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THE EFFECT OF SOAKING, WASHING AND FRYING ON THE CONCENTRATION OF FORMALDEHYDE IN SANGE BELAH SALTY FISH

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ABSTRACT

Formaldehyde in food has developed as public issue in the last two years. Several foods, such as salty fish, wet noodles and tofu were laboratorically proven using formaldehyde as preservative. A study on the effect of soaking and frying towards the concentration of formaldehyde in salty fish has been carried out. Sange belah was chosen as the model. The fish was soaked in formaldehyde solution (250 ppm in concentration) for 12 hours then it was washed, fried, and distilled in closed system. Distillate was reacted with Nash Reagent. The yellow color formed was measured spectrophotometrically at λ 415 nm. Result showed that there was a decreasing of formaldehyde concentration in the sample (Δ 63.27% after washing and Δ 83.03% after frying).

Keywords: Formaldehyde, salty fish, sange belah

PENGARUH PERENDAMAN, PENCUCIAN DAN PENGGORENGAN TERHADAP KONSENTRASI FORMALDEHID DALAM IKAN ASIN SANGE BELAH

ABSTRAK

Formaldehid dalam makanan telah menjadi bahan pembicaraan masyarakat selama dua tahun terakhir ini. Berdasarkan pengujian laboratorium beberapa makanan, seperti ikan asin, mie basah dan tahu telah terbukti menggunakan formaldehid sebagai pengawet. Telah dilakukan penelitian tentang pengaruh perendaman dan penggorengan terhadap konsentrasi formaldehid dalam ikan asin sange belah. Ikan asin tersebut direndam dalam larutan formaldehid (250 ppm) selama 12 jam, kemudian dicuci, digoreng dan didestilasi. Destilat direaksikan dengan pereaksi Nash. Warna kuning yang terbentuk diukur pada λ 415 nm. Hasil menunjukkan bahwa terdapat penurunan konsentrasi formaldehid dalam sampel (Δ 63,27% setelah perendaman dan pencucian, Δ 83,03% setelah penggorengan).

Kata kunci: Formaldehid, ikan asin, sange belah

INTRODUCTION

The investigation and laboratory assay which was carried out by Balai Besar Pengawas Obat dan Makanan Jakarta showed that formaldehyde was found in 56 from 98 (57%) food samples assayed. The samples assayed were salty fish, wet noodles and tofu. In 34 salty fish samples assayed, 64.7% contained formaldehyde. The samples were sange belah, cucut, and jambal roti. The samples were collected from traditional markets and supermarkets in Jakarta, Banten, Bogor, and Bekasi.

Formaldehyde, CH_2O, is volatile, colorless, and has penetrating odor. Its melting point ranges from -118°C to –92°C and its boiling point -21°C to –19°C (at 101,3 kPa). Its molecular weight is 30.03. This compound dissolves in water (400 to 500g/100mL at 25°C), in ethanol, acetone, DMSO (100g/100 mL). Formaldehyde is used as bactericide, astringent, antiperspirant and deodorant (Mutschler, 1991). Formaldehyde's vapor irritates the eyes, nose, respiratory system, larynx. It causes bronchitis, pneumoniae, and carcinoma in the nose and throat (Martindale, 1999). The intake of formaldehyde can cause pain in the abdominal, vomiting, diarrhea, decreasing of blood tension, coma, acidosis, and acute renal failure (Cahyadi, 2006).

Formaldehyde is ubiquitous in the environment. As an aqueous solution, it causes burns on contact with the skin and eyes, and the vapour is irritating to the eyes and respiratory system. Inhalation of the vapour has been shown to cause nasal cancer in rats and mice. However, epidemiological studies have failed to confirm whether or not the compound is carcinogenic in humans (Wartew, 1983). Formaldehyde exposure, acute pulmonary

response, and exposure control options were evaluated in a group of 34 workers in a gross anatomy laboratory. Time-weighted average (TWA) exposure to formaldehyde ranged from 0.07-2.94 parts per million (ppm) during dissecting operations. More than 94% were exposed to formaldehyde in excess of the ceiling value of 0.3 ppm recommended by the American Conference of Governmental Industrial Hygienists (ACGIH) (Farhang *et al.*, 2007).

The prohibition of using formaldehyde in food is described in the law sand regulations below:

- Law of The Republic of Indonesia No. 7/1996 about Food and Law of The Republic of Indonesia No. 8/1999 about Consumer Protection.
- Regulation of Minister of Health No. 1168/Menkes/PER/X/1999.
- Government Regulation of Republic of Indonesia No. 28/2004 about Safety, Quality and the Nutrition of Food.

The purpose of this research is to study the effect of soaking and frying on the concentration of formaldehyde in sange belah salty fish. Sange belah was chosen as the model because it was one among the samples of salty fish proven by Balai Besar Pengawas Obat dan Makanan Jakarta contained formaldehyde. The result of
this study is to give information about the importance of soaking, washing and frying in the processing of salty fish before it is served as daily meal.

MATERIALS AND METHOD

This research was carried out at Organic Chemistry Laboratory (Department of Chemistry, Faculty of Mathematics and Natural Sciences, Padjadjaran University) and Pharmaceutical Analysis Laboratory (Faculty of Pharmacy, Padjadjaran University).

Sample Preparation

Sange belah fresh fish (collected from Cirebon) was soaked with concentrated saline solution for 24 hours, dried under direct sun, and soaked with formaldehyde solution (250 ppm in concentration) for 12 hours.

Formaldehyde soaked sange belah salty fish was washed with warm water (±50 °C) for 25 minutes, and was fried.

20 grams of the sample was weighed accurately and was put it into round bottom flask. 100 mL of aquadest was added into the flask. The flask was connected with a condenser then the distillation was started until ±90 mL of distillate was obtained (Herlich, 1990).

Determination of Formaldehyde using Visible Spectrophotometry

Into 2 mL of distillate was added 2 mL of Nash reagent (contains 2 mL of acetyl acetone, 3 mL of acetic acid and 150 g of ammonium acetate). The solution was heated in the water bath for 30 minutes at 37±1 °C. The yellow color formed was measured at 415 nm (Roth, J.H, 1988).

RESULT AND DISCUSSION

The reaction between formaldehyde and Nash reagent which contains acetyl acetone, acetic acid and ammonium acetate, with the aid of heat, will produce a yellow cyclic compound, which shows maxima at 415 nm.

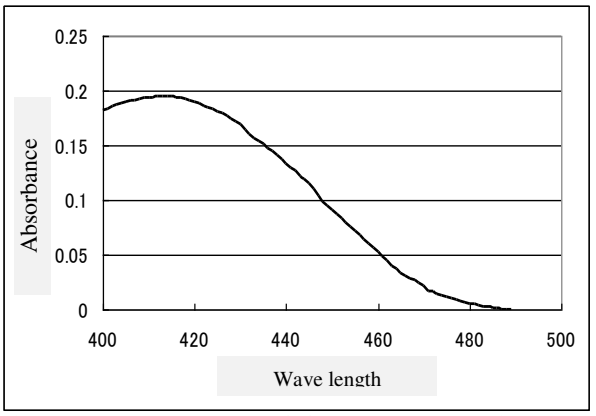

Figure 1. Spectrum of formaldehyde with Nash reagent

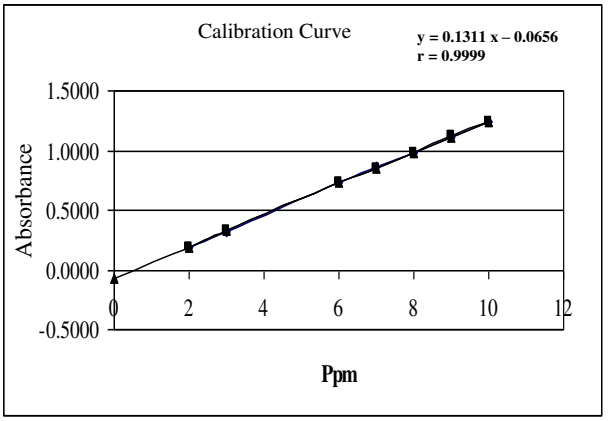

Figure 2. Calibration curve of formaldehyde

The yellow color produced by the reaction of distillate with Nash reagent was measured at 415 nm, and the concentration was calculated using linear regression equation from the calibration curve (Figure 2). The result was showed in Table 1, Table 2 and Figure 3.

Table 1. Determination of Formaldehyde in Sange Belah Salty Fish

No	Treatment of the fish	Formaldehyde found (µg/g)
1	Before washing process	120.36
2	After washing process	44.16
3	After frying process	20.24

Table 2. Decreasing of Formaldehyde in Salty Fish through Washing and Frying Process (%)

Process	Decreasing of Formaldehyde Concentration (%)
Washing	63.27
Washing and frying	83.03

The determination of formaldehyde concentration in the sample proved that washing and frying process gave significant different results. This condition was due to the physicochemical properties of formaldehyde: its solubility in water and its tendency to vaporize at higher temperature.

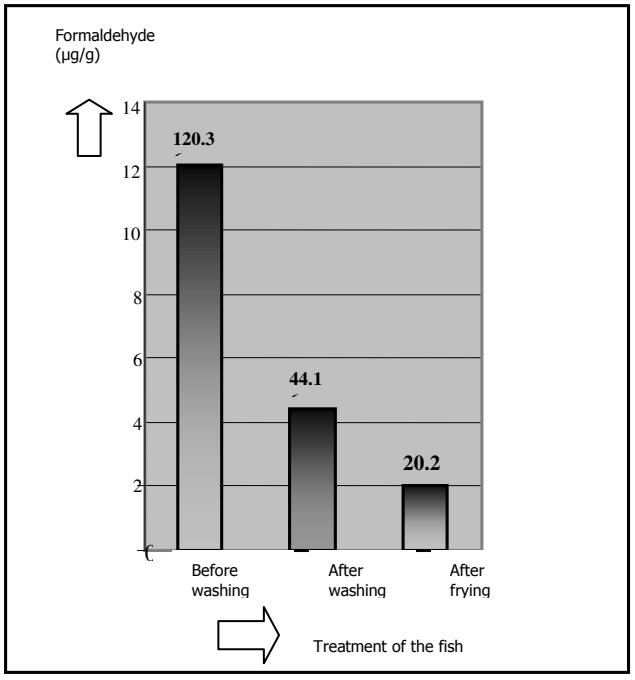

Figure 3. The effect of washing and frying on the concentration of formaldehyde in salty fish

Washing process decreased formaldehyde content in the sample up to 63.27%; whereas the washing and frying process lessened formaldehyde content to 83.03%. This phenomena can be explained as followed : Due to its chemical properties, formaldehyde can react with protein in the fish, and make the meat more elastic (Figure 4 and 5). Heating process may hydrolyze the protein and unbind its bonding with formaldehyde. Formaldehyde then is released as free volatile compound during the frying process.

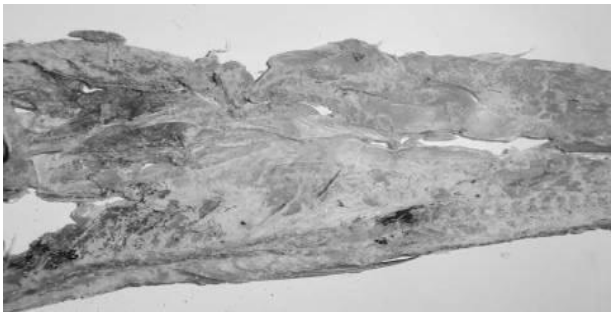

Figure 4. Sange belah salty fish without the addition of formaldehyde within a month of storage

Figure 5. Sange belah salty fish with the addition of formaldehyde within a month of storage

CONCLUSION

Result showed that soaking, washing and frying process reduced formaldehyde content in sange belah salty fish significantly. Formaldehyde found in sample was 120.26 µg/g. After washing, the decreasing of formaldehyde concentration was 63.27%. After frying, the decreasing of formaldehyde concentration was 83.03%.

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