



International Journal of Agriculture and Food Science

ISSN Print: 2664-844X
ISSN Online: 2664-8458
NAAS Rating: 4.97
IJAFA 2025; 7(3): 129-133
www.agriculturaljournals.com
Received: 04-01-2025
Accepted: 11-02-2025

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Assessment of the quality parameters of carbonated soft drinks, beverages and water in Sudanese industries as comparing with quality standard

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DOI: <https://www.doi.org/10.33545/2664844X.2025.v7.i3b.323>

Abstract

The present study was conducted in Faculty of agriculture in Elnelien University during the period 2020 - 2022. The objective of the study was to determine the quality parameters of carbonated soft drinks, beverages and water in Sudanese Industries as coincide with SSMO1999 and WHO (2011) standards. The data of samples were statistically analyzed by using the complete randomized design (CRD) and the mean separation were done by least significant different test (LSDT). The result of the study was found that quality parameters for soft drinks samples were collected from Sudanese soft drink industries as compare with maximum permissible limit, in case of Carbon dioxide, Coca, Fanta, Pepsi, Miranda, 7-up and Shampion were within recommened range (3-4.5), while Sprite, Stim, Royal, Pasignos and Assel were below range. Refer to PH, Coca, Fanta, Miranda, Stim, Royal and Champion were within recommened range (2.5-3.5), Pepsi, Sprite Pisaynose and Assel were below recommened range, 7-Up was above recommened range. Concerning to Total acidity all soft drinks samples were below recommened range (less than 0.4). The study of result indicates that the Brix in all soft drinks samples were whin range (10 - 17), accept Sprite, Fanta and Pepsi were blew the critacal limit, while all the beaverage samples were was within recommened range (12 -18). In case of Ozone concentratin and Dissolved Oxygen all soft drinks samples was within acceptable limit (0.2 - 0.4) and (4.0 - 8.0) respectively. All so the result deteted that the Removable torque in all soft drinks samples was within acceptable limit (5 - 17). And the Net content end product of all beverages and water samples were online within the permeshable range(1ml±Net). The study recommended that more elaborated work is recommended on general requirements of food safety program.

Keywords: Quality, parameters, Sudanese, soft drinks, beverages

Introduction

Materials

Dal group, Arak group, Elniel, Elberer group, Fowaz and Pasgianos companies provided all samples kindly, Khartoum, Sudan. All the other chemicals and reagents were utilized as received at analytical reagent grade.

Quality parameters of carbonated soft drinks, beverages and water

Sampling: The CSDs samples were obtained in triplicate from the factories during observational audition. Samples were kept in dry bottles sealed tidily and labeled. After that, all samples were transferred to analytical laboratory to meet the assessment of food safety and food quality requirement.

Analysis of quality parameters of carbonated soft drinks

CSDs samples were qualitatively analyzed for carbonation volume, pH, Titratable Acidity, Brix and inverted Brix (IB). In addition to sugar, alcohol and phosphate contents as well as heavy metals concentration according to the procedures of AOAC.

Carbonation Measurements: Amount of carbonation in a beverage sample measured as a number of gas volumes with Zahm-Nagel Handshake Tester (Somex Ltd, Ballyvourney, Macroom, Co. Cork, Ireland) according to the procedure described in Steen (2005).

Samples were taken and adjust temperature to 40 °C. The samples were equilibrated by gently inverting 15 times in 30 seconds. The bottle was placed under the tester and followed the method of carbonation measurement. Then maximum pressures and the temperature reading were recorded. Adjust pressure reading with altitude Correction factor if applicable. Corrected Pressure = Gauge Pressure - Altitude Correction Factor. Adjust temperature reading with correction factor, if needed, from the temperature calibration check. Convert pressure and temperature to gas volumes using the Carbonation Volumes Chart or Carbonation Volume slide rule.

Determination of pH and Titratable Acidity

The pH values were measured using a digital pH meter (Jenway 3510 pH Meter). The value was shown automatically on the screen. The titratable acidity of the CSDs was obtained by titration method. Burette filled with 0.1 Normal sodium hydroxide solutions to the zero line. Then Pipette 100.0 ml of degassed sample beverage into a clean and dry 250-mL beaker. Carefully place a clean, dry, stirring bar into the beaker. Place the beaker on the magnetic stirrer, and turn the stirrer on so the sample is gently agitated. Rinse the electrode with de-ionized water then immerse the bottom 1/3 of the electrode in the sample. Allow the pH reading to stabilize and record the beverage pH. Titrate the sample slowly with the 0.1N NaOH. The burette spout should be over the beverage, and slightly below the top of the beaker. Continue to add NaOH until the pH meter reads constant 8.75. Be careful not to overshoot 8.75 pH. Close the burette valve. Read the liquid level in the burette to the nearest 0.05ml. Consider this reading as the titer. If the NaOH solution normality is 0.100 N, then no correction is needed. If the sodium hydroxide solution normality is not 0.100 N, then multiply the titer by the correction factor. Calculations:

Actual TA = Titer x NaOH Correction Factor.

Determination of Brix and Inverted Brix

Brix measurement was done with a digital refractometer in temperature compensation mode (Model J157, Rudolph Research Analytical and USA). It measures the weight of dissolved solids in final beverages. Degassed CSDs samples were directly placed in Clean and dry prism of refractometer. Then close the top, if so equipped and wait about 20 seconds for temperature stabilization. Brix reading was taken. Brix inversion was also done with bench refractometers. It measures the change of sucrose molecule into the simple molecule of glucose and fructose. For measurement of Brix inversion degassed CSDs samples were then transferred into a sealable vial. About 0.4ml of 2.5N HCl per 35 ml sample to all non-carbonated beverages was added. Those were capped and sealed the vial to ensure no moisture loss or gain during the hot water bath. Samples were then placed in 100°C water bath for 40 minutes. Then sealed samples were removed and placed in cooling bath until samples temperature were approximately 200 °C. Gently shaken vial to mix any condensed water collected along the inside. Sample testing was done as described in the appropriate Brix test procedure.

Determination of Ozone Concentration

Spectrophotometric method was used to investigate the ozone concentration. Briefly, ozonation of 5 mL methyl

orange solution 5 mg/L. After ozonation, solution was diluted with distilled water until the pH is equal to the initial pH. The absorbance of methyl orange solution was then measured using a UV-Vis spectrophotometer at maximum absorption wavelength of 460 nm. Ozone concentration was determined based on the assumption that the number of moles of methyl orange oxidized is directly proportional to the number of moles of ozone to oxidize. This procedure was performed also for methyl orange solution with a concentration of 10 mg/L and 15 mg/L, as well as to the amount of methyl orange solution 10, 15 and 20 mL. Ozonation procedure was held three times.

Measurement of total dissolved solids

Procedure according to Laboratory Analytical Procedure (Lab) Issue Data (2008):

1. Wash filter paper
2. Dry evaporating dish & weigh
3. Stir sample
4. Pipette 50 ml while stirring
5. Filter and wash three times
6. Transfer filtrate to evaporating dish & dry
7. Cool & weigh

Calculating total dissolved solids concentration as bellow

$$\text{Mg Dissolved Solids/L} = \frac{(A-B) \times 1000}{\text{mL sample}} \quad 1.3$$

Where:

A = weight of dried residue + dish, mg

B = weight of dish, mg.

Measurement of total suspended solids (TSS)

Procedure according to Laboratory Analytical Procedure (Lab)

Issue Data (2008)

1. Wash filter paper & dry
2. Cool & weigh filter paper
3. Assemble filtration apparatus
4. Wet filter paper with distilled water
5. Stir sample
6. Pipette 50ml into filter while stirring
7. Filter arm wash three times
8. Transfer filtrate to evaporating dish & dry
9. Cool & weigh
10. Calculate in mg/ L
11. Repeat steps 1 to 10 using 10 ml aliquot

Calculating total suspended solids (TSS) concentration:

$$\text{Mg Suspended Solids/L} = \frac{(A-B) \times 1000}{\text{mL sample}} \quad 2.3$$

Where:

A weight of filter + dried residue, mg

B weight of filter, mg.

Determination of Dissolved Oxygen

Dissolved oxygen present in a given water sample was determined by iodometric method (winkler's method). Typically, take 100 ml of given water sample into a conical flask, and titrate slowly against N / 50 standard sodium thiosulphate solutions (taken in the burette). When the color

of the solution is very light yellowish add about 2 ml of freshly prepared starch solution, so the color of the solution turned into blue. Continue the titration till the disappearance of blue color of the solution and note down the volume of the titration used. The titration is repeated until a concordant volume is obtained.

The amount of dissolved oxygen (D.O.) in a given samples.....ppm

Calculations

$$\text{Normality of given water sample, } N_2 = \frac{N_1 \times V_2}{V_1} \quad 3.3$$

Amount of dissolved oxygen = $N_2 \times \text{Eq. wt of Oxygen} = N_2 \times 8 \text{g/Lit.} \dots \text{g/Lit}$

Amount of dissolved oxygen in ppm = $\dots \times 1000 \text{ mg/Lit.} \dots \text{ppm}$

Determination of Turbidity

- Switch on the power supply and check the battery of turbidity meter
- Now we have to calibrate the turbidity meter, for this purpose test tube containing distilled water in the test tube holder and close the test tube holder cover. Make sure that the mark on the test tube coincides with mark on panel.
- Now standard Formalin solution of known turbidity is placed in the path of light rays and the scale is brought to the known value of the standard Formalin solution. Gently agitate the sample and wait for the air bubbles to disappear.
- Place the sample in turbidity meter and close the cover
- Allow the reading for a few seconds to become stabilize and then take it.

Determination of torque of packing CSD

The torque was measuring according to ASTM D Standard test Method, (2018) as flowing:

1. Select sufficient quantities of new containers and closures to allow for control groups and at least 10 specimens for each torque measurement point per test variable. Also consider if a sterilization cycle is to be included.
2. Use the torque testing system to set the application torque at the application torque determined on the basis of the desired removal torque range. Record the application torque.
3. For static evaluation, measure the removal torque of one group immediately. Store the other remaining groups for the required intervals, temperatures and humidity before measuring the removal torque. Record the removal torque, the storage conditions, the interval before measurement.
4. For dynamic testing, use the torque testing system to set the application torque recommended at the application torque determined on the basis of the desired removal torque range. Record the application torque.
5. Measure the removal torque of one group immediately, Record the removal torque.
6. Subject the remaining specimens to the selected distribution cycle, and then measure the removal torque as before. If information about long term storage is also required, then further specimens can be subjected to the

required storage condition before removal torque measurements are made.

Record the removal torque, the storage conditions, and interval before measurement.

Report the application torque and mean value for each test condition variable.

Determination of Net weight of packing sample

The net weight of packing sample was calculated by subtracting the filled bottle from the empty bottle.

Statistical Analysis

The obtained data were stored in Microsoft Excel 2007 and then exported into SPSS Version 16.0 software (SPSS Inc., USA) for statistical analysis. The data of samples were statistically analyzed by using the complete randomized design (CRD) and the mean separation were done by least significant different test (LSDT).

Result and Discussion

Determination the some quality parameters test of soft drink samples collected from Sudanese soft drink industries as compare with maximum permissible limit (SSMO, 1999)

Table 1 demonstrated quality parameters in soft drinks samples collected from Sudanese soft drink industries as compare with maximum permissible limit. In case of Carbon dioxide (CO₂), Coca-Cola company soft drinks, Coca recorded 3.18 (within critical limit), Sprite recorded 2.50 (below critical limit) and Fanta recorded 3.13 (within critical limit), in case of Pepsi company soft drinks, Pepsi recorded 3.66, 7-Up recorded 3.71 and Miranda recorded 3.08 and are within critical limit while soft drinks of Stim, Stim reported 2.94 (below critical limit), Royal showed 2.37 (below critical limit) and Champion recorded 3.09 (within critical limit), in case of Pasgianos company, Pasgianos 2.77 and Assel recorded 1.97 which are below critical limit established by (SSMO, 1999).

Refer to PH, Coca - cola company soft drinks, Coca recorded 3.2 (within critical limit), Sprite recorded 2.4 (below critical limit) and Fanta recorded 3.1 (within critical limit), in case of Pepsi company soft drinks, Pepsi recorded 2.4 (below critical limit), 7-Up recorded 3.6 (above critical limit) and Miranda recorded 3.3 (within critical limit), in case of soft drinks of Stim, Stim reported 3.0 (within critical limit), Royal showed 3.3 (within critical limit) and Champion recorded 3.4 (within critical limit), in case of Pasgianos company, Pasgianos 3.5 and Assel recorded 2.90 which are below critical limit established by (SSMO, 1999). Refer to total acidity (T.A), Coca - cola company soft drinks, Coca recorded 0.31, Sprite recorded 0.20 and Fanta recorded 0.35, in case of Pepsi company soft drinks, Pepsi recorded 0.20, 7-Up recorded 0.18 and Miranda recorded 0.36, in case of soft drinks of Stim, Stim reported 0.19, Royal showed 0.23 and Champion recorded 0.24, in case of Pasgianos company, Pasgianos 0.24 and Assel recorded 0.22 and total acidity in all soft drinks was below critical limit. Refer to Brix, Coca - cola company soft drinks, Coca recorded 10.0, Sprite recorded 6.0 and Fanta recorded 9.2, in case of Pepsi company soft drinks, Pepsi recorded 9.0, 7-Up recorded 9.0 and Miranda recorded 13.0, in case of soft drinks of Stim, Stim reported 13.0, Royal showed 11.0 and Champion recorded 11.0, in case of Pasgianos company,

Pasgianos 12.0 and Assel recorded 11.0 and Brix in all soft drinks was within critical limit established by (SSMO, 1999).

Refer to Ozone (O₃), Coca - cola company soft drinks, Coca recorded 0.3, Sprite recorded 0.2 and Fanta recorded 0.3, in case of Pepsi company soft drinks, Pepsi recorded 0.2, 7-Up recorded 0.2 and Miranda recorded 0.3, in case of soft drinks of Stim, Stim reported 0.2, Royal showed 0.3 and Champion recorded 0.2, in case of Pasgianos company, Pasgianos 0.2 and Assel recorded 0.3 and Ozone in all soft drinks was within critical limit established by (SSMO, 1999).

Refer to dissolved Oxygen, Coca - cola company soft drinks, Coca recorded 5.2, Sprite recorded 6.3 and Fanta recorded 6.9, in case of Pepsi company soft drinks, Pepsi recorded 7.0, 7-Up recorded 5.5 and Miranda recorded 5.4, in case of soft drinks of Stim, Stim reported 6.4, Royal showed 6.2 and Champion recorded 7.2, in case of Pasgianos company, Pasgianos 7.4 and Assel recorded 6.8 and dissolved Oxygen in all soft drinks was within critical limit established by (SSMO, 1999).

Refer to removable torque, Coca - cola company soft drinks, Coca recorded 11.02, Sprite recorded 12.1 and Fanta recorded 12.4, in case of Pepsi company soft drinks, Pepsi recorded 10.6, 7-Up recorded 13.3 and Miranda recorded 13.7, in case of soft drinks of Stim, Stim reported 11.9, Royal showed 10.8 and Champion recorded 11.4, in case of Pasgianos company, Pasgianos 12.5 and Assel recorded 13.2 and removable torque in all soft drinks was within critical limit (SSMO, 1999).

Table 2 Determination the some quality parameters test of beverages and water samples collected from Sudanese soft drink industries as compare with maximum permissible limit (SSMO, 1999)

Refer to PH, Coca - cola company beverages, Rio Guava recorded 3.4 (below critical limit), Rio Mango recorded 3.4 (below critical limit) and Soft Water recorded 7.1, in case of Pepsi company beverages, Crystal Guava recorded 3.7 (below critical limit), Crystal Mango recorded 3.8 (below critical limit) and Crystal Water recorded 7.7, in case of beverages of Stim, Maza reported 3.7 (below critical limit), Yes Guava showed 3.9 (below critical limit) and Anhar Water recorded 7.2, in case of Pasgianos company, Forat Orange recorded 3.2 and Forat Water recorded 7.0, in case

of Fouz, Vita Guava recorded 3.2 and Vita Mango recorded 3.50 which are below critical limit (SSMO, 1999).

Refer to total acidity (T.A), Coca - cola company beverages, Rio Guava recorded 0.23 (below critical limit), Rio Mango recorded 0.22 (below critical limit) and Soft Water recorded none, in case of Pepsi company beverages, Crystal Guava recorded 0.22 (below critical limit), Crystal Mango recorded 0.29 (below critical limit) and Crystal Water recorded no acidity, in case of beverages of Stim, Maza reported 0.23 (below critical limit), Yes Guava showed 0.17 (below critical limit) and Anhar Water recorded none, in case of Pasgianos company, Forat Orange recorded 0.21 (below critical limit) and Forat Water recorded none, in case of Fouz, Vita Guava recorded 0.34 and Vita Mango recorded 0.31 which are below critical limit.

Refer to Brix, Coca - cola company beverages, Rio Guava recorded 12.2 (within critical limit), Rio Mango recorded 14.0 (within critical limit) and Soft Water recorded none, in case of Pepsi company beverages, Crystal Guava recorded 13.8 (within critical limit), Crystal Mango recorded 14.6 (within critical limit) and Crystal Water recorded none, in case of beverages of Stim, Maza reported 14.6 (within critical limit), Yes Guava showed 12.0 (within critical limit) and Anhar Water recorded none, in case of Pasgianos company, Forat Orange recorded 12.3 and Forat Water recorded none, in case of Fouz, Vita Guava recorded 12.7 and Vita Mango recorded 14.3 which are below critical limit.

Refer to total dissolved salts (TDS), all beverage other than water recorded no values while Coca - cola company Soft Water recorded 66.2 (within critical limit), Pepsi company Crystal Water recorded 142.2 (within critical limit), Stim Anhar Water recorded 98.7 (within critical limit), and Pasgianos company, Forat Water recorded 77.4 within critical limit (SSMO, 1999).

Refer to turbidity, all beverage other than water recorded no values while Coca - cola company Soft Water recorded 0.22 (within critical limit), Pepsi company Crystal Water recorded 0.27 (within critical limit), Stim Anhar Water recorded 0.21 (within critical limit), and Pasgianos company, Forat Water recorded 0.24 within critical limit (SSMO, 1999).

Net content end product quality parameters of all beverages and water are ok.

Table 1: Determination some Quality parameters test of soft drinks samples collected from Sudanese soft drink industries as compare with maximum permissible limit

Quality parameters	Critical limit	Companies										
		Coca-Cola			Pepsi			Stim			Pasgianos	
		Coca	Sprite	Fanta	Pepsi	7-Up	Miranda	Stim	Royal	Champion	Pasgianos	Assel
Carbon dioxide (CO ₂)	3 -4.5	3.18±0.02	5.02	±3.13	3.66	3.71	3.08	2.94	2.37	3.09	2.77	1.97
pH	2.5-3.5	3.2	2.4	3.1	2.4	3.6	3.3	3.0	3.3	3.4	3.5	2.9
Total acidity (T.A)	<0.4	0.31	0.20	0.35	0.20	0.18	0.36	0.19	0.23	0.24	0.24	0.22
Brix	10-17	10.0	6.0	9.2	9.0	9.0	13.0	13.0	11.8	11.0	12.0	11.0
Ozone (O ₃)	0.2-0.4	0.3	0.2	0.3	0.2	0.2	0.3	0.2	0.3	0.2	0.2	0.3
Dissolved Oxygen	4-8	5.2	6.3	6.9	7.0	5.4	5.5	6.4	6.2	7.2	7.4	6.8
removable Torque	5-17	11.02	12.1	12.4	10.6	13.3	13.7	11.9	10.8	11.4	12.5	13.2

Established Limit according to Sudanese Standard and Meteorology Organization (SSMO, 1999)

Table 2: Determination some Quality parameters test of beverages and water samples collected from Sudanese soft drink industries as compare with maximum permissible limit

Quality parameters	limit range	Companies												
		Coca-Cola			Arak			Stim			Pasgianos		Fouz	
		Rio Goafa	Rio Mango	Soft water	Crystal Goafa	Crystal Mango	Crystal water	Maza	Yes Goafa	Anhar water	Frat orange	Frat water	Vita Goafa	Vita Mango
pH	L. than 4	3.4	3.4	7.1	3.7	3.8	7.7	3.7	3.9	7.2	3.2	7.0	3.2	3.5
Total acidity	L. than 0.4	0.23	0.22	-	0.22	.29	-	0.23	0.17	-	0.21	-	0.24	0.31
Brix	12 - 18	12.2	14.0	-	13.8	14.6	-	14.6	12.0	-	12.3	-	12.7	14.3
TDS	150 - 180	-	-	66.2	-	-	142.2	-	-	98.7	-	77.4	-	-
Turbidity	L. than 0.3	-	-	0.22	-	-	0.27	-	-	0.21	-	0.24	-	-
Net content end product	1ml±Net	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok	Ok

Established Limit according to Sudanese Standard and Meteorology Organization (SSMO, 1999)

Conclusion and Recommendations

Conclusion

It was found that quality parameters in soft drinks samples collected from Sudanese soft drink industries as compare with maximum permissible limit, in case of Carbon dioxide, Coca, Fanta, Pepsi, Miranda, 7-up and Shampion were within critical limit, while Sprite, Stim, Royal, Pasignos and Assel were below limit.

Refer to PH, Coca, Fanta, Miranda, Stim, Royal and Champion were within critical limit), Pepsi, Sprite Pisaynose and Assel were below critical limit, 7-Up was above critical limit.

Total acidity in all soft drinks was below critical limit.

Brix in all soft drinks was within critical limit.

Ozone in all soft drinks was within critical limit.

Dissolved Oxygen in all soft drinks was within critical limit.

Removable torque in all soft drinks was within critical limit.

Net content end product quality parameters of all beverages and water are ok.

Recommendations

1. More elaborated work is recommended on Sudanese soft drink and baevarages to etermination heavy metals and microbial.

Acknowledgements

The authors would like to express their deep appreciation to the production managers and workers in the Sudanese soft drinks industries for providing the appropriate information to finish this study.

References

1. AOAC HW. International A: official methods of analysis of the AOAC international. Arlington County, VA, USA: The Association; c2000.
2. Ashurst P, *et al.* Soft drink and fruit juice problems solved. Woodhead Publishing; c2017.
3. Ramalakshmi K, *et al.* Separation and characterization of chromogenic acid-rich conserves from green coffee beans and their radical scavenging potential. J Sci Food Agric. 2011;46(1):109-115.
4. SSMO. Sudanese Standards and Metrology Organization. Standard of Non-Alcoholic carbonated soft drinks (250/2007); c2007.
5. Staudinger KC, Roth VSJA. Occupational lead poisoning. Am Fam Physician. 1998;57(4):719.
6. WHO. 2011.
7. WHO G. Strategies for implementing HACCP in small and/or less developed businesses; c1999.