

Iodometric Analysis of Formalin in Different Foods

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Abstract: The purpose of this study was to analysis formalin in different foods such as vegetables, fruits, seafoods and frozen food in Kalasin, Thailand. The method selected 10 plant samples such as carrot, onion, cucumber, tomato, lemon, green apple, grape, red apple, orange and banana, respectively. The seafood and frozen food were 12 samples such as sausage, shrimp, crab bar, fish ball, pork mixed chicken ball, chicken drumstick, chicken wing, pork, dolly fish, saba fish, squid and mussel, respectively. The chemical method was iodometric analysis of formalin in different foods. The results found formalin accumulated in 10 plants samples such as carrot, onion, cucumber, tomato, lemon, green apple, grape, red apple, orange and banana were 4.81 ± 0.26 , 4.60 ± 2.56 , 6.25 ± 2.02 , 8.77 ± 2.12 , 10.05 ± 1.46 , 6.53 ± 2.05 , 7.18 ± 2.47 , 2.805 ± 0.01 , 9.08 ± 0.45 and 3.69 ± 1.42 mgkg^{-1} , respectively. The seafood and frozen food found formalin content in 12 samples such as sausage, shrimp, crab bar, fish ball, pork mixed chicken ball, chicken drumstick, chicken wing, pork, dolly fish, saba fish, squid and mussel were 8.27 ± 2.8 , 8.14 ± 1.01 , 6.57 ± 1.14 , 13.19 ± 0.74 , 7.11 ± 1.82 , 7.68 ± 1.30 , 6.35 ± 0.95 , 12.37 ± 3.34 , 12.13 ± 0.58 , 7.68 ± 0.01 , 9.39 ± 0.06 and 6.71 ± 0.86 mgkg^{-1} , respectively. The research compares the amount of formalin level content in plant, seafood and frozen food. The highest formalin in plant was lemon. The highest formalin in seafood and frozen food was in fish ball. Therefore, the researcher expects this research will be useful for health consumers that selects seafood and frozen food.

Key words: Formalin, vegetables, fruits, seafood and frozen food, mixed, chicken

INTRODUCTION

Formalin is a cadaverous chemical of 37-50% aqueous solution of dissolved formaldehyde (CH_2O) in water. It is flammable, surprisingly reactive with many substances and with ease polymerizing colorless gas at regular temperature and strain. In air, it's far conveniently broken down by means of daylight with a half-life of about 30-50 min. But in liquid shape, it's miles solid over the years. Upon intraperitoneal, oral or inhaler publicity, formalin quickly diffuses into many tissues, inclusive of the brain, testis and liver. Formaldehyde is fast absorbed from the gastrointestinal tract following ingestion and from the breathing tract following inhalation which makes it a dangerous chemical for use as preservative (Mamun *et al.*, 2014).

Formaldehyde is a flammable, distinctly reactive and effectively polymerizing colorless gasoline at ordinary temperature and strain. It has a smelly, wonderful smell and may motive a burning sensation to the eyes, nose and lungs at excessive concentrations. Formalin, a formaldehyde water solution (40 vol.% or 37 wt.%) is a colorless liquid that's used as an organic preservative. Currently, it has been reported that formalin is broadly used in distinct countries as a chemical preservative for end result and fishes. There are direct and

indirect health hazards related to formaldehyde intake. The usage of formaldehyde as a food preservative is illegal in most of the nations. To restriction the use of formaldehyde as a meals preservative, the regulatory bodies frequently acquire food samples from nearby markets to carry out immediate evaluation or to ship it to the close by analytical laboratory for the qualitative and quantitative analysis of formaldehyde delivered in meals items but formaldehyde is certainly found in a huge form of meals objects including: culmination and greens, meats, fish, crustacean and dried mushroom as a common metabolic. In organic systems, formaldehyde is generated from distinct methylated compounds by demethylases and from serine-glycine interconversion catalyzed by way of pyridoxal phosphate evidently occurring formaldehyde content additionally varies consistent with the meal's objects and food conditions. The presence of evidently happening formaldehyde in meals items may additionally intrude in detecting artificially delivered formaldehyde in foods, therefore, it's far essential to quantify the evidently happening formaldehyde content material in food items to estimate external formaldehyde dosage (Songur *et al.*, 2010; Abdu *et al.*, 2014).

In latest years, formaldehyde is mentioned to be broadly used as a meals preservative to increase the shelf life of fruits and fishes in tropical countries.

Formaldehyde is averse to human health. Formaldehyde as a food preservative is legally prohibited in maximum of the international locations. To adjust formaldehyde software in foods, the regulatory bodies frequently behavior on-the-spot analytical checks to locate artificially added formaldehyde in meals objects. however, formaldehyde is ubiquitous within the environment and is present in many animal and plant species as a product of their normal metabolism. This clearly going on formaldehyde may additionally intervene within the detection of artificially added formaldehyde in ingredients. It's far, therefore, important to have a look at the concentration and formation mechanism of clearly taking place formaldehyde in food items. International Agency For Research on Cancer (2006) formaldehyde is a drab, smelly and irritant compound. it is usually observed as 37% aqueous answer that's known as formalin (Satin, 2004). Formaldehyde is used for various functions, together with preservatives and disinfectant. It additionally may be used in the production of cosmetics and commercial processes in addition to study and pulp production (McNary and Jackson, 2007; Immaculate and Jamila, 2018). Ingestion of as low as 30 mL of formalin has been stated to motive death in an adult individual. Ingestion may additionally cause corrosive injury to the gastrointestinal mucosa with nausea, vomiting, ache, bleeding and perforation. Corrosive accidents are commonly maximum pronounced inside the pharyngeal mucosa, epiglottis and esophagus. Systemic outcomes include metabolic acidosis, critical nervous device depression and coma, respiration distress, renal failure and associated cancer and tumor improvement (Wooster *et al.*, 2005). In this way the aim of this study was to analysis formalin in difference foods such as vegetables, fruits, seafoods and frozen food in Kalasin, Thailand.

MATERIALS AND METHODS

Selected samples: The method selected 10 vegetables and fruits samples such as carrot, onion, cucumber, tomato, lemon, green apple, grape, red apple, orange and banana, respectively. The seafood and frozen food were 12 samples such as sausage, shrimp, crab bar, fish ball, pork mixed chicken ball, chicken drumstick, chicken wing, pork, dolly fish, saba fish, squid and mussel, respectively.

Chemical analysis: The chemical method used iodometric analysis of formalin content in difference foods. In this method the samples fruits, vegetables, seafood frozen food added to an excess of hypoiodite, formed by acidifying standard potassium iodate an excess of potassium iodide and making the solution alkaline. Part of the hypoiodite is reduced by the formaldehyde in the

samples and the unreduced part is converted to iodine by acidifying the solution. The iodine is then titrated with sodium thiosulfate using starch indicator. Formalin is a solution of formaldehyde in water. The formulas for processing solutions are based on formalin which is 37.5% formaldehyde by weight and with a specific gravity of 1.095. The percent by weight and the specific gravity enter into the calculations for this determination. (Kingzett, Chem. News, 41:76 (1880); 43:161 (1881) I. M. Kolthoff, ChemWeekblad, 17:197 (1920) Walker (1964).

Step 1; Preparing samples: Grind sample 5 g and pipet 50.0 mL of 0.1 N potassium iodate into a 250-mL, add 5 mL of 7.0 N sulfuric acid, add 25 mL of 0.60 M potassium. Then mixed sample, add 25 mL of 2.5 N sodium hydroxide, add 10 mL of 7.0 N sulfuric acid.

Step 2; Titration: After preparing samples step 2 was titrate immediately with standardized 0.1 N sodium thiosulfate to a light-yellow color. Add 5 mL of starch indicator from a tip-up pipet and continue the titration to the disappearance of the blue color. Recorded the mL of standardized 0.1 sodium thiosulfate used.

Step 3; Calculation: Formalin, mg/kg = $(N \text{ KIO}_3) (\text{mL KIO}_3) - (N \text{ Na}_2\text{S}_2\text{O}_3) (\text{mL Na}_2\text{S}_2\text{O}_3) (\text{eq. wt. CH}_2\text{O}) (1000) (100) / (\text{g of sample}) (\% \text{ CH}_2\text{O by wt.}) (\text{sp g of CH}_2\text{O}) (1000) = (N \text{ KIO}_3) (50.0) - (N \text{ Na}_2\text{S}_2\text{O}_3) (\text{mL Na}_2\text{S}_2\text{O}_3) (15.015) (1000) (100) / (\text{g of sample}) (37.5) (1.095) (1000)$ (C.T. Kingzett, Chem. News, 41:76 (1880); 43:161 (1881) I. M. Kolthoff, ChemWeekblad, 17:197 (1920) Walker (1964).

RESULTS AND DISCUSSION

The results in Table 1 found formalin accumulated in 10 plants samples such as carrot, onion, cucumber, tomato, lemon, green apple, grape, red apple, orange and banana were 4.81 ± 0.26 , 4.60 ± 2.56 , 6.25 ± 2.02 , 8.77 ± 2.12 , 10.05 ± 1.46 , 6.53 ± 2.05 , 7.18 ± 2.47 , 2.805 ± 0.01 , 9.08 ± 0.45 and $3.69 \pm 1.42 \text{ mg kg}^{-1}$, respectively.

The seafood and frozen food in Table 2 found formalin content in 12 samples such as sausage, shrimp, crab bar, fish ball, pork mixed chicken ball, chicken drumstick, chicken wing, pork, dolly fish, saba fish, squid and mussel were 8.27 ± 2.8 , 8.14 ± 1.01 , 6.57 ± 1.14 , 13.19 ± 0.74 , 7.11 ± 1.82 , 7.68 ± 1.30 , 6.35 ± 0.95 , 12.37 ± 3.34 , 12.13 ± 0.58 , 7.68 ± 0.01 , 9.39 ± 0.06 and $6.71 \pm 0.86 \text{ mg kg}^{-1}$, respectively.

Sea foods are the cheap source of animal protein which come after meat and fowl animal protein foods. Seafood is a vital diet for lots people due to their unique dietary composition. As the sector populace is developing,

Table 1: Formalin content in vegetables and fruits

| Vegetables and fruits samples | Formalin (mgkg ⁻¹) |
|-------------------------------|--------------------------------|
| Carrot | 4.81±0.260 |
| Onion | 4.60±2.560 |
| Cucumber | 6.25±2.020 |
| Tomato | 8.77±2.120 |
| Lemon | 10.05±1.460 |
| Green apple | 6.53±2.050 |
| Grape | 7.18±2.470 |
| Red apple | 2.805±0.01 |
| Orange | 9.08±0.450 |
| Banana | 3.69±1.420 |

Table 2: Seafood and frozen food samples

| Seafood and frozen food samples | Formalin (mgkg ⁻¹) |
|---------------------------------|--------------------------------|
| Sausage | 8.27±2.800 |
| Shrimp | 8.14±1.010 |
| Crab bar | 6.57±1.14 |
| Fish ball | 13.19±0.740 |
| Pork mixed chicken ball | 7.11±1.820 |
| Chicken drumstick | 7.68±1.300 |
| Chicken wing | 6.35±0.950 |
| Pork | 12.37±3.340 |
| Dolly fish | 12.13±0.580 |
| Saba fish | 7.68±0.010 |
| Squid | 9.39±0.060 |
| Mussel | 6.71±0.860 |

the per capita intake of seafood is likewise growing swiftly. The low fats content material of many sea meals and the effect on coronary heart sickness of the n-3 polyunsaturated fatty acids in fatty pelagic fish species are extremely crucial element for health aware human beings in particular in affluent international locations where cardiovascular disorder mortality is high (Adebayo-Tayo *et al.*, 2012; Immaculate and Jamila, 2018) other than imparting nutrition, sea foods also motive harm to human health. The maximum large sources of fish borne sicknesses are related to the microbiological and chemical hazards. Chemical contamination in fish may additionally encompass herbal toxicants along with mycotoxins (Melchert and Pabel, 2004) and marine toxin environmental contaminants together with mercury and lead (Hui *et al.*, 2005). The formation of formaldehyde in fish can motive muscle sturdiness. Formaldehyde is a simple compound that's product of carbon, hydrogen and oxygen with the chemical formulae of CH₂O (Formaldehyde). It's miles determined everywhere and produced evidently by means of plant life, animals and human beings as part of regular lifestyles manner other than that formaldehyde is biodegradable and it could be destroyed via. the photochemical strategies which occur within the surroundings, via. biological moves within the frame and herbal processes in soil and water. It also categorized as the best aldehyde and its systematic name is methanol (Zhang *et al.*, 2009) and evidently taking place materials.

Formaldehyde became produced via. enzymatic decomposition of Trimethylamine-Oxide (TMAO) to equimolar amounts of Formaldehyde (FA) and

Dimethylamine (DMA) in seafood at some stage in postmortem storage and the general reaction equation is TMAO→DMA+formaldehyde (Kimura *et al.*, 2003). Formaldehyde additionally produced evidently and advanced throughout postmortem in marine fish by using an enzymatic reduction. The enzymatic reduction results in breakdown of trimethylamine oxide to formaldehyde and dimethylamine. Recent developments in international food manufacturing, processing, distribution and education are creating an increasing call for for meals safety research, so that, it will make sure a more secure global meals supply, however, chemical contamination in meals results in the primary sources of the foodborne sickness among them, terrific attention has been paid towards volatiles poisonous aldehydes like formaldehyde which has been suggested by way of the global agency for research on cancers carcinogenic to human beings. (Bianchi *et al.*, 2007, Cui *et al.*, 2007, Norliana *et al.*, 2009). Food safety has grown to be a crucial trouble and a broadly talked phrase of contemporary age. Medical field describes that proper managing, preparation and garage of food save you food borne contamination (Satin, 2004; Immaculate and Jamila, 2018). This includes some of exercises that ought to be observed to keep away from doubtlessly severe fitness hazards in human. Now a days people are more fitness aware and emphasize that food need to not most effective be nutritionally balanced but additionally secure for human consumption. Many national and international groups are working in collaboration to make certain meals protection and in maximum of the industrialized countries the issue of food safety, nice and environmental concerns are greater vital than the product charge and profits adjustments seafood constitutes an important meals element for a massive section of global population. (FAO, 2009).

CONCLUSION

The conclusion of this study found the amount of formalin level content in vegetables, fruits, seafood and frozen food. The highest formalin in plant was lemon (10.05±1.46 mgkg⁻¹), the second was orange (9.08±0.45 mgkg⁻¹), the third was tomato (8.77±2.12 mgkg⁻¹), the fourth was grape (7.18±2.47 mgkg⁻¹), the fifth was green apple (6.53±2.05 mgkg⁻¹), the sixth was cucumber (6.25±2.02mgkg⁻¹) the seventh was carrot (4.81 ±0.26mgkg⁻¹) the eight was onion (4.60±2.56 mgkg⁻¹) the ninth was banana (3.69±1.42 mgkg⁻¹) and the tenth was red apple 2.805±0.01 mgkg⁻¹), respectively. The highest formalin in seafood and frozen food was in fish ball (13.19±0.74 mgkg⁻¹), the second was pork (12.37±3.34 mgkg⁻¹), the third was dolly fish (12.13±0.58 mgkg⁻¹), the fourth was squid (9.39±0.06 mgkg⁻¹), the fifth was sausage (8.27±2.8 mgkg⁻¹), the sixth was shrimp (8.14±1.01 mgkg⁻¹) the seventh was saba fish

($7.68 \pm 0.01 \text{ mgkg}^{-1}$) the eight was chicken drumstick ($7.68 \pm 1.30 \text{ mgkg}^{-1}$) the ninth was pork mixed chicken ball ($7.11 \pm 1.82 \text{ mgkg}^{-1}$) the tenth was mussel ($6.71 \pm 0.86 \text{ mgkg}^{-1}$), the eleventh was crab bar ($6.57 \pm 1.14 \text{ mgkg}^{-1}$) and the twelfth was chicken wing $6.35 \pm 0.95 \text{ mgkg}^{-1}$. Therefore, the researcher expects this research will be useful for health consumers that selects seafood and frozen food.

Formaldehyde is metabolized naturally in our bodies by everyday metabolism and can also be determined in the air, natural meals, a few skin-care merchandises as well as preservatives in processed meals, specifically in dried and frozen meals (Zhang *et al.*, 2009). Small amount of formaldehyde does not harm fitness, however, it could cause minor to severe troubles along with pain, vomiting, coma and possible loss of life whilst large doses of formaldehyde is taken (Cui *et al.*, 2007).

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