

ORIGINAL ARTICLE

Analysis of Lead Chromate, Insect Infestation, Urea and pH in Various Brands of Instant Noodles Marketed in Malaysia.

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Abstract

Aim: Instant noodles have been a famous choice for people of all ages. However, there are more chemicals and harmful contents that have been used in the food production process which people are not aware of and not having concern about the negative effects on the human's health. Lead chromate, urea and insect infestation have been reported to cause significant health problem to human being. Moreover, deviation of normal pH can lead to metabolic disturbances.

Methods: In this study, qualitative analysis of some additive chemicals such as urea, lead chromate, insect infestation and pH determination were done.

Results: Among the 6 brands tested based on local-made product brands, we found that 2 of the brands contained lead chromate. As for insect infestation and urea test, negative results were observed and recorded for all instant noodles brands. For the pH value, one of the brands were found most alkaline and one as the most acidic.

Conclusion: Among the six instant noodles brands, two brands of instant noodles contained lead chromate and one was the most alkaline while the other with the most acidic content

Keywords: Chemicals, Insect infestation, Lead chromate, Noodles, pH, Urea.

Introduction

With food manufacturing and increasing demand, instant noodles have been a favourite choice of meal for people in all ages. In Malaysia, a report shows that Malaysians consume 3.6 million packets of instant noodles every day, which comes up to 1.34 billion packets of instant noodles being consumed every year.^[1] The real problem these days is the fact that people have started replacing real food with instant food, which is highly processed, richer in flavour, but, unfortunately, devoid of any nutrition.^[2] Somehow, they also contain harmful substances that can affect our health. Harmful substances in instant noodles and its effect towards health has often been questioned. A study showed that frequent consumption of instant noodles may be associated with increased cardio-metabolic risk factors among apparently healthy college students aged 18–29 years.^[3] The main ingredients for instant noodles are wheat flour, salt, or kansui (alkaline salt mixture of sodium carbonate, potassium carbonate, and sodium phosphate), and water. Other ingredients like starch, gums, emulsifiers, stabilizers, antioxidants, colouring, and flavouring agents are also added to improve the texture, eating quality, and shelf life of instant noodles.^[4] The contents of the soup powder are identical to those of the noodles as they both contain numerous harmful compounds and substances that can harm one's health. Instant noodles also have high levels of sodium and trans fats, both of which can raise cholesterol and blood pressure and lead to more serious, life-threatening conditions.^[5] One of the harmful components in the instant noodle's powder is bisphenol A (BPA), which can be found in the polystyrene foam containers in which the instant noodles are packaged, is another potential risk for women. Exposure to BPA interfere with enzymes essential in the production of estradiol.^[6]

Another substance that is commonly used in instant food industry is lead chromate. Lead chromate is widely used in food industry as a

yellow pigment used to enhance brightness. Studies have implicated that the addition of lead chromate in food have been the source of lead exposure.^[7] Adulterating food with lead chromate possess significant risks to human health and development such as neurotoxic effects. Lead chromate also can increase cancer mortality. Workers exposed to various forms of chromium compounds have suggested an increased incidences of respiratory cancers.^[8] It was suggested that one possible mechanism for lead chromate-induced carcinogenesis is through centrosome dysfunction, leading to the induction of aneuploidy.^[9]

One of the substances that may also be present in instant noodles is urea. It is reported that urea is used as flavouring agent and food additive in formulation and fermentation of yeast-raised baked goods, alcoholic beverages, and gelatine products.^[10] Urea, also known as carbamide, is an organic compound and chief nitrogenous end product of the metabolic breakdown of proteins in all mammals and some fishes.^[11] The substance occurs not only in the urine of all mammals but also in their blood, bile, milk, and perspiration. In the course of the breakdown of proteins, amino groups (NH₂) are removed from the amino acids that partly comprise proteins. These amino groups are converted to ammonia (NH₃), which is toxic to the body and thus must be converted to urea by the liver. The urea then passes to the kidneys and is eventually excreted in the urine.^[12] Urea can be irritating to the skin, eyes, and the respiratory tract. Repeated or prolonged contact with urea in fertilizer form on the skin may cause dermatitis. The substance decomposes on heating above melting point, producing toxic gases, and reacts violently with strong oxidants, nitrites, inorganic chlorides, chlorites and perchlorates, causing fire and explosion.^[13] Ingestion of urea can cause gastrointestinal irritation with nausea, vomiting and diarrhoea and cardiac disturbances. Inhalation of urea may cause respiratory tract irritation. In chronic condition, prolonged or repeated exposure may cause adverse

reproductive effects. In addition, neurological complications of uraemia can include seizures, lethargy, jerking movements, and stimulus-sensitive myoclonus.^[14]

As instant noodles are also included as processed and stored food, therefore it is susceptible to insect infestation. Pests that infest food include centipedes, cockroaches, dust mites, moths and silverfish. The food can become contaminated at any point during production, unsanitary conditions coupled with disease-carrying pests in food facilities until it arrives in consumer's home.^[15] Cockroaches can carry and spread diseases, including salmonella. Fire ant stings can cause serious allergic reactions.^[16] Signs of a cockroach infestation include faeces, saliva, and parts of their bodies that may shed or that fall off. Similar to dust mites, these parts of a cockroach contain specific proteins or allergens that may cause allergies or can even trigger asthma symptoms. In addition to these proteins that the cockroaches naturally carry, there have been tests done on cockroaches that examine the pathogens in their bodies such as *Salmonella* species, which causes typhoid. Poliovirus, which causes polio, has also been found in these insects. They can also cause dysentery.^[17]

pH plays a very important role in food preservation. In order to maintain the quality of industrial food, the pH of the food must be adjusted to prevent any unwanted microbial growth that may also be a detrimental factor. High pH level of instant noodles may cause many health problems to human. Excess of alkalinity in the body may cause gastrointestinal issues and skin irritations.^[18] Too much alkalinity may also agitate the body's normal pH, leading to metabolic alkalosis, a condition that may produce the following symptoms such as nausea, vomiting, hand tremors, muscle twitching, tingling in the extremities or face, and confusion. Alkalosis can also cause a decrease in free calcium in the body, which can affect bone health. This study was therefore conducted to analyze the presence of lead chromate, urea, insect infestation, and the pH value of noodle and soup powder from various

brands of instant noodles that are commonly consumed in Malaysia.

Materials and methods

Six (6) different brands of instant noodles (named as A to F) were bought randomly from the hypermarket. The noodles and the soup powder were then separated from the packaging. From the package, 75 mg of noodles were prepared by dissolving in 90°F warm water (15 mL). The noodle solution was incubated at 70°C for 10 minutes and cooled down to room temperature. The solutions were shaken and centrifuged at 2,000 rpm for 15 minutes. Aliquots of the solutions were extracted by homogenizing it with 20 to 30 mL distilled water and the resulting slurry was filtered. This step was repeated for several times until 150 mL was collected. From the extract, 10 mL aliquot was taken and 2 mL of trichloroethylene were added to 15 centrifuge tubes and centrifuged at 2,000 rpm for 15 minutes.^[19] The procedure was repeated for soup powder in the noodles.

Lead chromate test

To 10 mL of noodle sample, 10 drops of 2 M hydrochloric acid were added and any colour changes were observed. The development of pink color solution indicates the presence of lead chromate in the sample.^[20]

Urea test

To 1gm of soya bean powder, 10 mL of noodles sample was taken. The mixture was left for 5 minutes, and then a red litmus paper was dipped into the mixture. After 30 seconds, the litmus paper was taken out and any colour changes were observed. In the presence of urea, the red litmus paper turned blue.^[20]

Insect Infestation Test

In order to analyse insect infestation, 1gm of ninhydrin was dissolved in 100 mL of ethanol and a filter paper was impregnated in the prepared ninhydrin solution. The filter paper was then

taken out and dried. Some raw noodles were placed inside the filter paper. The filter paper was folded and crushed with a hammer. Any spots and colour changes observed. If there was presence of insect infestation, bluish purple spots were observed on the filter paper.^[20]

pH Test

A standardized electrode was dipped into the center of a well-mixed 10 mL of noodle sample until the reading stabilizes on the pH meter. After a minute, the reading of the pH meter was measured.^[21]

Results and discussion

There were six brands (A-F) of instant noodles tested in this experiment. For each brand, we had two types of samples, which were the noodles and its soup powder. The samples were tested for lead chromate, insect infestation, urea and pH level. Each tests were repeated for 5 times for all samples from the six different brands of instant noodles, and the results were observed. Analysis of lead chromate was done as shown in Table 1. Of all the samples tested, two showed positive results for lead chromate, and as a representative we showed only the positive results for lead chromate (Figure 1). Practically, for the lead chromate test, the solution would turn pink immediately if lead chromate was present in the sample. This happened because when chromium was dissolved in dilute hydrochloric acid, it would form solution containing the Cr^{2+} ion together with hydrogen gas. A precipitate was formed when hydrochloric acid was added into the samples and was considered a positive outcome, as this test played a crucial role in detecting the presence of lead in instant noodles because lead is toxic to humans and can affect people of any age or health status. Lead is particularly harmful to vulnerable populations, including babies, young children, pregnant women and their developing fetus, and others with chronic health conditions.

Urea test

For the urea test, all the samples (A to F) showed negative results as shown in Figure 2. As for urea test, soy bean powder was used to observe the presence of urea in the food sample. Soya bean powder was chosen as the testing material in this test because it had been detected that there urease enzyme is contained in the soya beans. Other than that, soya bean leaves also were recorded to have the urease enzyme but the enzyme is a thousand times less active than in the beans itself.^[22] Urease enzyme catalyses the hydrolysis of urea to carbon dioxide and ammonia.^[23] Red litmus paper would turn blue in the presence of urea. However, all of our food samples showed negative results on this test. Results indicated that there was no presence of urea in the most consumed instant noodles brands in this country. Furthermore, we were unable to find any previous research study that confirmed the presence of urea in the instant noodles.

Insect infestation test

For insect infestation test, the results obtained were negative for all the samples (A-F) as shown in Figure 3. The presence of insects' bodily fluids contaminating the noodles or the soup powder of the instant noodles can be detected using ninhydrin dissolved in alcohol. Positive results would show purple discolouration on the filter paper. Purple spot developed when ninhydrin reacted with free amino acid (and keto acid) present in the body fluid of the insect.^[24] The presence of insect infestation in instant noodles indicates possible contamination of instant noodles with microorganisms that are capable of causing disease in humans.^[25] However, this method is unable to detect eggs and small larval stages of these insects. Therefore, it was suggested that infestation-free grain should be retested after 2 to 4 weeks. The efficiency of the method also varies according to the species of insect and size and type of grain under test.

pH Test

For pH test, half of the instant noodles brands were slightly alkaline (B, C, E) and the remaining were slightly acidic (A, D, F) while all the soup powder was acidic as shown in Figure 4. The alkaline properties of the noodle brands used in this study were due to the presence of kansui, also known as lye water or alkaline salt, an alkaline solution that regulates acidity in the dough-making process. Lye water aids in the gluten development of the noodle as well as the promotion of starch gelatinization, both of which contribute to the springiness and chewiness characteristic of ramen.^[26] Lye water will also turn the noodles yellow and make them slippery. Asian noodles are usually characterised by the presence of sodium hydroxide, with the appearance of yellowness, a high pH, and are usually parboiled. A study demonstrated that the pH of yellow noodles that were stored at ambient temperature (28°C) for 10 days showed a pH of 10^{-7} for all samples.^[27] Our results were similar to these findings. Soup powder was acidic due to the presence of L-glutamic acid. Glutamic acid stimulates specific receptors of the taste buds, such as the amino acid receptor T1R1/T1R3, and

induces the flavour profile known as umami.^[28] Instant noodle powder also contains vinegar, which has a low pH value.^[29]

Conclusion

Two of the six instant noodles tested positive for lead chromate, and half of the brands' noodles were slightly alkaline, whereas all of the soup powders were acidic. All brands tested negative for urea and insect infestation. Further investigation into the quantitative measurement of such chemicals in instant noodles should be conducted using analytical techniques. Lead levels must be evaluated to check if they have surpassed the Malaysian Food Act and Regulation's maximum permissible limit of 2 mg/kg.^[30] Lead poisoning is one of the causes for learning disabilities in children.

Conflict of Interest

The authors declare no conflict of interest.

Table1. Analysis of lead chromate test

Brands	Noodle					Soup powder				
	1	2	3	4	5	1	2	3	4	5
A	-	-	-	-	-	-	-	-	-	+
B	-	-	-	-	-	-	-	-	-	-
C	-	-	-	-	+	+	+	+	+	+
D	-	-	-	-	-	-	-	-	-	-
E	-	-	-	-	-	-	-	-	-	-
F	-	-	-	-	-	-	-	-	-	-

*Presence of lead chromate in the sample is indicated by "+", absence of lead chromate in the sample is indicated by "-"

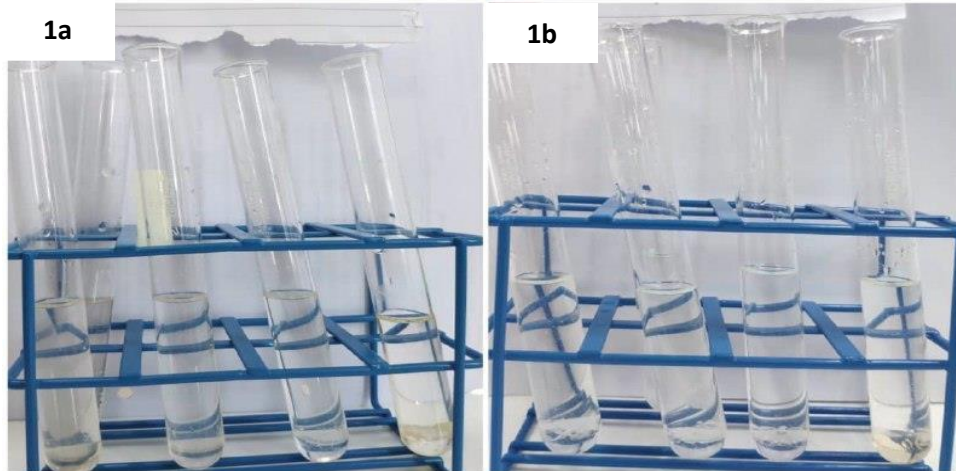


Figure 1. Lead chromate test showed precipitate for 1a) brand A and 1b) brand C

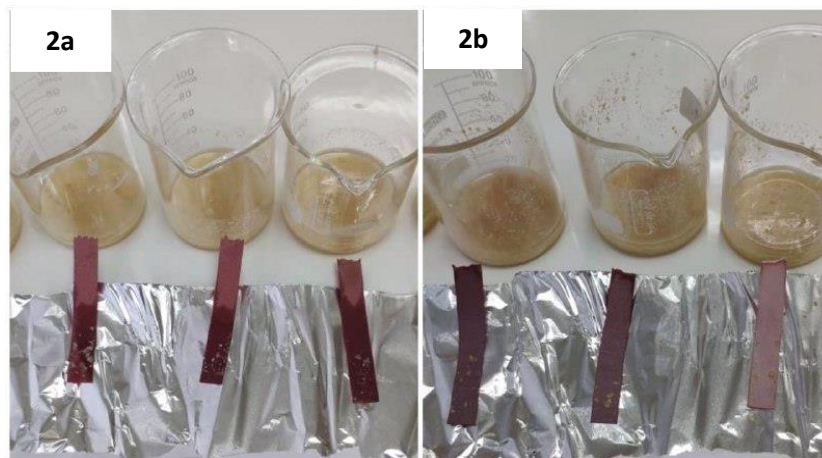


Figure 2. Urea test showed negative results for 2a) brand A and 2b) brand C

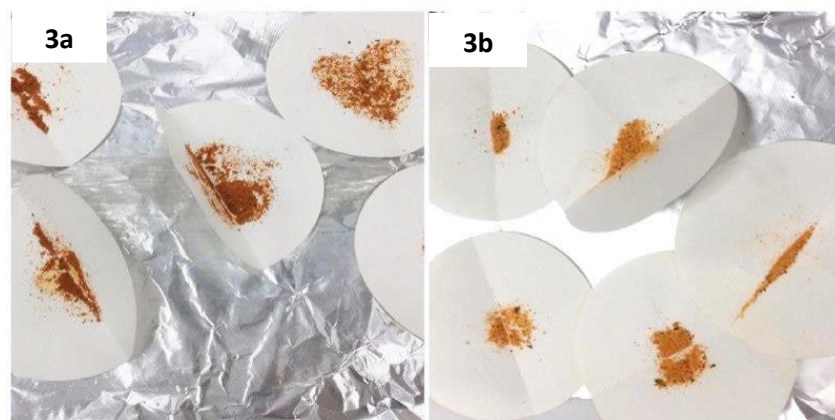


Figure 3. Insect infestation test showed negative results for 3a) brand B and 3b) brand D

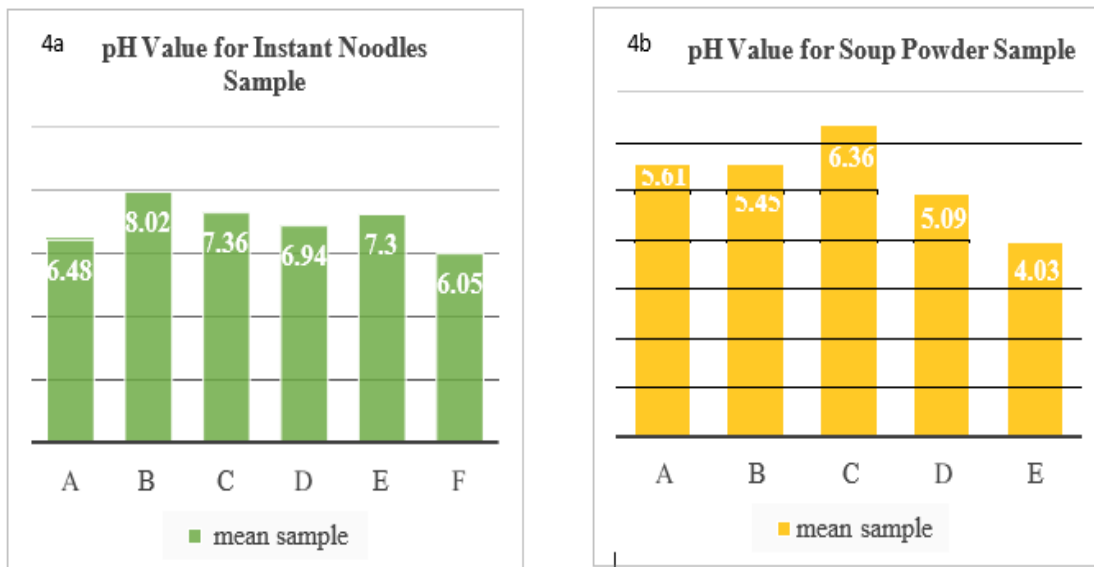


Figure 4. Mean value of pH. 4a) the instant noodles sample for Brands A, B, C, D, E and F and 4b) the soup powder samples for Brands A, B, C, D and E.

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