ISSN: 2278-4632
Vol-12 Issue-10 No.01 October 2022

ALUMINIUM LEACHING FROM FOOD CONTAINERS UNDER STRESS CONDITIONS CAUSES ALZHEIMER'S

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Abstract
Aluminum leaching from food containers under stressed conditions causes Alzheimer's disease. There is a chance of leaching of aluminum from foil food containers which causes Alzheimer's by exposure of aluminum. Aluminum is a neurotoxic metal and its exposure may be factor in etiology of various neurodegenerative diseases such as Alzheimer's disease (AD). There is a minute leaching of Al in the acidic and basic conditions which is examined by sample analysis and UV spectroscopic methods the sample was examined for identification of Al and scanned in UV. The drastic leaching of aluminum from the aluminum foil food containers causes deposition of aluminum in brain which causes neurodegenerative diseases like AD. Many studies have been performed to demonstrate aluminum effects on the human brain, and almost every study came to conclusion that patients with Alzheimer's or Parkinson's disease have elevated levels of aluminum.

key words: Aluminum food containers, stressed conditions, UVspectroscopy,Alzheimer's.

Introduction:

Aluminium is the third most common element in the earth crust.only oxygen and silicon are present in great proportion. Aluminium found in nature as a stable aluminium silicates. Aluminium eminent play the role in developmentbof alzheimers disease through drinking water and food (2) Aluminium has a extensive use in various end markets such as packaging.most of the aluminium used in the packaging in the form of rolled products either as flexible packaging such as fine foils or as a rigid packaging such as beverage can.
Aluminium is used in manufacturing of domestric coocking utensils ,because it can be bent or pressed into various shapes. The attractive prperties of rolled aluminium used in packaging can be summarized as duratability, strength, lightness, thermal conductivity, heat resistance, (3) barrier properties, food and drink compatibility, decorative potential,foil laminate, sustainability of aluminium pacakaging.

Brain Al load:

The possible role of aluminium in Alzheimer's disease(AD) gives risee to the importanat question wheather Al can enter the brain, and if it does,what the mechanism(s) of entry are.three routes have been proposed by which Al could enter brain fromm systemic circulation:blod brain barrier(BBB),nasal,olfactory pathway (11)and cerebro spinal fluid.more rapid exchange is possible through the BBB,as many carriers of Al have been identified at

BBB (14). (15)Transferrin(tf) mediated transport of aluminium ,is one of the mechanism suggested. Monocarboxylate transporter (MCT) is the another important carrier for brain aluminium influx,which is a proton co transporter, present at luminal and abluminal surfaceses of BBB. Despite its uniquitous presence,only 0.06-0.1% of Al which is ingested is absorbed across the gastrointestinal tractS (16).The uptake of Al was limited by presence other dietary compounds,such as citrate (17)which forms complex with it and commpetes with Ca,Mg,Si.., (18) Al absorption is presumed to be effected by vitamin-D and parathyroid hormones. (19)The involvement of gentic variant Tf, (20) has been found to be responsible for exces transport to brain.Al entry is restricted to the brain when once in the blood,the BBB comes into the picture.The changes in the structure and the function of the BBB underlies the various findings related to Al accumulation in AD. (21)Eventhough there is Al in brain of AD patients, the relation between Al and Alzheimer's is demonstrated by various studies that Al effects brain, and almost every study comes to the conclusion that ,there was elevated levels of Al in patient's with Alzheimer's disease and Parkinson's diseases . (22) These devasted and long lasting diseases are making their way into the lives of people through the environment and packaging of Al. (23)The food industry along with peopple who consumed need to be more aware about the health risks associated with the Al uptake in selective ways.Although that substantial link between the AD was not proven. But studies on the Al uptake indicated that it enters into the brain and bound to protein called transferrin,the protein that binds and transports the iron in the body. When the aluminium accumulated in brain,it aloso accumulates in other body organs like liver,bone,kidney ultimately results in kidney damage,renal effects,etc,. (24) Most of the publications states that food which is wrapped or stored in aluminum foil or containers causes in increase in aluminum content. (25)

MATERIALS AND METHODS

CHEMICAL REQUIREMENTS: Aluminium hydroxide standard solution, Acidic reagents like acetic acid, citric acid and basic reagents like sodium carbonate and sodium bicarbonate, Complexometric titration reagents

EQUIPMENTS REQUIRED:

- Uv spectrophotometer mini spectrophotometer SL 207
- Spectra treat software was used along with quartz cuvette
- Absoption spectra was recorded on multiple wave length
- Digital weighing balance- scale from infra tech sales and services, Chennai

SELECTION OF STRESSED CONDITIONS :

Where the extent of increassed leaching of aluminum is strongly dependent of temperature , pH and orgganic acids etc,. (26)

1.pH As the food we eat may be at different pH conditions ,three different pH ranges have been selected. The food we eat may contain different substances which are at different pH ranges. For example lemon which contain citric acid is at acidic pH and water is neutral substance.

2.Temperature: As the food and others substance has been packed into food containers in the hot conditions only, so Tempetarure is considered as one of the stress condition.

SELECTION OF REAGENTS: most of the food contains citric acid,vinegar by this the selection of reagents involves in acidic,basic and neutral type . (27)

ACIDIC REAGENTS: Acetic acid, Citric acid

NEUTRAL REAGENTS : Water

BASIC REAGENTS: Sodium carbonate(Na2CO3), Sodium bicarbonate (NaHCO3) (28)

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METHODS OF DETERMINATION

QUALITATIVEMETHOD: Identificationtests

INSTRUMENTAL METHOD: uv spectroscopy

METHOD DEVELOPMENT

Test Sample preparation: 100 ml of water was heated and poured into container. Allowed to cool for 30 minutes . the prepared solutions are treated as a sample and undergone with various tests.

Reference Sample preparation: 100 ml of water with 1gm of aluminium hydroxide(Al(OH)3) was heated and poured into container. Allowed to cool for 30 minutes . The prepared solution are treated as a reference sample and undergone with various tests.

Figure1:test sample analysis

Figure2:reference sample analysis

OPTIMIZED METHODS:

QUALITATIVE TESTS:

Identification tests: General test for Aluminium identification are with sodium hydroxide and ammonium hydroxide.

Reference with NaOH: To the standard solution of aluminium hydroxide(Al(OH)3), add few ml of sodium hydroxide (NaOH) results in the formation of white precipitate.

Reference with NH4OH: To the standard solution of Aluminium hydroxide add few drops of Ammonium hydroxide (NH4OH)forms white ring indicated presence of aluminium (29)

Figure3:Ref sample with NaOH

Figure4:Ref sample with NH4OH

For basic solutions: The identification of alumiunium in basic solutions, the test solution is treated by different basic reagents and identified by general identification test of aluminium which indicates the leaching of aluminium in basic solutions.

Sodium carbonate with NaOH: To the test sample solution of sodium carbonate (10% sodium carbonate solution heated and poured into aluminium container) add few drops of sodium hydroxide (NaOH) results in the formation of white precipitate indicates presence of aluminium.

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Sodium carbonate with NH4OH: To the test sample solution of sodium carbonate(10% sodium carbonate solution heated and poured into aluminium container)add few drops of ammonium hydroxide results in the formation of white ring indicates presence of aluminium.

Sodium bicarbonate with NaOH: To the test sample solution of sodium bicarbonate (10%sodium bicarbonate heated and poured into aluminium container) add few drops of sodium hydroxide results in the formation of white precipitate indicates presence of aluminium.

Figure5: Na_2Co_3 with NaOH

Figure6: Na_2Co_3 with NH4OH

Figure7: $NaHCo_3$ with NaOH

UV SPECTROSCOPY METHOD:

Test Sample analysis:

Neutral reference sample preparation:
0.1 grams of aluminium hydroxide is dissolved in 10ml of water. From the above solution 1ml is pippeted out and diluted to 10ml with distilled water. The solution is scanned between 200-600nm wavelength.

For neutral solution:
Sample solution(heated water which is poured into aluminium container) is taken and diluted to 10 ml with distilled water The solution is scanned between 200-600nm wavelength.

For Basic solution:

With sodium carbonate reference sample preparation:
Sample solution of sodium carbonate(10% sodium carbonate solution heated and poured into aluminium container) is taken and diluted. To this 0.1 gram standard aluminium hydroxide. From the above solution 1ml is pippeted out and diluted to 10ml with distilled water. The solution is scanned between 200-600nm wavelength.

Test Sodium carbonate sample: Sample solution (10% sodium carbonate is heated and poured into aluminium container) is taken and diluted to 10ml with distilled water. The solution is scanned between 200-600nm wavelength.

Sodium bicarbonate reference sample preparation:
Sample solution of sodium bicarbonate(10% sodium bicarbonate solution heated and poured into aluminium container) is taken and diluted to 10ml with distilled water. To the above solution add 0.1 gram aluminium hydroxide.From the above solution 1ml is pippeted out and diluted to 10ml with distilled water. The solution is scanned between 200-600nmwavelength.

Test Sodium bicarbonate sample:
Sample solution of sodium bicarbonate (10%sodium bicarbonate solution heated and poured into aluminium container) is taken and diluted to 10ml with distilled water. The solution is scanned between 200-600nm wavelengths.

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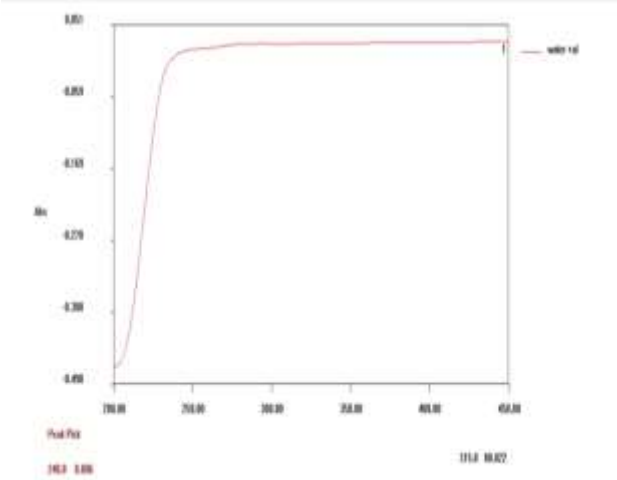

Figure8 ref neutral sample analysis

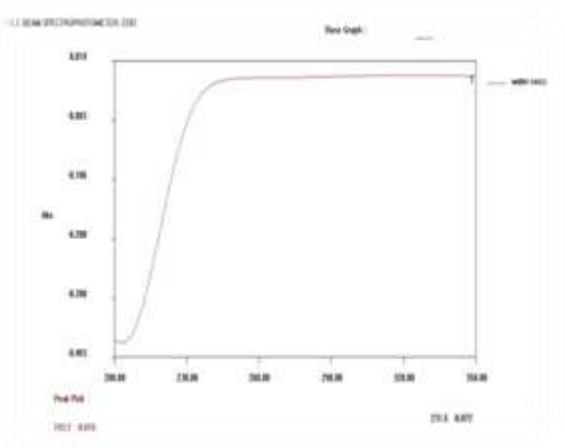

Figure9 test neutral sample analysis

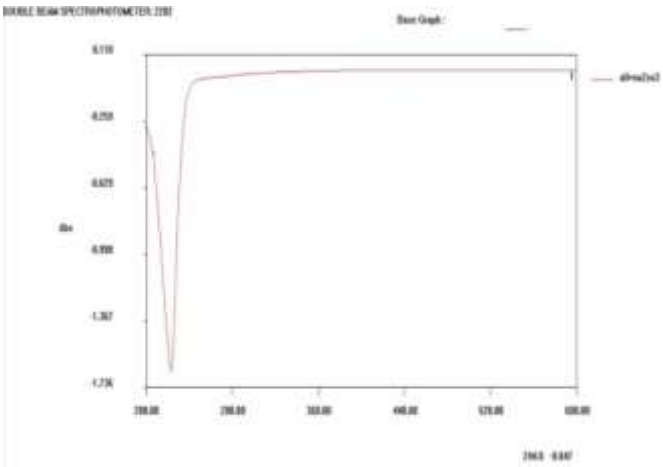

Figure10 ref sodium carbonate sample

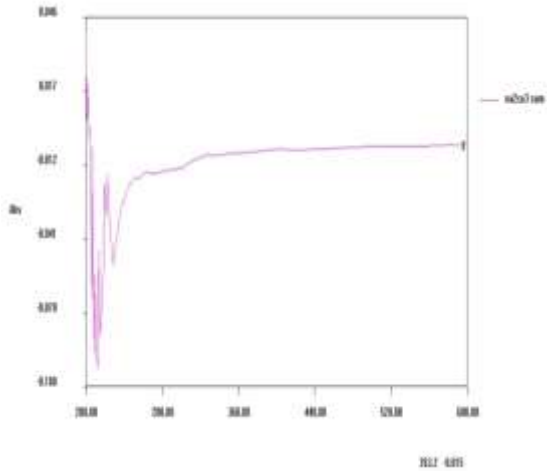

Figure11 test sodium carbonate sample

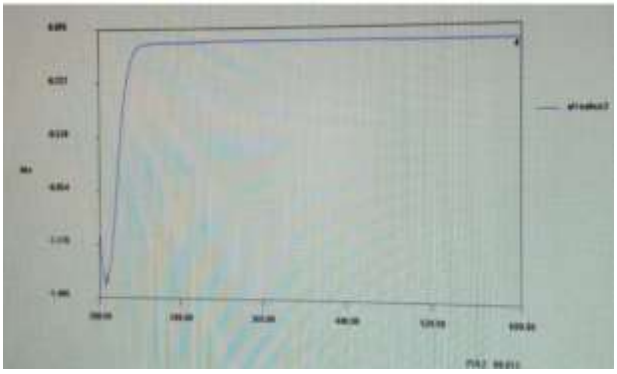

Figure12 ref sodium bicarbonate sample

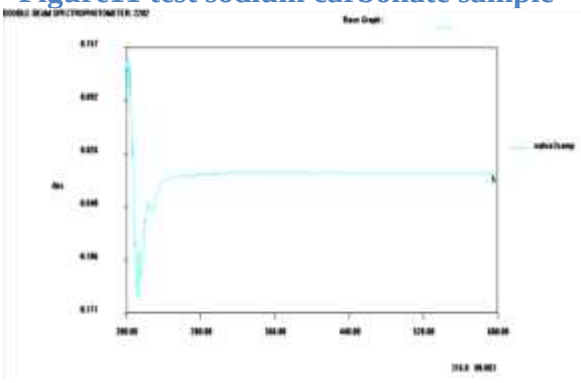

Figure13 testsodium bicarbonate sample with

Acidic solution (Citric acid) reference sample preparation:

Sample solution of citric acid (lemon juice heated and poured into aluminium ontainers) is taken and diluted to 10ml with water To this solution add 0.1 gram Aluminium hydroxide is added. From the above solution 1ml is pippeted out and diluted to 10ml with distilled water. The solution is scanned between 200-600nm wavelength.

Test Citric acid sample:

Sample solution of citric acid(Lemon juice heated and poured into aluminium container) is taken and diluted to 10ml with water. The solution is scanned between the wavelength 200-600nm.

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With Acetic acid reference sample preparation:

sample solution of acetic acid(vinegar heated and poured into Aluminium container) is taken and diluted to 10ml with distilled water. To this add 0.1 gram Aluminium hydroxide. From the above solution 1ml is pippeted out and diluted to 10ml with distilled water.The solution is scanned between the wavelength 200-600nm.

Test Acetic acid sample:

Sample solution of Acetic acid (Vinegar heated and poured into Aluminium container) Is taken and diluted to 10ml with distilled water. The solution is scanned between the wavelength 200-600nm.

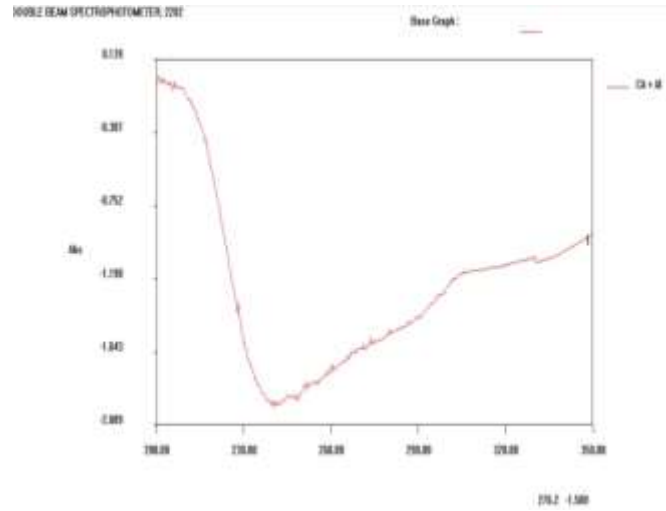

Figure14 ref citric acid sample

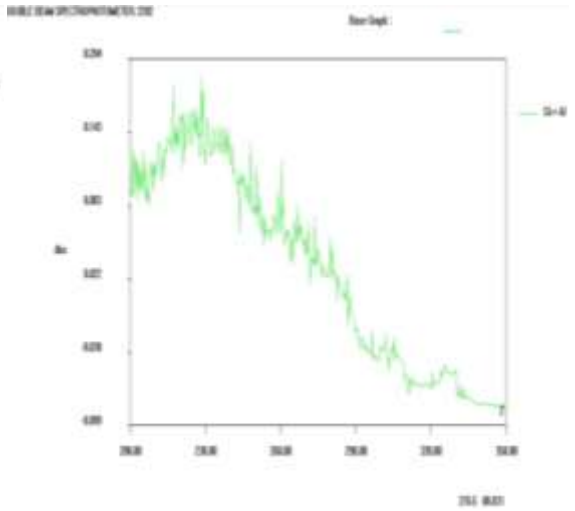

Figure15 test citric acid sample

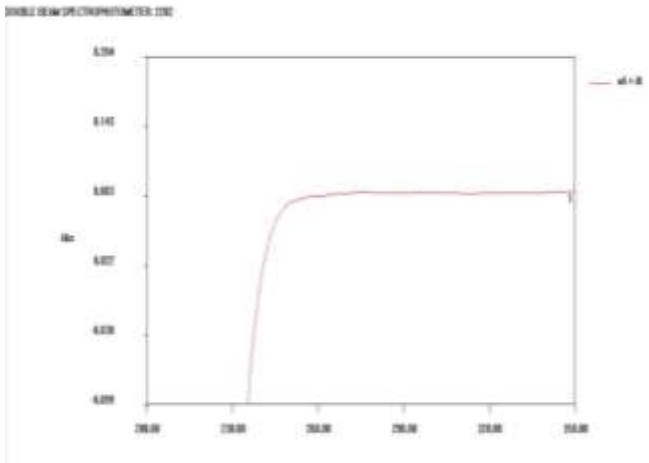

Figure16 ref acetic acid sample

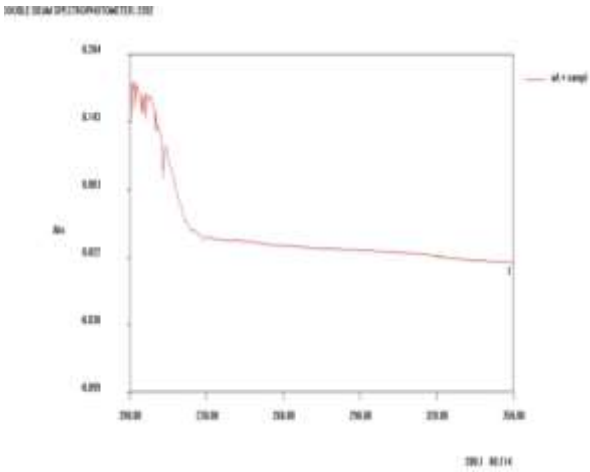

Figure17 test acetic acid sample

LINEARITY GRAPH FOR ALUMINIUM HYDROXIDE STANDARD SOLUTION: Various dilutions of Aluminium hydroxide standard solution is taken and absorbance is checked under wave length between 200-400 (table1)

Concentration(µg/ml)	Absorbance
1	-0.007
3	-0.022
5	-0.037
7	-0.051
9	-0.067

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10	0.074

Table1: aluminium conc and absorbance

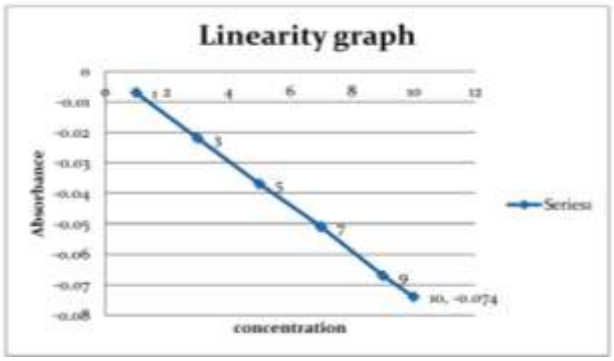

Figure17 test sample with acetic acid

RESULTS AND DISSCUSION:

From Identification test: The basic solutions like sodium carbonate and sodium bicarbonate are heated and poured in Al containers,cooled and tested for presence of Al by forming white precipate by treating the sodium carbonate with NaOH; the other is the sodium carbonate test solution along with NH4OH results in ring formation results in presence of aliminium. The test with sodium bicarbonate solution treated with NaOH yields to white precipitate which indicates presence of alumimim.

From Uv spectroscopic methods: From the analysis it was found that there is a leaching of aluminium from the Aluminium containers in neutral solutions (water). From the linearity graph it was observed that absorption of aluminium hydroxide varies with the concentration.

CONCLUSION:

The summary of results of projects can be concluded as:

There is drastic leach of aluminum from Aluminum containers in basic and neutral conditions Leaching is negligible in acidic conditions. From the work we have done till now it was observed that There is a chances of leaching of aluminum and other substances from the food containers under stressed conditions and we want to continue our work by further working on it by using other methods. With the continueous use of aluminum containers there is chance of increase in aluminum load in brain which leads to alzheimeir's disease. So it is better to stop usage the aluminum food container and replace them with glass or other material. upon the continuous storage the Al containers gets detoriated which causes the spoilage of storage material and containers too.

Fig: Detoriated aluminum foils upon stored with alkaline solution

ISSN: 2278-4632
Vol-12 Issue-10 No.01 October 2022

ACKNOWLEDGEMENT

This work was supported and done at my B.pharmacy as a project in the aditya pharmacy college,surrampalem. sowmya.k, geetha.k,divya teja.k,bhagya.k. are participated and helped to done this work together under guidance of Ch.hemath kumar M.pharm,(PhD).

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