

Figure 6 also shows that the samples whose water is replaced more often have a lower increase of TMAB in day 7. It is caused by the decreased number of initial bacteria in the tofu after disinfection with ozonated water. The percentage of disinfection for each replacement period can be seen in Figure 7. Figure 7 shows that samples with replacement every 40 minutes had the highest percentage of disinfection compared with 60-minute replacements and those that were not replaced. It was able to disinfect bacteria by 96% (5.24 log cfu / gr). If the ozonated water is renewed within a period of time, the decomposed ozone will continue to be replaced with new dissolved ozone. Therefore, the water replacement every 40 minutes has the most amount of ozone compared to the 60-minute period and that is not replaced at all.

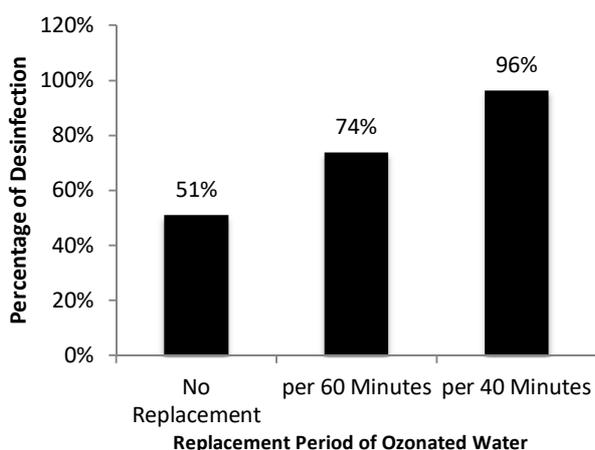


Fig. 7 Percentage of Disinfection in Different Replacement Period (ozone dosage: 0.32 mg/L; storage temperature: 8°C; water pH: 5)

2) *The Change of pH:* The effect of the replacement period of the ozonated water on the pH change of tofu can be seen in Figure 8. The results show that the more frequent the water replacement period, the slower the increase of the pH. On the 7th day the lowest pH was found in the sample with replacement every 40 minutes, which was 6.58. Whereas the pH value of tofu for replacement every 60 minutes and without replacement is 6.72 and 6.79. The difference in pH that is not too significant is still categorized as accurate because the pH values in all samples are above the error margin of the pH meter, which is ± 0.02 pH units.

The more frequent the replacement of ozonated water, the more the amount of ozone dissolved in water that can disinfect bacteria in the tofu. In the sample with replacement every 40 minutes, the number of TBMA living in it is the least compared to other samples. If the number of TBMA is less, the protease enzyme produced is also less. The number of protease enzymes that are less will have an impact on the less amount of protein degraded by TBMA through proteolysis reaction. As a result, the number of base compounds (TVB) produced also decreases, so the change in pH of the tofu is not too drastic.

Although the proteolysis reaction can occur without the presence of bacteria, the reaction has a slow rate due to the absence of compounds that can reduce the activation energy and accelerate the reaction rate. The presence of protease enzymes from bacteria will accelerate the rate of proteolysis

reactions and, therefore, speed up tofu's damage. In other words, the replacement of ozonated water is effective in slowing the rate of increase in pH due to its ability to disinfect bacteria.

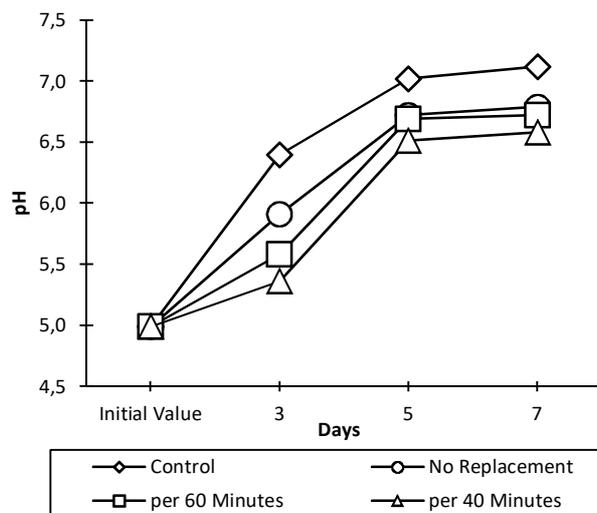


Fig. 8 pH of Tofu in Different Replacement Period (ozone dosage: 0.32 mg/L; storage temperature: 8°C; water pH: 5)

3) *The Change of Protein Content:* The effect of the replacement period of ozonated water on changes in protein content can be seen in Figure 9. It can be observed that there is a substantial decrease in protein content after contacted with ozone. A more frequent replacement period will increase the amount of ozone contacted with tofu, thus providing more ozone doses to oxidize proteins. The more frequent the replacements will increase the amount of ozone dissolved in water, thus giving more ozone doses to oxidize proteins. As previously explained, ozone will degrade protein by reacting with the amino acid monomers in it. Damage to these amino acids can change the physical properties of proteins that have an impact on protein degradation [20].

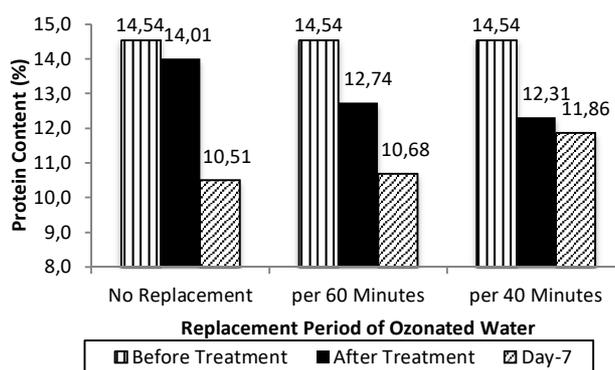


Fig. 9 Protein Content of Tofu on Different Replacement Period

On the other hand, there is a significant difference shown on protein levels at day 7. Although the protein content in the sample with replacement every 40 minutes decreases the most after being contacted with ozone, its protein content on day 7 has the highest value. The reduction of protein during storage is no longer affected by ozone but by the activity of microorganisms in the tofu. Tofu with fewer amounts of

TMAB has a lower rate of protein decrease. This is because the fewer protease enzymes exist in the tofu, so the rate of protein hydrolysis will be slower.

IV. CONCLUSION

To conclude, this research shows that the longer the exposure time between tofu and ozonated water (0.32 mg/L), the more preserved the tofu's quality. The exposure time of 120 minutes can disinfect TMAB for 51%. Also, the replacement of ozonated water was effective to protect tofu's quality. The more frequent the replacement, the more preserved the quality of tofu. Replacement of ozonated water every 40 minutes can disinfect TMAB for 96% and therefore perform better to support the quality of tofu.

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