

Research Article

# Assessment of Cancer Risk from Potassium-40 in Sachet Water Consumed in Mubi Local Government Area, Adamawa State, Nigeria

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## Abstract

Sachet water is a major drinking water in Mubi. This research assessed Potassium-40 (40K) radioactivity concentration in sachet water consumed by Mubi dwellers and the associated cancer risks. Samples from fifteen (15) sachet water brand were analyzed at Centre for Energy Research and Training (CERT) Ahmadu Bello University Zaria (ABU) using gamma spectrometry. The results for the analysis showed that Potassium-40 concentration in sachet water from the sampling locations ranged from 36.08 – 98.91Bq/L and the cancer risk ranged from 0.0000082 – 0.000022 Risk/year for location M8 and M2 respectively. The results obtained for all the fifteen (15) sampling locations were below 0.1 Bq/L recommended screening limit by WHO and others radiation regulatory bodies. The sachet water from the companies were contaminant free, therefore pose no any cancer risk, even though the results were below the screening limit, it is important to keep on testing and treating the water quality time to time.

**Keywords:** Potassium-40, Risk, Cancer, Water Quality, Concentration

## Abbreviations

M1 = ADSU SACHET WATER  
M2 =MUGULBU WATER  
M3= EL-HAM WATER  
M4 =KWALI WATER  
M5 =KHAIRAT WATER  
M6 =YETTORE WATER  
M7 =AMJAD WATER  
M8 =AFAMA WATER  
M9 =WHORA WATER  
M10=UKTEEMA WATER  
M11= KUDASON WATER  
M12 =SANDY WATER  
M13 = SAHAVA WATER  
M14 =AMAS WATER  
M15 =SHAMS WATER

## 1. Introduction

The naturally occurring radionuclides originate in the earth's crust where Uranium and Potassium are widely distributed and detectable in all soils and rock [1]. Absolute ages of rock, minerals and meteorites are determined using decay of long-lived radioactive isotopes and accumulation of their stable decay product [2]. 40K and 137Cs are isotopes representing

elements that are distinguished by slight differences in their chemical properties but that have different origins in the environment [3]. 40K Krolak is a natural isotope whose percentage in the total Potassium content is estimated at 0.0119 [3]. Exposure to ionizing radiation from natural source is a continuous and unavoidable feature of life on earth. The greatest contribution to mankind exposure comes from natural background radiation and the worldwide [4]. 40K occurs extensively in nature and is found in mineral, ores, soils, rocks, sand, rivers. The decayed residues of animals and plants organisms also contain this radioisotope [4].

## 2. Materials and Method Study Area

Mubi located in Adamawa State, Nigeria (approx. 100031 – 100301N, 130101 – 130301E), is a historic commercial hub founded by Fali and Gude peasants, later becoming a German base (1902) and British colonial outpost. It is now major Centre for commerce and Agriculture, divided in to Mubi North and South.

### 2.1. Sampling

A total of fifteen (15) sachets water samples were collected from both Mubi North and South local Government

metropolis. The water samples were collected in 1Liter container and was acidified with nitric acid (HNO<sub>3</sub>) to prevent any loss by absorption of the radionuclides around the container walls and reduced growth of microorganisms.

## 2.2. Sample Preparation

100ml of water sample was mixed with 5ml of concentrated nitric acid in a 250ml conical flask. It was heated in a hot plate till the volume was reduced to 10ml. The hot solution was filtered in to 100ml volumetric flask and diluted up to the mark. This procedure was repeated for all the water samples from each of the company [4].

## 2.3. Estimation of Radioactivity Of K-40

The standard method was applied to find out the concentration of K-40 in the soil and water samples that is,

for potassium, the peak at 1.46MeV was used for analysis. The detector system coupled with 3" × 3" NaI crystal with 1024 channels were used for the process of measurement [4].

The expression for the cancer risk is given by:

$$\text{Cancer risk} = \text{Concentration (Bq/L)} \times \text{dose coefficient (Sv/Bq)} \times \text{ingestion rate (L/Y)} \times \text{risk factor (risk/Sv)} [4].$$

Where by

$$\text{Dose Coefficient (Sv/Bq)} = 0.000000062$$

$$\text{Ingestion Rate (L/Y)} = 730$$

$$\text{Risk Factor (risk/Sv)} = 0.05$$

## 3. Results and Discussion

NO	SAMPLE ID	K-40 (Bq/L)	CANCERRISKS (RISK/YEAR)
1	M1	79.47	0.000018
2	M2	98.91	0.000022
3	M3	86.47	0.00002
4	M4	85.38	0.000019
5	M5	73.72	0.000017
6	M6	65.21	0.000015
7	M7	83.86	0.000019
8	M8	36.08	0.0000082
9	M9	46.85	0.000011
10	M10	64.15	0.000015
11	M11	46.84	0.000011
12	M12	49.23	0.000011
13	M13	42.13	0.0000095
14	M14	62.71	0.000014
15	M15	47.14	0.000011

**Table 1: Samples Collection With Activity Concentration and Cancer Risks**

The table above showed that sachet table coded M2 recorded the highest Potassium-40 concentration, and the highest cancer risk, while M8 has the lowest K-40 concentration

with least cancer risk. The fluctuations of the results showed different concentration of K -40 in each of the sample's brand, all the results were below screening limit.

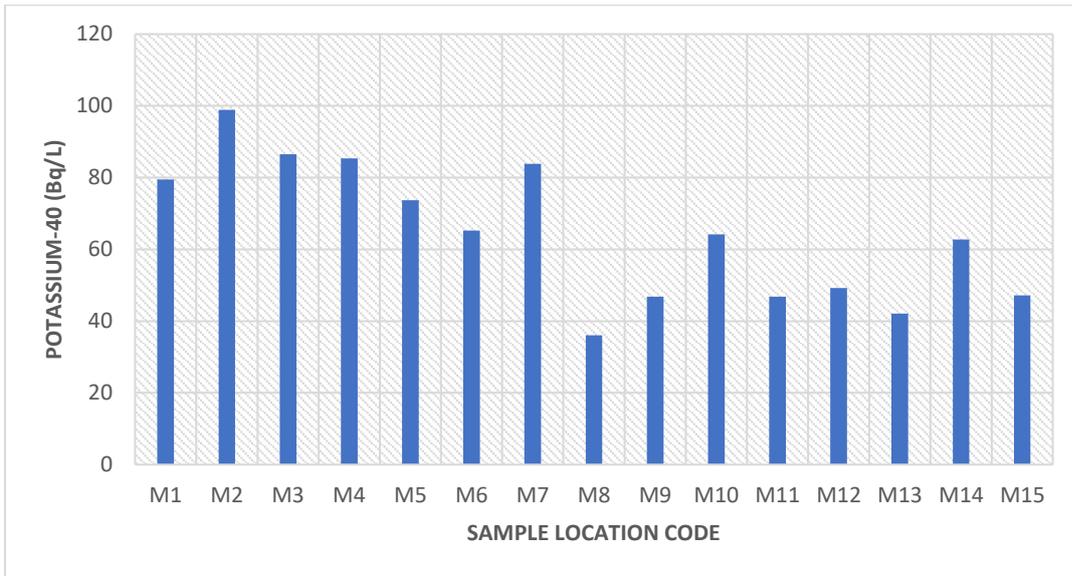


Figure 1: Chart Showing Samples Code and K-40 Concentration

The figure above showed that sachet table water coded M2 has the highest bar, meaning has the highest contamination of K-40, while M8 has the shortest bar, which implied lowest activity concentration,

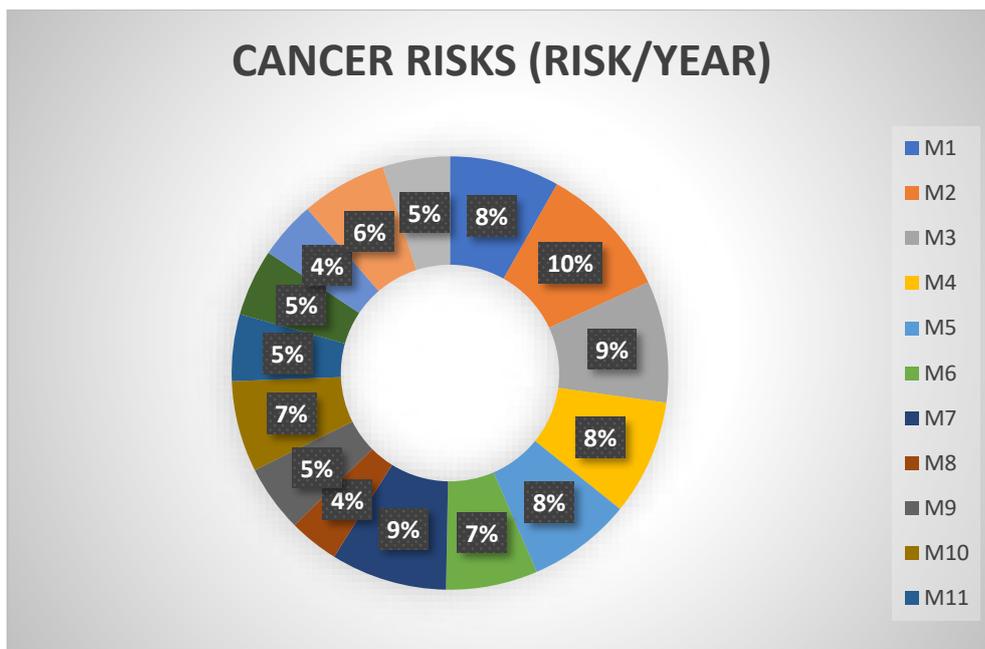
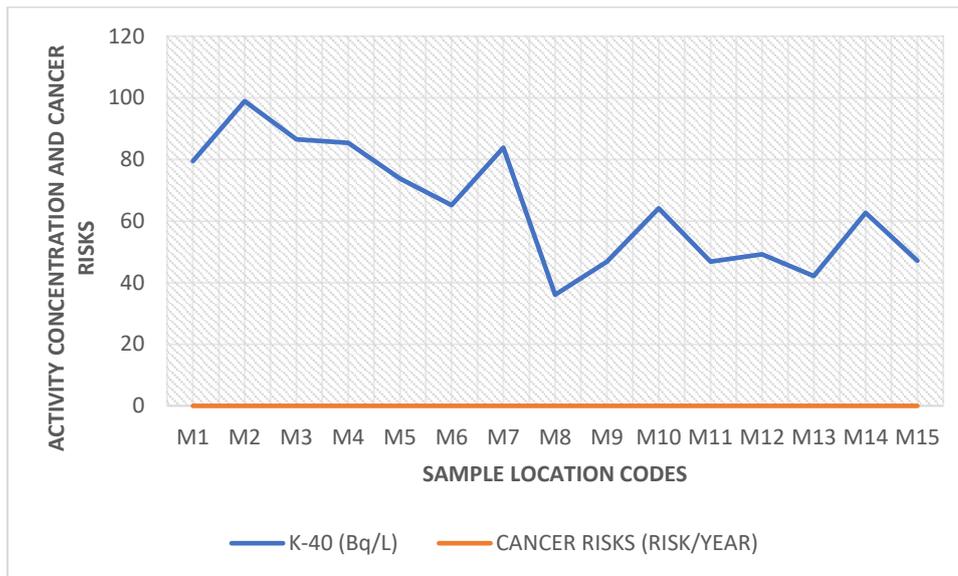


Figure 2: Pie Chart Showing Percentage of Cancer Risks

The figure above showed that the chance of cancer risk for Mubi dwellers consuming the mentioned sachets water is 10 out of 100, which is very low, therefore the water is good for consumption and for other domestic activities.



**Figure 3: Line Chart Showing Sachet Water and Activity Concentration**

The key from the figure above showed that the cancer risk for sachets table water for this research was absolutely insignificant, therefore pose no any detrimental health challenges to the people consuming it.

#### Acknowledgment

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#### 4. Conclusion

The results obtained for both activity concentration and cancer risk were below the screening limit, therefore consuming the water will pose detriment effect, even though the values were low, morning the quality of the water time to time is very important.

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