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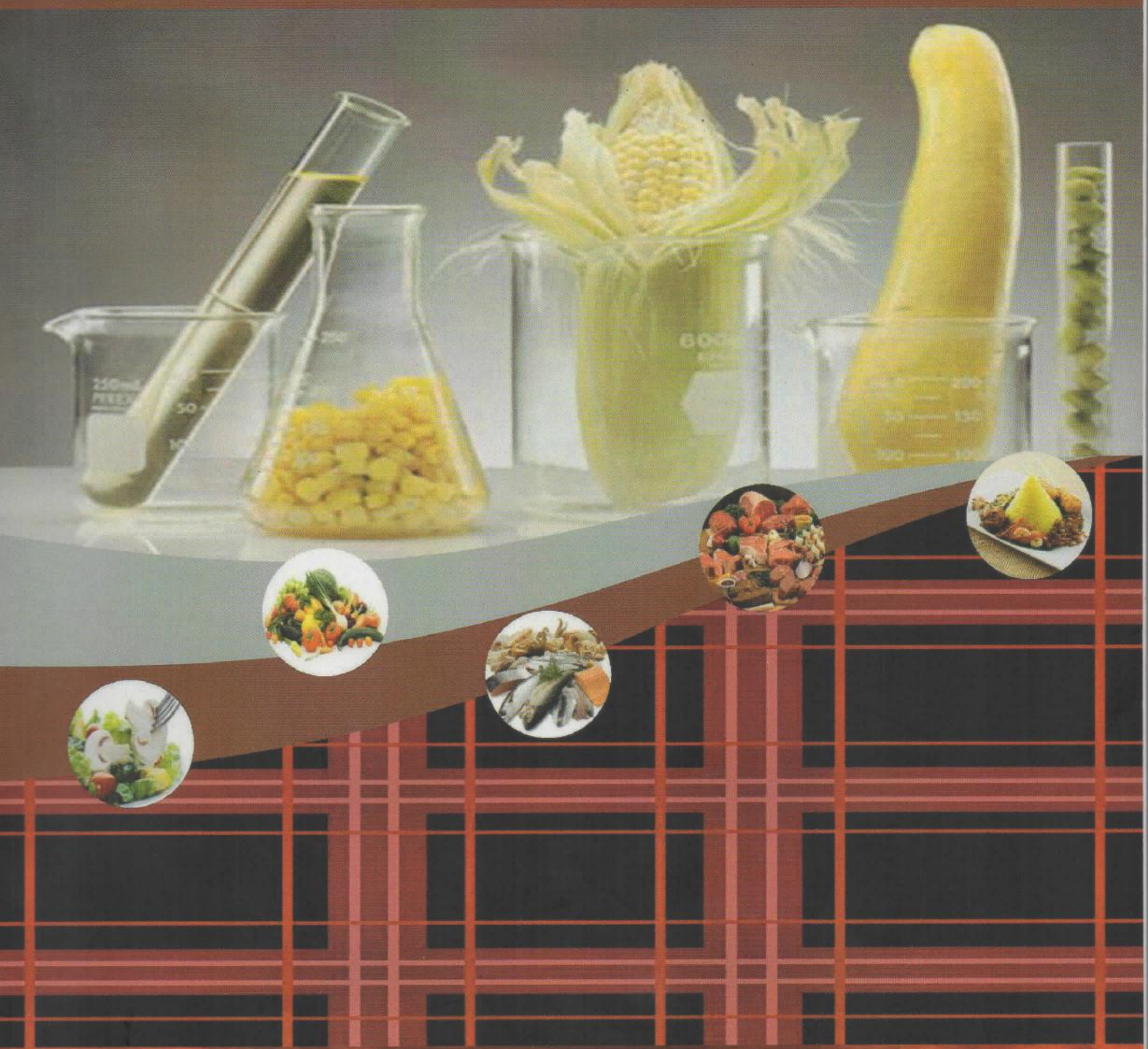
**The Indonesian Association of Food Technologists Chapter KALTIM**
**Present**

# PROCEEDING

## International Conference on Food, Agriculture and Culinary Tourism



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# Preface

The greatest regards should be expressed only to God the Almighty, Allah SWT. We have finished the Proceeding of The 1st International Conference on Food, Agriculture and Culinary Tourism (ICFACT) in six months after the conference which was held on 4-6 August 2015. This conference is in coherence with a grand agenda of increasing national and local food security and also improving nutritional statuses of the people. The conference focused on food, agricultural products and culinary that support food security, safety, processing advancement and their aesthetical aspects.

This conference proceeding volume contains the written version of most of the contributions presented during the conference, as oral and poster presentation. During the conference there were 6 keynote speakers, 37 oral presenters and 15 poster presenters who gave their speech, presentations and posters of their recent research. This conference presented international speakers from Chulalongkorn University, Associate Professor Saiwarun Chaiwanichsiri, University Putera Malaysia, Associate Professor Azmawani AbdRahman, and a leading presenter, Prof. Dr. Dato Othman Yatim from University Brunei Darussalam. Also, this conference featured fellow professors and scientists from UMS, IPB, LIPI, Balitbang Pertanian, Unpad, Manado, Papua, Mataram, Denpasar, Samarinda, and other places.

All papers presented in this proceeding have been through a series of reviewing process by the Editorial Team. Some paper presented in ICFACT will be published as a special edition of a Scopus Indexed Journal and will be processed through a more in-depth scientific review.

We would like to thanks and appreciate all authors, The Samarinda city government, Food Security and Agricultural Executive Counseling Board of Samarinda, PT Pupuk Kaltim, Food Review Indonesia, and Kulinologi Indonesia, The Editorial Team, The Proceeding Team, The Head of IAFT Chapter Kaltim, and the entire committee member who have been contributed in ICFACT and the proceeding publication.

See you in the next ICFACT at Bumi Etam.

Samarinda, February 2016

Editor

# Quality Changes During Postharvest Handling Chain of Black Tiger Shrimp (*Penaeus Monodon Fab.* 1897) from Brackish Water Pond in Mahakam Delta Region : Case Study

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**Abstract**

Shrimps are more perishable food and their quality are depend on some of factors including harvest condition, handling process, storage duration and temparature during handling. Most of farmer and collector in Mahakam delta are not aware about the postharvest handling so that caused low quality of shrimp. The aim of this study were to investigate of biochemical quality and microbiological content on the postharvest handling chain of shrimp in Mahakam delta region. The study were carried out in three sub districts namely Muara Jawa, Anggana and Muara Badak. Three small ponds around 2-5 Ha in each sub districts were used as observation unit. The shrimp samples were taken at ponds, farmer point and depot. The biochemical parameters observed were moisture content, pH, TVB-N, indole and microbial parameter was Total Plate Count (TPC). The result showed that moisture content of shrimp was signifant differences ($P<0.05$) at pond, farmer point and depot in Muara Jawa, Anggana and Muara Badak. The pH content found was not significant differences ($P>0.05$) at ponds, farmer point and depot in Muara Jawa, Anggana and Muara Badak sub districts. The TVB-N content of shrimp was significant differences ($P<0.05$) at all of handling stages in three sub districts. The indole content of shrimp was found only at depot level in three sub districts. The TPC content found was not siginificant level on all handling stages in three sub districts studied area. From the research found, it can be concluded that the quality of postharvest handling chain of black tiger shrimp in Mahakam delta were still meet the requirements, however they still need improvement so that the shrimp quality will increase more.

**Key words:** Change, Quality, postharvest, handling chain, pond, Mahakam Delta.

## I. Introduction

Mahakam Delta is located in the jurisdiction of Kutai Kartanegara district that is the largest contributor of exporting black tiger shrimp to East Kalimantan. Mahakam delta has been known as a centre of good shrimp culture in Indonesia, especially Muara Jawa, Anggana and Muara Badak sub districts. Doe to its unique condition and it was very good mangrove forest that intensively converted into brackish water ponds and favourable environment for shrimp culture and tradisional shrimp farming. In 2011, the production of black tiger shrimp from Kutai Kartanegara district contributed as much as 13.259 tons (65%) for shrimp exports of East Kalimantan. These exports were consisted of 6156 tons of shrimp, white shrimp 2786 tons and 4316 tons of other shrimp (Marine and Fisheries Agency of Kutai Kartanegara, 2012). The main cultivated species in this region is *Penaeus monodon*, more commonly refered to as black tiger shrimp. Consumers today are critical and require the provision of safe and healthy food products. Exportable shrimp requires special care to retain as much as particable to original physical appearance, odor and orgaoleptic condition. It must be free from dirt, filth, pathogenic organism, uncertified chemicals and any antibiotic event in the minute's quality. The importing countries particularly the USA, UE and Japan are highly conscious about food hygiene and safety (Paul, S. *et al*., 2010; Hassan, M.N. *et al*., 2012).

Postharvest handling chain of shrimp practices in Mahakam delta region consist of three stages: harvesting by famer at the pond, postharvest handling by farmer at the farmer point and postharvest handling by collectors at depot and then bring to processing plant. Long period of postharvest handling chain, use of inadequate of ice, bad water quality for handling process caused low quality of shrimp. In the region, most of the shrimp farmers and collectors are not aware on the importance of the postharvest handling. The shrimps which brought to processing plant sometimes do not meet the criteria of standard shrimp quality at processing plant. The shrimps sold to the processing plant were not always accepted even in some

condition it will be rejected. The Shrimps were severely degraded during handling and transportation, around 20-30% was below minimum accepted processing plant quality (Asikin, A.N., 2012; Asikin, A.N. *et al.*, 2012). The longtime of postharvest handling chain to processing plant caused quality change of shrimps. In this postharvest handling chain, shrimps pass one stage to another stage with the elapse of time, time duration because the inner biochemical degradation of shrimp body in the different stage (Ali, M.Y., *et al.*, 2013). They are exposed to ambient temperature for a long time from capture to receiving at the depot. Ice was used in depots only when a bulk quantity was gathered and finally transported to the plants (Hassan, M.N., *et al.*, 2012). Serious quality deterioration has been reported at this stage (Kamal *et al.*, 2000). Hossain *et al.* (2010), quality of processing product very varies depend on quality of raw material. Therefore, to produce good quality shrimp and shrimp products, the raw shrimp should be wholesome. Moreover, the wholesomeness of finished products depends on the harvesting, postharvest care, transportation, handling and sanitation and hygiene aspects at farms, depots and industry levels (Faridullah, M., *et al.*, 2008). Some causes of postharvest quality losses from farm until processing plant have been reported. Paul, *et al.* (2010), but they did not present any lab-based practical on quality change each stage. Other researchers, Ali, M.Y., *et al.* ($2013^{a}$), Ali, M.Y., *et al.* ($2013^{b}$) have already carried out in this respect, but they only determained of protein losses in the value chain. So far, there are no researcher has been conducted on quality of shrimp during postharvest handling chain. Therefore, the aim of this study were to investigate of biochemical quality and microbiological content on the postharvest handling chain of shrimp in Mahakam delta region. The improvement of postharvest handling is necessary in order to produce excellent shrimp quality in Indonesia, especially in Mahakam delta region which could produce more competitive quality.

## II. Materials and Methods

### 2.1. Study area

The study was conducted at three subdistricts: sub district of Muara Jawa in Muara Pegah village, sub district of Anggana in Muara Pantuan village and sub district of Muara Badak in Saloapi village in Mahakam delta region. Two small ponds around 2-5 Ha in each subdistricts were used in unit observation. This size was selected since it was more manageable than bigger ponds.

### 2.2. Sampling collection

Black tiger shrimp (*P. monodon*) were obtained from three different sub districts in Mahakam delta : Muara Jawa, Anggana and Muara Badak (Figure. 1). The sample of 150 shrimps on everage of 25-45 g were taken from each subdistrict on different time and the shrimp samples were divided into three stages of handling :

1. Ponds

The 50 samples of whole shrimps were taken immediately after harvesting.

2. Farmer point

After harvesting, farmer brought shrimp to farmer point. In this point, the farmer usually practice sorting (separate shrimp from fish and foreign materials), washing, beheading and icing (water chilling system). The farmers were used pond water/well water or potable water to handling of shrimp. In farmer point level, shrimps stored for 1-2 days and then shrimps brought to depot.

The 50 samples of headless shrimps were taken from farmer point.

3. Depot

In depot level, the collector (depot owner call collector) applied sorting (freshness and size), washing and icing (water chilling system). Owner depot call collector. In this level, the shrimp stored for 2-3 days depend on volume of shrimp and then brought to the processing plant. The samples of 50 headless shrimps were taken from depot level.

All samples immediately placed into containers and added crushed ice with ratio is 1:1 (shrimps:ice) and brought to laboratory and stored for one day at refrigerator before being analyzed.

### 2.3. Biochemical quality determination

#### 2.3.1. Determination of moisture content (AOAC, 1995)

Weighed accurately about 5 g of the shrimp muscles in a moisture dish with slip on cover. Dried in an air oven (Mimmert UNB 500) at 100-1°C for 5 hours. The dishes were then put and cool in a dessicator. The dish weighed quickly. Return the dish with the cover to and dry for another ½ hour. Cool in the dessicator and weigh again. Repeat until successive weights do not differ more than 1 mg.

#### 2.3.2. Determination of TVB-N (Antonacopoulos and Vincke, 1989)

Determination of TVB-N was carried out by adding 10 g blended shrimp muscle sample in 300 ml distillated water in kjeldhal flask 500 ml. After addition of 2 g magnesium oxide (MgO) and 2-3 drops anti bumping granules and anti foaming silicone, the vessel is inserted into the preheated steam generator and the distillation is started immediately (steam flow approx. 10 ml/min). The distillate is collected in the receiver, containing 10 ml boric acid and 8 drops Tashiro indicator, filled up to approx. 100 ml with distillated water. Distilation time is exactly 12 min: 10 min with condenser outlet immersed, 2 min above the surface of the distillation. Titration the distillate containing volatile basic nitrogen with 0.1 N HCL until the

change colour point. Calculation: Volume ml 0.1 N HCLx14=mg TVB-N/100g.

### 2.3.3. Determination of pH (AOAC, 2005)

pH of shrimp was measured at room tenperatur by ten (10) g samples were homogenized and mixed thoroughly with 100 ml distillated water and pH determined using the pH meter 330i (WTW, Germany).

### 2.3.4. Determination of Indole (Snellings *et al.*, 2003).

Indole was extracted from shrimp muscle by grinding 20 g shrimp with 50 ml toluene and 5 ml 5% TCA for 1 min. The puree was centrifuged for 30 min at 3500 rpm to separate the tuluena from the shrimp pulp. The tuluena layer was decanted and filtered through a 0.45 µm syringe filter into a beaker containing anhydrous $N_2SO_4$. The absorbence of MeOH (as solvent) at bottom layer was measured with a Hach DR/2000 spectrophotometer at 567 nm. Unadultrated shrimp were used as the blank for the absorbence measurements. A Cary 50 Conc UV/VIS spectrophotometer was used in experiments.

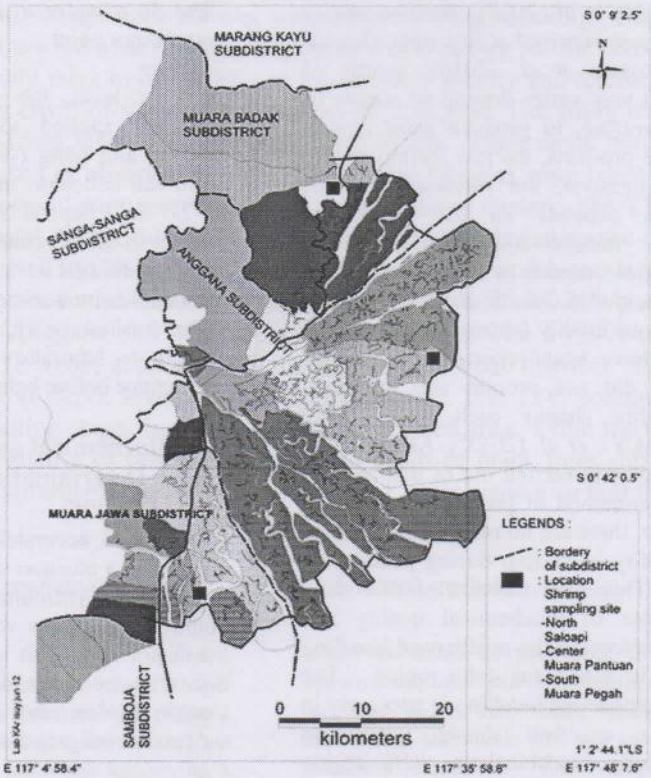


Figure.1. Map of Kutai Kartanegara Regency Showing Sampling Sites of Shrimp *(P. Monodon* F) at Ponds of Mahakam Delta Region. Blue line: Bordery of Mahakam delta region. (Source: Laboratory of Karto-Hidrooceanografi, Faculty of Fishery and Marine Science, Mulawarman University).

### 2.4. Determination of Microbiogycal (TPC) (BSN, 2006a)

Twenty five g of the shrimp muscle tissue were aseptically taken and crushed in a mortar with a pastle. Shrimp homogenates were prepared by adding 9 mL of sterile distillated water to 1 g of the crushed samples. Thereafter, 1 mL each of homogenized solutions was inoculated using spread plate method into nutrient agar and incubated at 25°C for 24 hours. The total plate count was determined on the nutrient agar. After incubation the colonies were counted using colony forming unit and cfu/g was calculated.

### 2.5. Statistical Analysis

Results are expressed as means± standard deviation. The significant ($P<0.05$) of the parameters were assessed by one way ANOVA test. SPSS (PASW), for windows (Version 22) was used for statistical analysis.

## III. Results and Discussion

### 3.1. Change of moisture content

The moisture content of postharvest shrimp tends to increase during handling process. The moisture content of the shrimp can be affected by postharvest handling of shrimp started in ponds. The

moisture content of shrimp at different handling stages in Muara Jawa, Anggana, Muara Badak sub districts are represented in Figure.1. The moisture content was increased gradually during hadling from ponds to depot varied significantly ($P<0.05$). The moisture content of fresh shrimps, prior to handling by farmers in three sub districts ranged of between 76.28%-78.02%. However, after handling by farmers at farmer point and collectors at depot, shrimp moisture content increased to 78.81-81.59%. In Muara Jawa, moisture content of shrimp was 77.64%, 77.59% and 81.59% at ponds, farmer point and depot respectively. The moisture content of shrimp tends to increase during handling stages, except at farmer point. In Anggana, moisture content of shrimp was increased from ponds to depot. The moisture content was found as 78.02%, 79.42% and 80.87% at ponds, farmer point and depot respectively. In Muara Badak, the moisture content of shrimp was increased from pond to depot, where the higher moisture content was found at depot as 78.81% than at ponds and farmer point as 76.28% and 78.16% respectively. On an average basis moisture shrimp content increased by approximately 3.10% from ponds to depots in Mahakam delta region. Method of handling can influence shrimp quality. In generally, farmers and collectors in Mahakam delta region stored the shrimp at chilling water system. Chilling methods used greatly affect the moisture content of shrimp during handling. Hence, soaking shrimp in chilling water system can cause water uptake by shrimp meat or rehydration. Rachmawati *et al.* (2007), states that the increase in the moisture content in the fish during storage in line with the continuing process of deterioration. The higher moisture content in the shrimp, the faster the shrimp decay process. In addition, soaking in ice plus water can cause shrimp softening and the loss of some nutrients in shrimp (Jeyasekaran *et al.*, 2006).

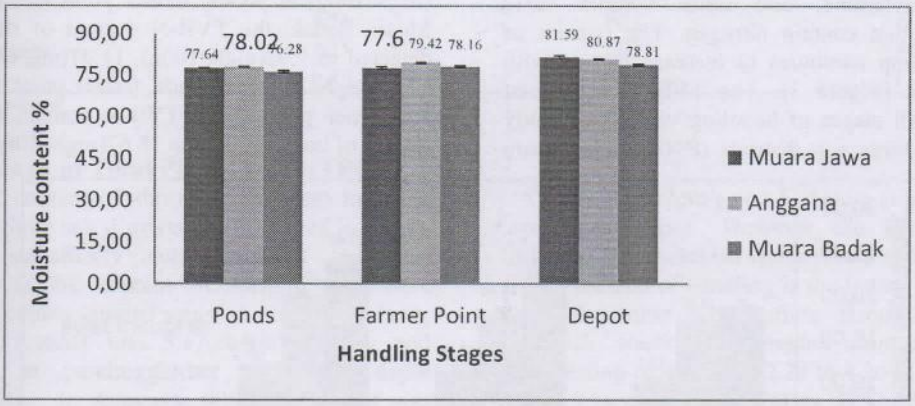


Figure. 2. Moisture Content (%) of Shrimp at Different Stages of Postharvest Handling Chain in Three Sub districts of Mahakam Delta Region.

### 3.2. Changes of pH content

The results showed that the pH value of shrimp fluctuated from pond until depot at Muara Jawa, Anggana and Muara Badak sub districts (Figure. 1). In Muara Jawa, pH content of shrimp was not significantly different ($P>0.05$), whereas in Anggana and Muara Badak sub districts were significant defferences ($P<0.05$) from ponds, farmer point and depot level. The pH content fluctuated was 6.89, 6.86 and 6.89 at ponds, farmer point and depots respectively in Muara Jawa sub district. In Anggana, the pH content found was 6.96, 6.55 and 6.69 at ponds, farmer point and depot respectively. In Muara Badak, the pH content was reorded as 6.91, 6.67 and 6.72 at ponds, farmer point and depot respectively. Nevertheless, the pH content of shrimp from Muara Jawa was higher than to other districts. The pH content of shrimp from the three sub districts of the present study agrees with Mohamed-Ali, F.H. (2011), the pH of marine products varies from 5.8 to 7.2 depending on conditions at the time of harvest, but the normal pH varies from 5.8 to 6.5. Walker and Betts (2000) reported that, ultimate pH of meat was significant for resistance to spoilage because most bacteria grow optimally at about pH 7 and not well below pH 4. The changes of pH value was caused by biochemical processes occuring during handling. After the death of shrimp, glycolysis occures anaerobically. The process produces lactic acid lowering the pH value of shrimp. Value of pH increases after handling by the collectors (depot).

Increasing pH value caused by the activities of proteolytic enzymes that degrade proteins result in volatile bases such as ammonia, methylamine compounds and trimethylamine (Abu-Bakar *et al.*, 2008).

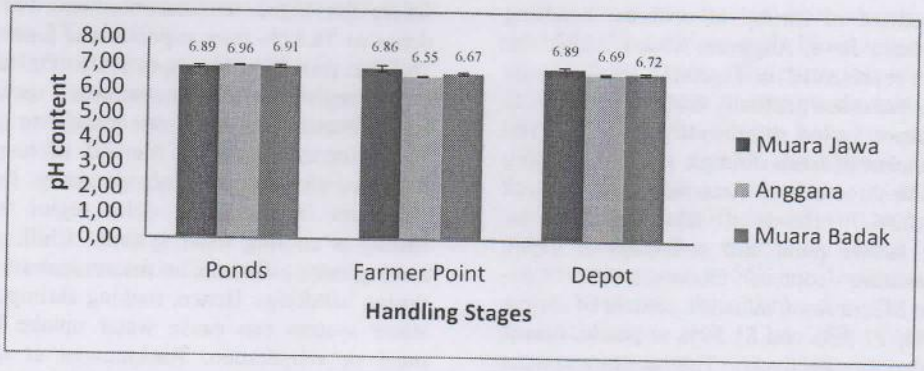


Figure 3. pH Content of Shrimp at Different Stages of Postharvest Handling Chain at Three Subdistricts of Mahakam Delta Region.

### 3.3. Change of TVB-N content

One of parameter indicating level of freshness of fishery products is Total Volatile Base (TVB-N), which is volatile basic compounds consisting of ammonia, methylamine compounds, dimetilamin and trimethylamine, and other volatile basic compounds that contain nitrogen. The content of TVB-N shrimp continues to increase in line with storage time (Figure 3). The TVB-N content of shrimps at all stages of handling was significantly different at three sub districts ($P<0.05$). In Muara Jawa, the TVB-N content was recorded as 18.67(mgN/100g), 20.02(mgN/100g), 23.95(mgN/100g) at ponds, farmer point and depot respectively. In Anggana, the TVB-N content was 16.85(mgN/100g), 18.22(mgN/100g) and 19.93 (mgN/100g) at ponds, farmer point and depot. In Muara Badak, the TVB-N content of shrimp was detected as 9.92(mgN/100g), 11.41(mgN/100g) and 12.09(mgN/100g) at ponds, farmer point and depot. At farmer point level, TVB-N content of shrimp ranged of between 9.92 to 18.67(mgN/100g). g.

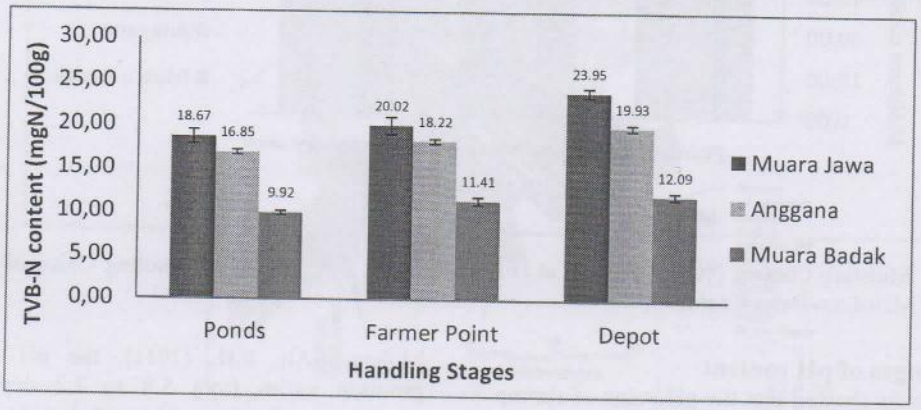


Figure 4. TVB-N Contents of Shrimp at Different Stages of Postharvest Handling Chain at Three Sub districts of Mahakam Delta Region.

TVB-N value of this study agree with Ali, M.Y., *et al.* (2013[b]), at farm level when shrimp were fresh, TVB-N content ranged between 15.30-19.91 (mgN/100g). In this study, on an average basis TVB-N content increased approximately 3.51 (mgN/100g) from pond level to depot level. However, The lowest TVB-N content of shrimp untill the end of handling stages were found in Muara Badak sub district followed by shrimp from Anggana and Muara Jawa. The highest TVB-N content was found on shrimps from ponds to depot in Muara Jawa sub district. After harvesting (Muara Badak and Anggana), the shrimps were soaked in ice water immediately, so that can slow down the process of autolysis and microbial activity, except Muara Jawa subs district. Handling process by farmer used pond water or river water, without/inadequate of ice and low sanitation that can increased number of bacteria on the shrimps. The higher the content of TVB-N, the higher the rate of quality deterioration of shrimp (Zeng *et al.*, 2005). According to Nirmal and Benjakul (2011), TVB content significantly correlate with microbial content. Increased TVB content during handling process is considered to be caused by the degradation of protein or its derivatives by microbe activity that continues process of quality deterioration (Zeng *et al.*, 2005). The process of

decline of the quality of the shrimp depends on the temperature of the water during soaking. The lower the temperature of ice water, the slower quality deterioration process occur (Jeyasekaran *et al.*, 2006). However, TVB-N content of shrimp from three subdistricts are still under TVB-N content limit for shrimp. According to Cobb *et al.* (1973) the limit is 30 mg N/100

### 3.4. Change of indole content

Indole content of shrimp at handling stages from 3 sub districts showed that indole has not been detected either in the pond or in the farmer point. Indole was first detected when the shrimp in depot (Table 1). The highest indole content were found in shrimp from Muara Jawa sub district followed the shrimps from two other sub districts. This condition indicates that the handling process of the shrimp at the depot has not done well; it means that deterioration has occured. However, the indole value in shrimp from the 3 sub districts still in acceptable level of freshness, because the content of indole in shrimp that can be accepted by the US-FDA is 25 µg/100g (Benner *et al.*, 2003). Indole can be used as an index of freshness of the shrimp. Indole enzymatically is produced through metabolism of proteins by bacteria. Proteolytic bacteria will hydrolyze the protein into free amino acids using proteinase and peptidase enzymes. Furthermore, the amino acid tryptophan residues would undergo decarboxylation and deamination reactions catalyzed by the enzyme tryptophanase bacteria producing indole (Snellings *et al.*, 2003).

Table 1. Indole Content (mg/100g) of Shrimps at Different Stages of Posthsrvest Handling Chain in Three Sub districts of Mahakam Delta Region.

| Handling stages | Subdistricts of Mahakam Delta Region | | |
|---|---|---|---|
| | Muara Jawa | Anggana | Muara Badak |
| Ponds | ND | ND | ND |
| Farmer point | ND | ND | ND |
| Depot | 1.25 | 1.12 | 1.10 |

ND = Not Detected

### 3.5. Change of Total Plate Count (TPC)

The TPC content of shrimp at different handling stages in three sub districts are presented in Figure 5. The statistically not significant variations ($P>0.05$) in the content of shrimp TPC were observed among studied samples. In Muara Jawa, the TPC content was 5.17cfu/g, 5.23cfu/g and 5.30cfu/g at ponds, farmer point and depot respectively. In Anggana, the TPC content was found as 5.45cfu/g, 5.23cfu/g and 5.46cfu/g at ponds, farmer point and depot respectively. In Muara Badak, TPC content was recorded as 5.08cfu/g, 5.07cfu/g and 5.25cfu/g at ponds, farmer point and depot. However, the TPC content of shrimp from brackish water ponds in Muara Badak until the end of handling is the lowest compared to two the other sub districts. Bacteria counts on brakish water *P. monodon* immediately after harvesting ranged from 2.23 to 4.20 (cfu/g) at 20°C and 3.36 to 4.20 (cfu/g) at 37°C (Reilly *et al.*, 1985). Harvesting temperature at ponds of study area was recorded at range 28-40°C.

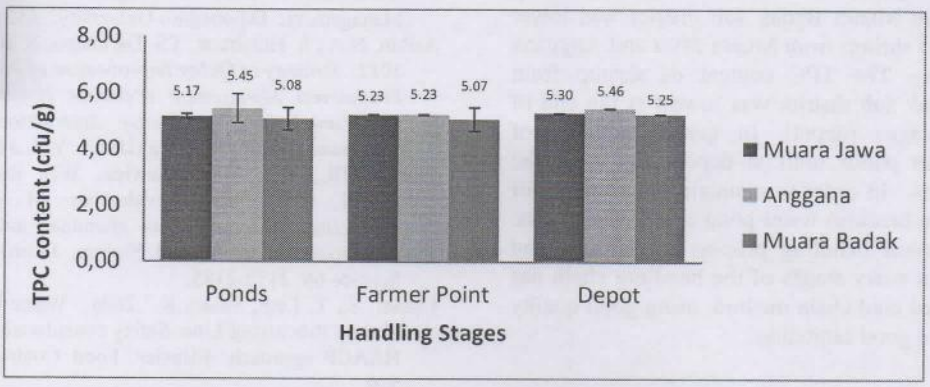


Figure. 5. TPC Contents of Shrimp at Different Stages of Postharvest Handling Chain in Three Subdistricts of Mahakam Delta Region.

Decrease in TPC content of shrimp occured at farmer point whereas farmers removed heads of shrimps (behead). Shrimp beheading is intended to remove most of bacteria, especially bacteria at head

of shrimp. Novak (1973) stated that, the head occupies 40% of the total weight of shrimp and contains about 75% of bacteria. Increasing TPC content in shrimp could be caused by increase amount of bacteria that had already existed (depot). It is caused by inadequate ice amount used by farmers to lower temperature during handling. In addition, cross-contamination occurs between workers, equipment and water used during the handling process. The river water used by farmers in the sub district of Muara Jawa and Anggana can increase the content of bacteria (pond to depot). While the farmers and collector in the sub district of Muara Badak use well water/taps during the process of handling. Therefore, TPC content of shrimp from Muara Badak subdistrict was lowest compared to others subdistrict since at ponds until depot. According to Casani *et al.* (2006), microorganisms and organic matter in the water must be removed to prevent the growth of microorganisms that can cause spoilage and contamination of pathogenic bacteria. Also according to Hatha *et al.,* (2003), microbial content of the shrimp will continue to increase during transport and storage. The content of TPC in postharvest shrimp from ponds in Mahakam delta are generally lower than the requirements according to SNI 7388:2009, TPC content must be less than $5x10^5$ or log 5.70 cfu / g (BSN, 2009).

## Conclusion

Postharvest handling stages at pond, farmer point and depot in the subdistricts of Muara Jawa, Anggana and Muara Badak were difference on quality of shrimp produced. The moisture content of shrimp from Muara Badak was lower than two sub districts until the depot. The pH content of shrimp not significance in three subdistricts, while TVB-N content of shrimp was lower on shrimp from Muara Badak compared to others until the end of handling chain. Indole content of shrimp was detected at depot of three districts. However, shrimp content from Muara Badak sub district was lower compared to shrimp from Muara Jawa and Anggana sub districts. The TPC content of shrimp from Muara Badak sub district was lowest at the end of handling stages (depot). In general, quality of shrimp from ponds until at depots still meet the requirements. In order to maintain good quality of shrimp from brackish water pond at Mahakam delta, the postharvest handling process by farmers and collectors in every stages of the handling chain has to be applied cold chain method, using good quality of water and good sanitation.

## Acknowledgements

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