SQUALEN BULLETIN

Chitosan and Ariid Catfish Swim-Bladder Gelatin Coating for Enhanced Preservation of White Shrimp (*Litopenaeus vannamei*)

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ABSTRACT

White shrimp (*Litopenaeus vannamei*) is a fishery product with high economic value but is perishable. Shrimp chitosan and swim bladder gelatin have good antimicrobial, antioxidant, and gelling abilities. This study aims to prove the effectiveness of edible coatings with the optimum ratio in maintaining the quality of white shrimp during storage. The treatments were shrimp chitosan-swim bladder gelatin ratio as an edible coating on white shrimp samples control (0:0), P1 (3:7), P2 (5:5), and P3 (7:3) with storage points of 0, 24, 48, and 72 hours. The test parameters used were Thiobarbituric Acid (TBA), Total Plate Count (TPC), Peroxide Value (PV), Total Volatile Basic Nitrogen (TVBN), Degree of Acidity (pH), Weight Shrinkage, Sensory (Appearance, Texture, Odour) and Melanosis. The results showed a significant difference in TBA, TPC, PV, TVBN, pH, Sensory, and Melanosis. Providing edible coatings effectively inhibited enzyme activity, microbes, and oxidation in white shrimp so that good quality and quality can last longer. Sample P3 (7:3) showed optimum results on the test with TPC 59.33×10^3 CFU/g, PV 3.33 meq/kg, TVBN 24.31 mgN/100g, pH 7.14, and Melanosis 2.82.

Keywords: edible coating, chitosan, gelatin, white shrimp

Introduction

White shrimp (*Litopenaeus vannamei*) has a high economic value in the world food trade, especially in 2021 where Indonesian shrimp exports increased by 28.96% and 4.78% compared to 2019 and 2020 (Kementerian Kelautan dan Perikanan, 2021). Yolandika et al. (2022) stated that shrimp export commodities are mostly fresh and frozen. In this case, fresh shrimp, which includes fishery products known for their perishable nature and susceptibility to spoilage because they contain 29.63-35.17% protein, 3.31-8.46% fat, and 58.63-77.57% moisture (Liu et al., 2021), requires proper handling so that quality is maintained until it reaches consumers.

Edible coatings are derived from renewable raw materials such as a mixture of lipids, polysaccharides, and proteins that have a protective function from water vapor, gases, and other solutes, carriers of various components such as emulsifiers, antimicrobials, and antioxidants (Matloob et al., 2023). Suitable materials for making edible coatings are gelatin and chitosan, which are edible polymers that can be combined into coatings (Salehi, 2020). Lasmi et al. (2021) also stated that gelatin can form edible coatings by wrapping and protecting products from oxygen and microbial contamination. Aref et al. (2022) stated that chitosan applied to grey mullet (*Mugil cephalus*) fish sticks using edible coating containing chitosan, nano chitosan and clove oil is proven to suppress the growth of microorganisms in the TPC test, also suppress the occurrence of fat oxidation in the TBA test.

However, some studies have shown that when chitosan is added to products that have high water content, the viscosity value of chitosan will decrease (do Amaral Sobral et al., 2022) and the viscosity cannot be long-term due to hydrolysis between chitosan and acetic acid solvents (Thirugnanasambandan & Gopinath, 2023). The addition of gelatin increases the viscosity of edible coatings from chitosan. Gelatin has hydrophilic properties that are easily dispersed and bind free water to increase the viscosity of chitosan edible, non-dispersible coating that binds free water. These two materials have good affinity and compatibility properties, so they can be used together as coatings on fishery products (Rathod et al., 2023). One of the fishery materials that is good for gelatine production is the swim bladder, which has amino acids glycine, alanine, proline, and hydroxyproline, where hydroxyproline affects gelatine formation (Kanwate & Kudre, 2022).

Arius thalassinus swim bladders are a collagen-dense, protein-rich, and cost-effective waste product, they have not yet been utilized as a matrix for seafood preservation (Kurniasih et al., 2021). Prior research has demonstrated that gelatin derived from fish swim bladders possesses advantageous physicochemical attributes, such as excellent transparency, pliability, and effective barrier properties against oxygen and moisture, thereby rendering it appropriate for utilization in edible coating applications (Wang et al., 2021; Lan et al., 2024). Transforming this biological waste into an effective edible coating requires precise tuning of the polymer blend, as the volumetric ratio between chitosan and gelatin dictates the coating's mechanical durability and permeability. This study addresses this gap by converting sea catfish waste into gelatin and evaluating how different biopolymer ratios influence the shelf-life extension of fresh white shrimp.

Material and Methods

Materials

The materials used in this study include fresh white shrimp (*Litopenaeus vannamei*) with size 70 (PT Bumi Asri Lestari, Situbondo, Indonesia), dried ariid catfish (*Arius thalassinus*) swim bladder (Bandarharjo, Semarang, Indonesia), shrimp chitosan with 155.31 mPas viscosity and 97.28% degree of deacetylation (Phy Edumedia, Malang, Indonesia), distilled water, sodium hydroxide (NaOH), acetic acid (CH_3COOH), trichloroacetic acid (TCA) (Sigma Aldrich, Singapore), Boric acid (H_3BO_3) (Merck, Darmstadt, Germany), potassium carbonate (K_2CO_3) (Merck, Darmstadt, Germany), hydrochloric acid (HCl) (Merck, Darmstadt, Germany), 2-thiobarbituric acid (TBA reagent) (Sigma Aldrich, Singapore), phosphate buffer (Sigma Aldrich, Singapore), plate count agar (PCA) (Merck, Darmstadt, Germany), chloroform (Merck, Darmstadt, Germany), potassium iodide (KI) (Merck, Darmstadt, Germany), and sodium thiosulfate ($Na_2S_2O_3$) (Merck, Darmstadt, Germany).

Methods

Preparation of Swim Bladder Gelatin

Gelatin from dried ariid catfish swim bladder was extracted using a modified method from Sinthusamran et al. (2018), adjusting acetic acid concentration and soaking time. The swim bladder was cut into 1x1 cm pieces, washed, and soaked in 0.1 M NaOH (1:10 b/v) for 8 hours at 4°C, refreshing the NaOH every 2 hours. After neutralizing with distilled water, the pieces were soaked in 0.5 M CH_3COOH (1:2 b/v) for 60 hours at 29°C. The swim bladder was then washed to neutral pH and extracted with distilled water (1:3 b/v) for 3 hours at 80°C. The gelatin extract was filtered, dried in an oven at 60°C for 48 hours, ground into powder, and stored with silica gel to prevent moisture, ready for use in edible coating production.

Preparation of Edible Coating Solution

The edible coating solution was prepared using a modified method from Farajzadeh et al. (2016). A 1% chitosan solution was made by mixing 10 g of shrimp chitosan powder with 900 mL of distilled water, stirring for 10 minutes. Then, 15 mL of acetic acid was added, stirring the mixture for 1 hour at 40°C. Distilled water was added to reach a final volume of 1000 mL, and the solution was stored at room temperature. A 5% swim bladder gelatin solution was prepared by dissolving 50 g of gelatin powder in 1000 mL of distilled water, stirring for 15 minutes at 35°C, cooling at 7°C for 15 minutes, and reheating at 55°C for 30 minutes. Edible coatings were prepared by mixing the chitosan and gelatin solutions in three ratios: 3:7 (P1), 5:5 (P2), and 7:3 (P3), then stirred at 45°C for 30 minutes until homogeneous. The coating solution was then allowed to cool.

Coating of Edible Coating Solution on Fresh Shrimp

Shrimp coating with edible coating solution using the method of Nagarajan et al. (2021) with a slight modification. Fresh white shrimps were washed with clean water and cut off the head. The shrimps were fully immersed in each of the prepared shrimp chitosan-swim bladder coatings with comparative treatment, after which they were drained for 1-2 minutes. An electric fan assisted the draining process to help accelerate the drying of the coating on the surface of the shrimp. Both coated and uncoated shrimp samples were stored in sealed containers for 72 hours at room temperature. During storage, samples of all treatments, including control, were tested for sensory, melanosis, weight loss, pH, PV, TVBN, TBA, and TPC every 24 hours since hour 0.

Determination of Thiobarbituric Acid Reactive Substances (TBARS)

Lipid oxidation in the shrimp was assessed using TBARS by following Wu et al. (2016) method by using UV-vis spectrophotometer (Shimadzu co ltd, Kyoto Japan). A standard curve of malondialdehyde was used to determine the sample's malondialdehyde equivalent content. The MDA concentration was calculated using the regression equation derived from the standard curve. TBARS values was expressed using the following formula:

$$\text{TBARS (mg MDA/kg sample)} = \frac{7.8 \times D \times 3}{m}$$

note: D : absorbance

Microbiological Analysis

Microbiological analysis refers to SNI 2332.3:2015 on Microbiological Test Methods-Part 3: Determination of Total Plate Count (TPC) in Fishery Products. There are two TPC methods, namely, the pour plate method and the spread plate method. The method used in this study is the spread plate method. Calculation of TPC using the following formula:

$$N = \frac{\Sigma C}{[(1 \times n1)+(0,1 \times n2)] \times d}$$

note: N: number of colonies in the sample (CFU/g); ΣC: number of colonies in all cups; n1: number of cups in the first dilution; n2: number of cups in the second dilution; d: the first dilution counted

Determination of Peroxide Value (PV)

The shrimp sample's peroxide value (PV) was measured according to SNI 8392-2:2018, which outlines the iodometric titration method for determining peroxide levels in fish oil. Two grams of the sample were ground and dissolved in 30 mL of a glacial acetic acid and chloroform mixture (3:2). Then, 0.5 mL of saturated KI solution and 30 mL of distilled water were added. After adding 0.5 mL of starch solution, the mixture turned blue-black. It was then titrated with 0.01 N $Na_2S_2O_3$ until it became clear yellow. The peroxide value was calculated using the appropriate formula:

$$\text{Peroxide Value} = \frac{1000 \times (V-Vo) \times N}{m}$$

note: V: volume of Na2S2O3 0.002 M used by the sample; Vo: volume of Na2S2O3 0.002 M used blank; N: concentration of Na2S2O3; M: sample mass.

Determination of Total Volatile Basic Nitrogen (TVBN)

The Value of TVBN was measured based on the method of SNI 2354.8:2009 on Chemical Test Method-Part 8: Determination of Total Volatile Base Nitrogen (TVB-N) and Trimethyl Amin Nitrogen (TMA-N) in Fishery Products. The procedure to analyze TVBN in shrimp samples is done through three stages: extraction, distillation, and titration. The calculation is based on the endpoint of the titration, which is indicated by the color of the solution becoming purple. Calculation of the titration result is calculated using the following formula:

$$\text{TVBN (mgN/100g)} = \frac{(Vc-Vb) \times N \times 14.007 \times 2 \times 100}{W}$$

note: Vc: volume of HCl solution in sample titration; Vb: volume of HCl solution in blank titration; N: normality of HCl solution; W: sample weight (g); 14.007: atomic weight of nitrogen; 2: dilution factor

Measurement of pH

The pH testing followed SNI 6989.11-2019 guidelines for water and wastewater, using a pH meter. The procedure involved calibrating the pH meter with a buffer solution, drying it with tissue paper, rinsing the electrode with distilled water, then with the test sample. The electrode was immersed in the test sample until a stable pH reading was displayed, which was then recorded.

Weight Loss Analysis

Weight loss analysis refers to Medina-Jaramillo et al. (2020). Weight loss is the difference between the initial and final mass by weighing. The following formula makes the calculation of weight loss:

$$\% W = \frac{m0-mf}{m0}$$

note: % W: Weight Loss; m0: Initial weight before treatment; mf : Weight at each time

Sensory Analysis

Sensory testing refers to SNI 2346:2015 on Organoleptic and or Sensory Testing Guidelines. Sensory analysis was carried out based on the scoresheet in SNI 01-2728.1-2006 on Specifications for Fresh Shrimp by analyzing appearance, odor, and texture. Sensory calculations were performed at a 95% confidence level.

Melanosis Analysis

Melanosis observation refers to Lopez-Caballero et al. (2019). Observations used a numerical scale to determine the Value of melanosis in shrimp. Observations were made by thirty panelists using the following Table 1.

Statistical Analysis

All experiments were done in triplicates. The results are shown as mean ± standard deviation, and the probability value of $p<0.05$ was considered significant. One-way analysis of variance (ANOVA) was applied in this study, and Duncan's multiple range test was used to compare the mean differences. All the statistical assessments were conducted using the Statistical Package for Social Sciences (SPSS for Windows, SPSS Inc., Chicago, IL, USA).

Results and Discussion

Thiobarbituric Acid Reactive Substances (TBARS)

The TBA values of the control and treated shrimp samples are shown in Fig. 1A. At hour 0, P2 and P3 treatments had high TBA values of 10.23 and 13.31 mg

Table 1. Scale used to describe and rate the occurrence of melanosis (black spot)

Melanosis Scale	Description
0	Absent
2	Slight, up to 20% of shrimp surface affected
4	Moderate, 20 – 40% of shrimp surface affected
6	Significant, 40 – 60% of shrimp surface affected
8	Severe, 60 – 80% of shrimp surface affected
10	Very severe, 80 – 100% of shrimp surface affected

MDA/kg, respectively, while the control and P1 had lower TBA values of 4.86 and 4.84 mg MDA/kg. All treatments showed increased TBA values over the storage period (0 to 72 hours). The control and P1 experienced a significant increase ($p<0.05$) in TBA from the start of storage to hour 48, while P2 and P3 showed a significant increase ($p<0.05$) from hours 24 to 48. These results suggest that the chitosan-gelatin coating on shrimp helped limit the increase in TBA values, making the rise less pronounced and prolonged than P2 and P3. According to Kamali et al. (2023), edible coatings rich in polysaccharides can extend the shelf life of shrimp by inhibiting fat oxidation.

At the end of storage (72 hours), TBA values were 21.96 mg MDA/kg for the control, 21.41 mg MDA/kg for P1, 23.88 mg MDA/kg for P2, and 23.30 mg MDA/kg for P3. While P3 had high TBA values at both the beginning and end of storage, it also showed the lowest percentage increase (17.37%) among all treatments. Differences in initial fat content could explain the variation in TBA values. Higher fat content generally results in higher TBA values due to increased oxidation. Chitosan coatings can protect against oxidation by acting as barriers to oxygen. Comparative studies by Charoenphun et al. (2023), Karimkhani et al. (2025) and Dastaran et al. (2025). show that TBA results can vary based on storage conditions and fat types, with effective coatings reducing fat oxidation and extending shelf life. Despite these coatings, all treatments exceeded the TBA threshold for seafood (5 mg MDA/kg), indicating significant oxidation over the storage period.

Total Plate Count (TPC)

All treatments (control, P1, P2, and P3) showed an increase in total plate count (TPC) during storage, as seen in Fig. 1B. This increase is due to the growth of bacteria and microbes in the shrimp samples, which can be influenced by internal factors (such as the shrimp's core temperature and natural microbial flora) and external

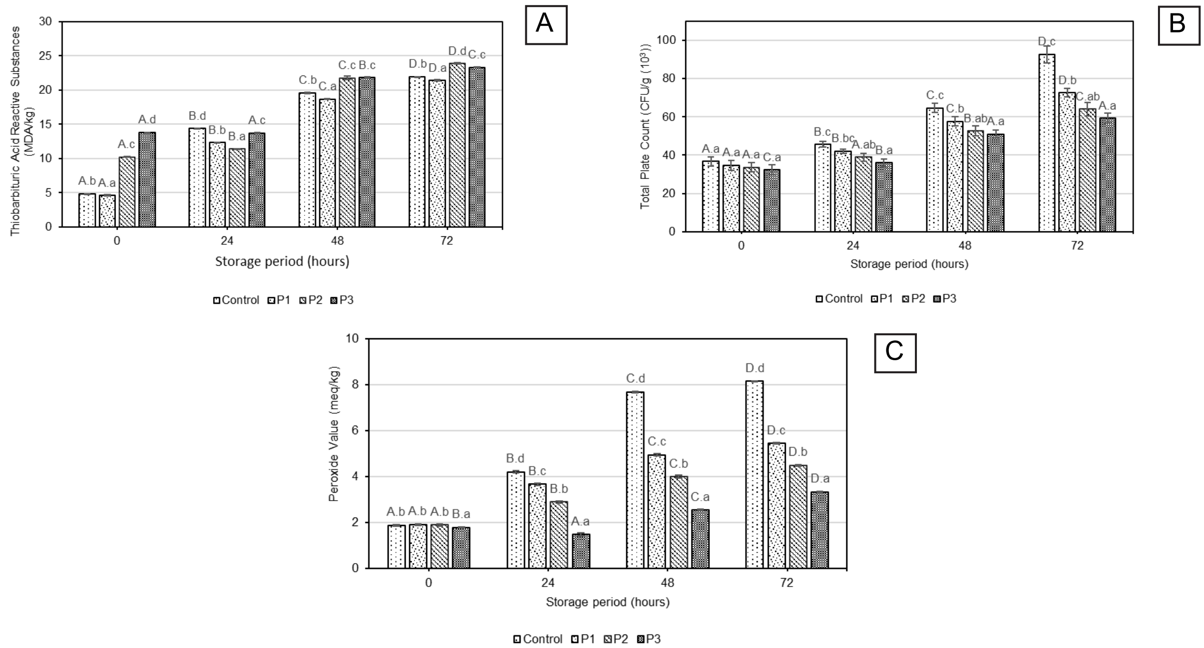


Figure 1. Time profiles of thiobarbituric acid reactive substances (A), total plate count (B), and peroxide value (C) in white shrimp samples stored at room temperature for up to 72 hours. Different capital-letter superscripts indicate significant differences among treatments, while different lowercase-letter superscripts indicate significant differences within each storage time ($p<0.05$).

factors (such as handling, storage conditions, and environmental sanitation). According to Li et al. (2021), TPC increases as bacterial growth accelerates post-mortem, influenced by rising internal temperatures and tissue degradation, which leads to spoilage. Babaei et al. (2025) noted that shrimp meat has higher carbohydrate and nitrogen content than fish, promoting faster bacterial growth and spoilage.

A significant increase in TPC (p<0.05) was observed in the control, rising from 36.67x10^{3} CFU/g at the start to 92.67x10^{3} CFU/g at hour 72. The P3 treatment, which had the highest chitosan content, showed the lowest TPC, from 32.33x10^{3} CFU/g initially to 59.33x10^{3} CFU/g after 72 hours. Based on SNI 01-2728.1-2006 standards for fresh shrimp, the acceptable TPC limit is less than 5.0x10^{5} CFU/g. The control group approached this limit, while P3, due to its higher chitosan content, better inhibited bacterial growth. Comparatively, studies by Erge and Eren (2021) and Nogueira et al. (2025) demonstrated that chitosan-gelatin edible coatings can reduce aerobic bacteria counts and extend the shrimp's shelf life, confirming this study's findings.

Peroxide Value (PV)

Significant differences in peroxide value (PV) (p<0.05) are evident in the storage period, as shown in Fig. 1C. The control sample exhibited a sharp increase in PV from 1.88 meq/kg at the start of storage to 8.15 meq/kg after 72 hours. This rise is attributed to the lack of a coating to prevent fat oxidation during storage. Coatings are designed to inhibit oxidation; according to Hu et al. (2022), coatings effectively reduce oxidation activity. The increase in PV for white shrimp indicates that fatty acids in the shrimp muscle are undergoing oxidation. The loss of hydrogen from fatty acid bonds produces free radical ions that react with oxygen to form hydroperoxides. The acceptable PV limit for fresh shrimp is 5 meq/kg.

At the start of storage, PV values for all treatments were similar: 1.88 meq/kg for control, 1.91 meq/kg for P1, 1.89 meq/kg for P2, and 1.79 meq/kg for P3. However, all treatments experienced a significant increase (p<0.05) in PV over time. After 72 hours, PV values for P1, P2, and P3 were 5.44, 4.48, and 3.33 meq/kg, respectively. Treatment P3 (7:3 ratio) had the lowest PV at the end of storage, indicating that shrimp chitosan was more effective than swim bladder gelatin. Hu et al. (2022) found that higher chitosan concentrations increase antioxidant activity. Chitosan reduces free radical activity by binding hydrogen peroxide, superoxide anions, and Cu2+ ions, extending the shelf life of oxidation-prone products like shrimp. Liu et al. (2022) showed that chitosan-gelatin edible coatings effectively reduce fat oxidation in white shrimp, reflected by decreased PV. Similarly, Chen et al. (2022) demonstrated that chitosan-gelatin coatings suppress fat oxidation, lowering PV in white shrimp.

Total Volatile Base Nitrogen (TVBN)

Figure 2A shows that treatment P3 has the lowest TVBN value of 24.31 mgN/100g, compared to P1 at 27.08 mgN/100g and P2 at 25.29 mgN/100g, while the

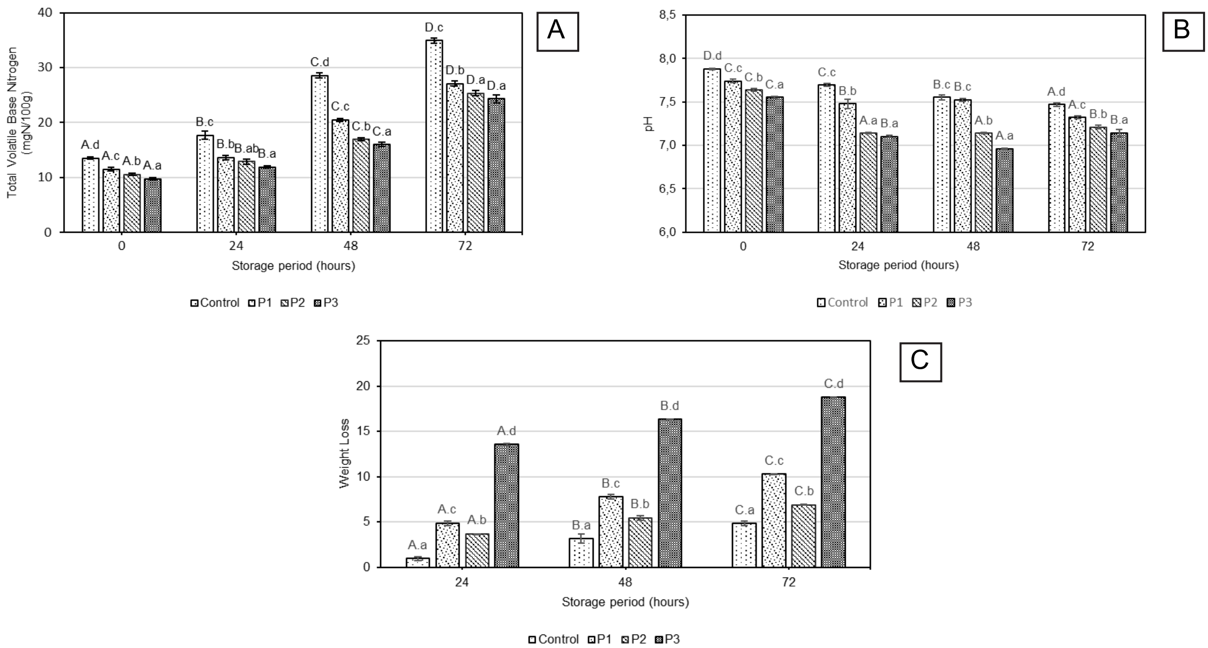


Figure 2. Time profiles of total volatile base nitrogen (A), pH (B), and weight loss (C) in white shrimp samples stored at room temperature for up to 72 hours. Different capital-letter superscripts indicate significant differences among treatments, while different lowercase-letter superscripts indicate significant differences within each storage time (p<0.05).

control has the highest Value of 34.92 mgN/100g after 72 hours. P3 is considered good quality as its TVBN content remains below the acceptable limit. Benmohand et al. (2024) reports that freshly harvested shrimp typically have a TVBN content of 5-20 mg/100g, which increases with storage time. Shrimp freshness can be classified based on TVBN as follows: very good (≤ 25 mg/100g), good (≤ 30 mg/100g), acceptable (≤ 35 mg/100g), and poor (> 35 mg/100g).

TVBN values rose significantly from 24 to 72 hours across all treatments. The chitosan-gelatin coatings (P1, P2, and P3) kept TVBN levels below 30 mgN/100g, indicating that these coatings slow the increase in TVBN. The chitosan-gelatin coating effectively suppresses bacterial growth and enzymatic activity, especially the 7:3 chitosan-gelatin ratio (P3), significantly reducing TVBN levels (p<0.05). Uncoated shrimp exceeded the acceptable TVBN limit sooner than coated shrimp. Chitosan coatings help prevent and delay the formation of volatile bases (Chen et al., 2022, Nogueira et al., 2025).

Van (2020) found that chitosan-gelatin edible coatings effectively reduce protein decomposition in white shrimp, as indicated by lower TVBN values. Lv et al. (2023) also demonstrated that chitosan-gelatin coatings can slow the increase in TVBN, thereby reducing protein breakdown.

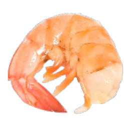
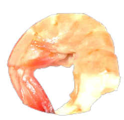
pH

Figure 2B shows a significant decrease in pH (p<0.05) across all treatments during storage. The control showed a steady decline, while P2's pH increased from 24 to 72 hours and P3's pH rose at 48 hours. Initially, pH values were 7.88 (control), 7.74 (P1), 7.64 (P2), and 7.55 (P3). After 72 hours, they were 7.47, 7.32, 7.21, and 7.14, respectively. Chitosan-gelatin coatings led to fluctuating pH levels, with P3 having the lowest final pH. P3 had the slightest change in pH (0.41), while P2 had the highest (0.43). Chitosan's antimicrobial properties help maintain pH below 7.7, indicating effective inhibition of microbial activity, especially with a 7:3 chitosan ratio. Thi et al. (2022) found that chitosan-gelatin coatings maintain acidity, reflecting freshness.

Weight Loss

Figure 2C shows significant weight loss increases (p<0.05) in all treatments. P3 had the highest weight loss at 18.75%, while the control had the lowest at 4.81%. P2 had 6.88% weight loss, and P1 had 10.28%. Weight loss

Table 2. Shrimp melanosis during the storage period

Period (Hours)	Control (0:0)	P1 (3:7)	P2 (5:5)	P3 (7:3)
0				
24				
48				
72				

is due to moisture loss, affecting texture (Liu et al., 2020). Chitosan forms a semipermeable film that helps retain moisture but may need to be more effective (Cazon et al., 2022). Mixing chitosan with gelatin improves moisture retention. P2, with a 5:5 chitosan-gelatin ratio, had the lowest weight loss increase. Higher chitosan ratios led to more shrinkage, while higher gelatin ratios reduced it. Nawaz et al. (2020) and Saki & Hosseini (2018) found that chitosan-gelatin coatings reduce weight loss and maintain freshness.

Melanosis

Table 2 shows melanosis developed in all samples during storage. It appeared as early as the control and P2, starting at 24 hours, with the control showing the highest increase in melanosis (6.58). P1 and P3 started showing melanosis at 48 hours. Melanosis occurs if shrimp are not immediately treated or stored. Chitosan-gelatin coatings help inhibit melanosis. Babaei et al. (2025) found that gelatin coatings can reduce melanosis by preventing phenol polymerization into black pigment.

Melanosis in white shrimp increased with storage time, more so in the control than in treatments P1 and P3. Chitosan inhibits melanosis by blocking melanin production and polyphenol oxidation enzymes, which prevents black pigment formation (Hatem et al., 2022). Morachis et al. (2021) found that chitosan-gelatin coatings help maintain sensory qualities like color and texture, enhancing consumer acceptance. Aref et al. (2022) also reported that these coatings reduce melanosis, preserving shrimp's appearance.

Sensory Analysis

Figure 3A shows a significant decrease in appearance sensory value for the control, from 8.43 to 3.73 over 72 hours. Treatments P1, P2, and P3 showed less decrease, with initial values of 8.37, 8.20, and 8.37, respectively. P3, with a 7:3 chitosan-gelatin ratio, maintained the highest appearance value (6.23), followed by P1 (6.07) and P2 (5.93). Chitosan coatings effectively preserve shrimp appearance during storage (Yuan et al., 2016).

Color changes in Table 2 show the control turned red and developed black spots by 24 hours, worsening with time. P1 and P3 started pink, turning yellow by 48 and 72 hours, while P2 showed incomplete pink at 24 hours, yellowing by 72 hours. Color changes are linked to enzymatic oxidation and were less severe in coated samples (Cui et al., 2023). Odor values in Figure 3B decreased significantly (p<0.05) across all samples. Initial values were above 8, indicating good quality, but dropped to 3.00 (control), 4.00 (P1), 4.67 (P2), and 4.53 (P3) at the end of storage. P2, with a balanced chitosan-gelatin ratio (5:5), had the highest odor sensory value, followed by P3.

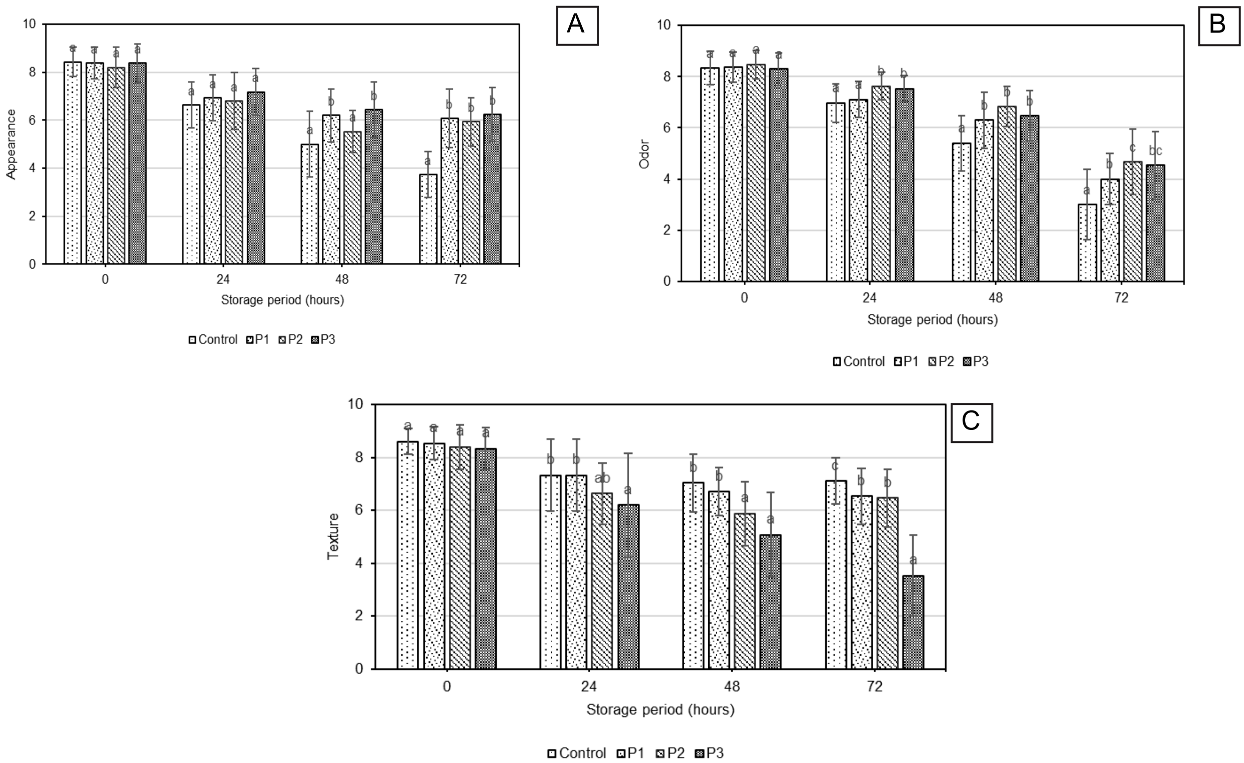


Figure 3. Time profile of sensory analysis: appearance (A), odor (B), and texture (C) in white shrimp samples stored at room temperature for up to 72 hours. Different lowercase-letter superscripts indicate significant differences within each storage time (p<0.05).

Figure 3. Time profile of sensory analysis: appearance (A), odor (B), and texture (C) in white shrimp samples stored at room temperature for up to 72 hours. Different lowercase-letter superscripts indicate significant differences within each storage time (p<0.05).

The control sample had the lowest odor value due to its lack of treatment, leading to faster microbial and enzymatic decay (Liu et al., 2020). Chitosan-coated shrimp showed better sensory results due to reduced microbial activity, chemical decomposition, and melanosis. Figure 3C shows significant texture changes (p<0.05) across all samples. Initially, all samples had texture values above 8.00. By 72 hours, sample P3 had the lowest texture value of 3.53, indicating softness due to high water loss. The control and P1 retained better texture, with P1's higher gelatin ratio contributing to better texture preservation. High chitosan content in P3 did not effectively maintain texture. Chitosan's brittleness and low water vapor permeability are cited issues (Naiu et al., 2021). Additionally, higher storage temperatures can accelerate color changes in shrimp (Li et al., 2024).

Conclusion

Edible coatings of chitosan and gelatin affect shrimp quality during storage. Chitosan's antimicrobial and antioxidant properties and gelatin's gel-forming ability improve shrimp preservation until 72 hours at room temperature. P3 (7:3 chitosan:gelatin) was most effective for TPC, PV, TVBN, pH, and melanosis, while P1 (3:7 chitosan:gelatin) improved TBA and sensory values but had suboptimal weight loss effects. Further research should explore the antioxidant and antimicrobial properties of these coatings.

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