International Scholars Journals

African Journal of Chemistry ISSN 4391-3199 Vol. 5 (6), pp. 335-337, June, 2018. Available online at www.internationalscholarsjournals.org © International Scholars Journals



*Short communication*

# Physico-chemical analysis and toxicological studies of *Madaran sukudai* (a local drink in Northern Nigeria)

**Owalude, S. O.* and Tella, A.C**.

Chemistry Department, University of Ilorin, P. M. B. 1515, Ilorin, Nigeria.

Accepted September 22, 2017

**Physico-chemical analyses have been carried out on concentrated *Madaran sukudai*, diluted *M. sukudai* and pure formalin. Both the infrared and UV-visible spectroscopic studies on the three solutions revealed that the madaran sukudai is essentially a dilute formalin solution. Toxicological studies of the effect of *M. sukudai* on the white albino rats were also carried out. The results showed that there was significant increase in the enzymes (Alanine aminotransferase, ALT) activities in the heart and liver of these rats with no significant increase in Aspartate aminotransferase, AST) activities when compared to the control.**

**Key words:** *Madaran sukudai*, formalin, UV-visible spectroscopy, infrared spectroscopy, alanine aminotransferase, aspartate aminotransferase, white albino rats.

## INTRODUCTION

*Madaran sukudai* is a local alcohol- substitute which is produced and mainly consumed by the people in the Northern region of Nigeria. According to the vendors, the madaran sukudai is produced by dilution of a chemical bought from an undisclosed source with six or more times equivalent of clean water and the mixture well shaken after which it is ready for drinking. Once taken, there is a cold, burning sensation at the back of the tongue down the throat. Investigation shows that many people drink it for different reasons, some take it to relieve dental or chest pain. It is usually recommended by sellers to smo-kers to clear their chest. It is not approved by the National Agency for Food and Drug Administration and Control, yet sellers vend it freely in cities, towns and villages, dispensing it to consumers who have found in Sukudai, a substitute for alcohol. However, a recent media report revealed that the *M. sukudai* is no more than formalin, a potent chemical substance used to preserve corpses in mortuary (Sun, 2007). Formalin is an aqueous mixture of formaldehyde and methyl alcohol (Vaughn and Strader, 1986) . Literature reports also con- firm that formalin at times may contain contaminants such as formic acid (Bayer and Wolfgang, 1997). The chemical compound formaldehyde has a pungent smell, it is the simplest alde-hyde with the chemical formula HCHO.

*Corresponding author. E-mail: owalude1412@yahoo.com

The largest source of formaldehyde is the chemical industries. It is found in cigarette smoke and also can be formed in the environment during the burning of fuel or household waste (Albert et al., 1999). Among many other applications, formaldehyde preserves or fixes tissues or cells by irreversibly cross linking primary amine groups in proteins with other nearby nitrogen atoms or DNA through a $–CH_2–$ linkage (Salman et al., 2001). It is the ability of formaldehyde to fix tissue that the mortuary attendants found it very useful in embalming of corpses to disinfect and temporarily preserve human remains prior to burial.

Various toxicological studies have been carried out on the effect of exposure to formaldehyde and have been found to be carcinogenic both to humans (Albert et al., 1999; Johannsen et al., 1986; Takashi et al., 1986; Dalby, 1982) and animals' alike (Strayer et al., 1985; Olsen et al., 1984). These great health hazards resulting from exposure to formaldehyde prompted us to carry out physico-chemical tests on *M. sukudai* to confirm the presence of formalin and the toxicological effects of its consumption on the white albino rats.

## MATERIALS AND METHODS

### Materials

The reagents used were analar grade and were used as received. Samples of *M. sukudai* were purchased from the hawkers in Ilorin,

**Table 1.** Infrared absorption frequencies ($cm^{-1}$) of *Madaran Sukudai* and Formalin

| Formalin | Madaran Sukudai | | |
|---|---|---|---|
| | Ilorin | Minna | Lafia |
| 605.62b | 601.54b | 599.54b | 601.36b |
| 1103.34vw | 1100.46vw | 1102.96vw | 1123.96vw |
| 1429.22w | 1504.07w | 1504.20w | 1486.24w |
| 1640.20vs(νC=O) | 1634vs(νC=O) | 1634.86vs(νC=O) | 1638.16vs(νC=O) |
| 2080.47s | 2077.13s | 2070.64s | 2077.41s |
| 3430.42b(νO-H) | 3443.39b (νO-H) | 3438.64b(νO-H) | 3446.20b(νO-H) |

w = weak; b = broad; s = strong; vs = very strong; vw = very weak

(Kwara state), Minna (Niger state), Lafia (Nasarawa state), Nigeria.

#### Preliminary tests

Samples of *M. sukudai* were subjected to various tests. Its action on litmus paper, colour and the odour were noted. The pH, solubility in water and its boiling point were determined. The corresponding tests on pure formalin solution were also carried out and observations noted. Chemical tests were also carried out on *M. sukudai* to determine the functional groups present.

#### Spectrophotometric analyses

UV spectra of both the *M. sukudai* and pure formalin were recorded on the Aquamate V4.60 UV-visible spectrophotometer while their IR spectra were recorded using KBr pellets with SP3-30 IR spectrometer.

#### Toxicological studies

The effects of repeated administration of *M. sukudai* on the level of Aspartate aminotransferase (AST) and Alanine aminotransferase (ALT) activities in the livers and the hearts of the white albino rats were investigated. A total of 25 white albino rats of Wister strain weighing between 180 to 210g. They were housed in a clean metal cages contained in a well ventilated house conditions (temperature 28 - 31$^{o}$C; humidity 50 - 55%; 12 h natural light and 12 h darkness) and were allowed free access to rat pellets and clean tap water. They were grouped into five groups consisting of five animals each as follows:

A. Control administered with 1ml of distilled water
B. Received 0.1 ml distilled water and 0.9 ml *Madaran sukudai*
C. Received 0.2 ml distilled water and 0.8 ml *Madaran sukudai*
D. Received 0.4 ml distilled water and 0.6 ml *Madaran sukudai*
E. Received 0.5 ml distilled water and 0.5 ml *Madaran sukudai*

The *M. sukudai* solution and distilled water were administered orally to the rats in all the groups three times daily for seven days. The weight of the rats before and after administration was noted and all the rats were sacrificed 24 h after their seven daily doses.

#### Preparation of the tissue homogenates

The method described by Yakubu et al was adopted (Yakubu et al., 2005). The rats were quickly dissected and both the livers and hearts were removed, decapsulated and blotted in tissue paper and weighed. The organs were then homogenized separately in 0.25 M sucrose solution (1:5 w/v) and stored frozen for 24 h before being used for the estimation of AST and ALT activities.

#### Estimation of the enzymes activities

The activities of AST and ALT in the liver and heart were estimated for each rat following the published procedures (Wright et al., 1972; Gornal et al., 1949).

#### Statistical analyses

Statistical significance was determined using Duncan Multiple Range Test and values were considered statistically significant at $P < 0.005$.

## RESULTS

The preliminary tests showed that both the *Madaran sukudai* and formalin share common characteristics. They are colourless, very soluble in water, no visible effect on litmus paper and they have choking smell. The pH of the samples ranges between 2.3 and 4.6 which compared well with that of formalin which is usually bet-ween 2 and 4. The samples also have almost the same boiling points with formalin at 101$^{o}$C. Addition of Fehling solution to the solutions results in a deep blue precipitate which changes to green and subsequently to reddish brown on standing. A shining silver deposit is no-ticed on the side of test tubes when Tollens reagent is added to the two solutions. The principal IR bands in the spectra of the Madaran Sukudai for the three states and pure Formalin are shown in Table 1 below.

## DISCUSSIONS

The results obtained from the addition of Fehling solution to the *M. sukudai* and the positive silver mirror test confirms the presence of aldehyde group. From the U.V spectra of solutions of *M. sukudai* from the three sources, absorption bands at 199, 204 and 201nm which is attributed to $n \rightarrow (C=O)$ is observed and is similar to that of formalin at 198.0 nm. The IR spectra shows similar bands at 1634 $cm^{-1}$(Ilorin), 1634.86 $cm^{-1}$(Lafia) and 1638.16 $cm^{-1}$(Minna) in *M. sukudai* and 1640 $cm^{-1}$ in Formalin which

**Table 2.** Effect of administration of *Madaran sukudai* at the dose of 3.33 mg/kg body weight on the ALT and AST activities of rat liver and heart.

| Group | AST | concentration | ALT | concentration |
|---|---|---|---|---|
| | Liver | Heart | Liver | Heart |
| A control | 1590 ± 54.77 | 1527 ± 44.91 | 1342 ± 52.49 | 1186 ± 130.91 |
| B | 1316 ± 396.68 | 1345 ± 185.13 | 1704 ± 370.26 | 1893 ± 114.47 |
| C | 1209 ± 112.28 | 1211 ± 108.99 | 2058 ± 430 | 2085 ± 58.61 |
| D | 1085 ± 9.31 | 1266 ± 235.52 | 1576 ± 158.84 | 1523 ± 152.65 |
| E | 1180 ± 12.65 | 1252 ± 120.41 | 1680 ± 126.15 | 1656 ± 132.11 |

Values are mean of 4 determinations ± SD. Enzyme activities are expressed in U/l/min/mg protein

are attributed to the ν(C=O) of the carbonyl in the aldehyde (Abd El Waheed et al., 2004). Bands between 3438 and 3446 $cm^{-1}$ in *M. sukudai* and 3430 $cm^{-1}$ in Formalin are due to ν(O-H) stretching frequency (Abd El Waheed et al., 2004). All these affirm that *M. sukudai* and Formalin are essentially the same. The effects of repeated administration of *M. sukudai* on the liver and the heart of the albino rats are shown in Table 2. When compared with the control group at the stated dose of 3.33 mg/kg body weight, there is no significant effect on the AST activities both in the liver and the heart. However, the administrations of *M. sukudai* lead to a significant increase in the activities of ALT in both the heart and the liver when compared with the control. The significant increase in activities of ALT in both the liver and the heart may be attributed to induction in the enzyme synthesis probably de novo (Ogunniran et al., 2007). This increase in activities of ALT in both the liver and the heart implies a possible damage to the cells of these organs (Malomo et al., 1993). The damage to the tissues of these organs caused a leakage and increased activity could be a compensatory mechanism by these organs to replace the lost enzymes by increase their synthesis (Malomo et al., 1995).

## Conclusion

The results of the preliminary tests, UV- absorption and IR measurements have shown that the *M. sukudai* is actua-lly formalin solution. Also from the results of the toxico-logical studies, one can conclude that *M. sukudai* is a silent killer which does not have an instant effect on the body but takes time to manifest.

### REFERENCES


Abd El Waheed MG, Abd El Wanees S, El Gamel M, Abd El Haleem (2004). Physico-chemical studies of some aminobenzoic acid hyrazide complexes. J. Serb. Chem. Soc. 69: 255-264.

Albert RE, Sellakumar AR, Laskin S, Kuschner M, Nelson N, Synder CA (1999). Gaseous formaldehyde and hydrogen chloride induction of nasal cancer in the rat. J. Nat. Cancer Inst. 64(4): 597-603.

Bayer H, Wolfgang W (1997). Organic Chemistry, Albion Publishing Chichester, West Sussex, England, pp 201- 203.

Dalby NE (1982). Formaldehyde and tumors in hamsters' respiratory tracts, Toxicology. 24: 9-14.

Gornall AC, Bardawill CJ, David MM (1949). Determination of serum protein by means of biuret reaction. J. Biol. Chem. 177: 751-756.

Johannsen FR, Levinski GJ, Tegeris AS (1986). Effect of formaldehyde in the rat and dog following oral exposure. Toxicology Letters, 30:1-6.

Malomo SO, Ale OO, Adedoyin AM (1993). Effect of chloroquine on some leukocyte enzymes during energy malnutrition-an in vitro study. Biosci. Res. Commmun. 5:53-55.

Malomo SO, Daramola AS, Balogun EA (1995). Some serum and tissue enzyme changes in mice infected with *Plasmodium yoelii nigeriensis* before and after administration of halofantrine hydrochloride. Nig. J. Biochem. Mol. Biol. 10:71-77.

Ogunniran KO, Tella AC, Alensela M, Yakubu MT (2007). Synthesis, physical properties, antimicrobial potentials of some antibiotics complexed with transition metals and their effects on alkaline phosphatase activities of selected rat tissues. Afr. J. Biotechnol. 6(10):1202-1208.

Olsen JH, Jensen SP, Hink M, Faurbo K, Breum NO, Jensen OM (1984). Occupational formaldehyde exposure and increased nasal cancer risk in man. Int. J. Cancer, 34: 639-644.

Salman A, Argov S, Ramesh J, Goldstein J, Smelnikov I, Guterman H and Mordechai S (2001). Characterization of normal and malignant human colonic tissues, Cellular and Molecular Biology. 47(22):QL159-QL166.

Stayer LS, Smith AB, Reeve G (1985). Proportionate mortality study of workers in the garment industry exposed to formaldehyde. American J. Ind. Med. 7: 229-240.

Sunday Sun (Nigeria) Newspaper (2007). 3(27): 5.

Takashi M, Hasegawa R, Furukawa F, Toyoda K, Seta H, Hayashi V (1986). Effects of ethanol, potassium metabisulfite, formaldehyde and hydrogen peroxide on gastric carcinogenesis in rats after initiation with N-methyl-N-nitro-N-nitrosoguanicidine. Japan J. Cancer Res. 77: 118-124.

Vaughn TL, Strader C (1986). Formaldehyde and cancer of the pharynx, sinus and nasal cavity. Int. J. Cancer, 38: 677-683

Wright PJ, Leathwood PD, Plummer DT (1972). Enzymes in rat urine alkaline phosphatase, Enzymologia, 42:317-327.

Yakubu MT, Akanji MA, Oladiji AT (2005). Aphrodisiac potentials of aqueous extract of Fadogia agrestis (Schweinf. Ex Heirn) stem in male albino rats. Asian J. Androl. 7(4): 399-404.