.
2. Adeleke R, Abiodun OA. Physicochemical Properties of Commercial Local Beverages in Osun State, Nigeria. Pak J Nutr 2010; 9:853-855.
3. BOND. Corrosion Monitoring. Bond company 630 E. Diamond Avenue – Suite J/K Gaithersburg 2023. Available online at: https://hohwatertechnology.com/blog/what-are-corrosion-coupons-and-do-i-need-them/. Accessed 30 January, 2023
4. Brandeis University. Corrosive chemicals. Published by the Department of Environmental Health and Safety, Brandeis University, United States 2023. Available Online at: https://www.brandeis.edu/environmental-health-safety/safety/labs/corrosives.html. Accessed 10 January, 2023

5. BYJU's Conductivity of Water 2023. Available Online at: https://byjus.com/physics/conductivity-of-water/. Accessed 13, February, 2023.
6. Chukwujindu MAI, Anwuli LO, Bassey FI. A Survey of Metal Profiles in some Traditional Alcoholic Beverages in Nigeria. Food Sci Nutr 2014; 2:724-733. doi: 10.1002/fsn3.163
7. Control Automation. Measuring Electrical Conductivity 2023. Available Online at: https://control.com/textbook/continuous-analytical-measurement/conductivity-measurement/. Accesses 23 February, 2023.
8. Darius Barkauskas. What Are Corrosion Coupons and Do I Need Them? HOH Water Technology, Palatine 2022.
9. Egoro ET, Ilegbedion GI, Zebedee UL, Manjula SS. Toxic Effects of Chronic Consumption of Ogogoro (Local Gin): A Biochemical and Hematological Study in Some Male Consumers in Ajegunle Nigeria. Glob J Med Res 2018; 18 (K6):15–22.
10. EHS. Corrosive Materials. Published by Environmental Health Safety Princeton University 2023. Available Online at: https://ehs.princeton.edu/laboratory-research/chemical-safety /corrosive-materials. Accessed 13 January, 2023.
11. Eshemokha U. Side Effects and Health Benefits of Ogogoro 2021. Available online at: https://nimedhealth.com.ng/2021/05/30/side-effects-and-health-benefits-of-ogogoro/ Accessed 22 February, 2023.
12. Guma TN, Abubakar AA. Analysis of Steel-Corrosive Chemical Species in Nigerian Defence Academy Soil in Kaduna Metropolis Using X-Ray Fluorescence and Diffraction Techniques. Uniport J Eng Sci Res 2020; 5:139-146.
13. Guma TN, Aliyu J. Effects of Food Chloride Environment at a Canteen on Corrosion, Hardness Integrity and Food-Safety Level of Aluminum Cookwares. Niger J Eng 2021; 28 (3):50-55.
14. Guma TN, Ajunwa JS, Andamowei J, Abdullaziz A. Effects of Time-Aged Heat Treatments on the Hardness and Corrosion Resistances of some Sand-Cast Aluminum-Silicon-Iron Alloys. World J Innov Res 2020; 9(4):44-50.
15. Guma TN, Maikudi MM. Corrosion of Aluminum metal in Food Environments and its Associated Health Risk Issues: A Review. Arid Zone J Eng Technol Environ 2023; 19(1):1-13.
16. Guma TN, Odita KV, Ozoekwe NCA, Akor T. Analysis of Shell Failure of a Semi-trailer Tanker Used for Hauling Petroleum Products. J Sci Technol Res 2019; 1(3):144-160.
17. Idonije OB, Festus OO, Asika ECA, Ilegbusi MI, Okhiai OA. Comparative Biochemical Analysis of Local Gin (Ogogoro) from Different Parts of Nigeria and Imported Gin (Dry Gin) - Toxicogenic, Carcinogenic and Sociopolitical Implications. J med sci clin Tri 2012; 1-4. doi: 10.7237/sjmct/179
18. Malik AU, Kutty PCM, Siddiqi NA, Adijani IN, Ahmed S. The influence of pH and chloride concentration on the corrosion behavior of AISI 316L steel in aqueous solutions. Corros Sci 1992; 33(11):1809-1827.
19. Moritiwon O, Ogundeko TO, Bitrus J, Oyebode D, Abobarin OI. Effect of some Nigerian traditional alcoholic beverages on the estrous cycle and histological assessment of the ovaries and uterus of albino rats. GSC Biol Pharm Sci 2021; 14(01):027–036. doi: 10.30574/gscbps.2021.14.1.00011
20. Olasupo NA, Obayori OS. Utilization of Palm Wine (*Elaeis Guineensis*) for the Improved Production of Nigerian Indigenous Alcoholic Drink – Ogogoro. J Food Process Preserv 2007; 27(5):365-372. doi: 10.1111/j.1745-4549.2003.tb00523.x
21. Personna YR, Slater L, Ntarlagiannis D, Werkema D, Szabo Z. Electrical signatures of ethanol-liquid mixtures: Implications for monitoring biofuels migration in the subsurface 2023.
22. Prawoto Y, Ibrahim K, Nik WBW. Effect of pH and Chloride Concentration on the Corrosion of Duplex Stainless Steel. Arab J Sci Eng 2009; 34(2C):115-127.
23. Shim J, Song A. A pH Measurement Study on Commercial Alcoholic Drinks. J Dent Hyg Sci 2012; 12(6):696-701.