

**Abstract**—This study was conducted to detect effect of CO<sub>2</sub> and N<sub>2</sub> gas packaging on chicken meat quality and microbial traits during storage. After slaughtering, chicken breasts were packaged with various rate of CO<sub>2</sub> and N<sub>2</sub>, such as 0:0, 20:80, 40:60, 60:40, 80:20, and 100% CO<sub>2</sub> and stored for 6 days at 4°C. In meat color, L\* and a\* value increased with increasing CO<sub>2</sub>. VBN and TBARS values were also reduced with CO<sub>2</sub> increase especially on the day of 6. Number of total microbes was decreased with 100% CO<sub>2</sub> gas packaging. However, when 100% of CO<sub>2</sub> was injected in the chicken breast packaging, packaging tray was transformed its shape and meat. Therefore, to enhance chicken meat shelf life without transforming the appearance, the rate of 40:60 (CO<sub>2</sub>:N<sub>2</sub>) would be desirable in the poultry meat industry.

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## I. INTRODUCTION

Modified atmosphere packaging system is developed to improve a defect of vacuum packaging system and works as retard breathing rate of meat and microbial growth on meat [1]. Gas packaging system is use gas such as CO<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub> alone or in combination instead of the air in the packaging. Especially, CO<sub>2</sub> is absorbed in water on the meat surface and reduced the pH, microbial growth, and enzyme activity [2]. It also removes water of cell membrane and changed permeability of cell membrane. Also, O<sub>2</sub> remains meat color and N<sub>2</sub> is use as buffer of the packaging and be shaped of the packaging. This study was performed to enhance chicken meat storage days using by modified atmosphere packaging system.

## II. MATERIALS AND METHODS

The chickens (ROSS) in 35d of age were reared in the floor. When slaughter, the chicken were fasted for 8 hrs and slaughtered in the local slaughtering house. Chicken breast meat was separated and packaged by modified atmosphere packaging machine with gases of CO<sub>2</sub> and N<sub>2</sub> in the ratio of 20:80, 40:60, 60:40, or 80:20, respectively. The packaged chicken breast was stored at 1 and 4°C for 6 days and analyzed on the day of 1, 3, and 6. For the chicken meat quality, pH, color, TBARS, VBN, and total microbes were determined.

## III. RESULTS AND DISCUSSION

This section present the results elaborated and elaborate the importance of the work or suggest applications and extensions.

Modified atmosphere packaging (MAP) is developed to improve the defects of vacuum packaging. MAP reduces breathing velocity of meat, microbial growth, and enzymatic hydrolysis. Major gases to use are CO<sub>2</sub>, N<sub>2</sub>, and O<sub>2</sub> instead of air or in combination. Especially, CO<sub>2</sub> is dissolved on the surface water of the meat and suppress pH, microbial growth, and enzyme activity. N<sub>2</sub> prevents the packaged meat products from battering and remains the appearance. In this respect, the present study was conducted to reduce microbial growth and lipid oxidation and to increase shelf life of the chicken meat by using MAP. The lightness (L\*) increased from 52.30 to 60.16 with increasing of CO<sub>2</sub> ratio and this trend was shown on day 3. On the other hand, the yellowness (b\*) was not influenced by storage days and CO<sub>2</sub> level. Lipid oxidation (TBARS) was 0.168 mgMA/kg in chicken of control group at day 3, however, decreased from 0.161 to 0.127 mgMA/kg with increasing CO<sub>2</sub> ratio. Similar trend was shown in protein denaturation (VBN). Number of total microbes was 4.77 log CFU/cm<sup>2</sup> in chicken meat of control group at day 3, however, the number was decreased from 4.64 to 3.24 log CFU/cm<sup>2</sup> with increasing CO<sub>2</sub> level. According to above results, the shelf life of chicken meat was increased with increasing level of CO<sub>2</sub> ratio by reducing lipid oxidation and microbes, however, more than 60% of CO<sub>2</sub> in the package resulted in distortion of the packaging tray. In conclusion, CO<sub>2</sub> and N<sub>2</sub> mixture in the ratio of 40 : 60 should be optimum level to enhance shelf life of chicken meat without distortion of package.

#### IV. CONCLUSION

MAP is effective to enhance meat quality during storage, however, high cost is one of the defect in the packaging industry. Therefore further study will be necessary to compensate the economical fault.

#### REFERENCES

- [1] UK MAFF 1999 Enforcement guide to EC Poultry meat market standard regulations
- [2] USDA 1988 United States Classes, Standards and Grades for Poultry

**Table 1. Changes of lightness on mixed gas packing of chicken breast meat during storage period (CO<sub>2</sub>:N<sub>2</sub>)**

Items	Control	20:80	40:60	60:40	80:20	CO <sub>2</sub> 100%
1day	56.33±2.04	52.30±0.72	53.70±0.78	55.42±1.46	57.92±1.31	60.16±2.51
3day	57.38±0.93	53.74±0.52	55.33±1.35	57.99±1.79	59.34±1.79	58.87±4.98
6day	52.85±2.34	55.32±0.74	57.74±0.54	59.09±0.64	61.61±2.63	59.55±0.79

**Table 2. Changes of redness on mixed gas packing of chicken breast meat during storage period**

Items	Control	20:80	40:60	60:40	80:20	CO <sub>2</sub> 100%
1day	1.39±0.84	1.13±0.34	1.09±0.09	1.36±0.98	1.07±0.37	2.98±0.22
3day	1.55±0.64	1.69±0.24	0.86±0.04	1.92±0.88	0.90±0.77	1.79±0.24
6day	0.92±0.64	1.11±0.21	1.31±0.04	1.36±0.08	1.23±0.68	1.99±0.53

**Table 3. Changes of VBN value on mixed gas packing of chicken breast meat during storage period**

Items	Control	20:80	40:60	60:40	80:20	CO <sub>2</sub> 100%
1day	4.98±0.16	4.76±0.16	4.48±0.16	3.61±0.42	3.52±0.60	3.34±0.16
3day	6.59±0.27	6.49±0.16	6.31±0.27	5.76±0.27	5.40±0.16	5.03±0.16
6day	8.37±0.27	8.28±0.16	7.91±0.16	7.09±0.16	6.72±0.27	6.54±0.16

**Table 4. Changes of TBARS value on mixed gas packing of chicken breast meat during storage period**

Items	Control	20:80	40:60	60:40	80:20	CO <sub>2</sub> 100%
1day	0.161±0.02	0.123±0.01	0.121±0.01	0.107±0.02	0.104±0.01	0.073±0.00
3day	0.168±0.01	0.161±0.02	0.157±0.01	0.137±0.01	0.135±0.01	0.127±0.01
6day	0.202±0.01	0.193±0.01	0.173±0.01	0.169±0.01	0.167±0.01	0.160±0.01

**Table 5. Changes of total bacterial counts on mixed gas packing of chicken breast meat during storage period (unit : mgMA/cm<sup>2</sup>)**

Items	Control	20:80	40:60	60:40	80:20	CO <sub>2</sub> 100%
1day	3.59±0.51	3.13±0.06	3.20±0.08	3.40±0.13	3.07±0.18	3.12±0.02
3day	4.77±0.05	4.64±0.15	4.06±0.06	3.49±0.08	3.24±0.11	3.30±0.00
6day	6.39±0.16	6.01±0.03	5.38±0.07	4.90±0.09	4.82±0.24	4.62±0.47