STUDIES ON PROLONGING SHELF-LIFE OF MEAT PRODUCT IN PACKAGE COMBINED BY OZONE GAS AND O2 SCAVENGER.

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SUMMARY

This experiment was carried out to extend shelf-life of meat product by the high concentration of ozone gas. Microbial test and other analysis on the condition of different packaging method at 5℉ were investigated with packaged vienner sausage in polyaluminum bag (1cc/m2 24hrs atm) . The treatments of this experiment were devided into 1) Vacuum-packaging 2) O2 Scavenger 3) O3 packaging (250ppm v/v) 4) O2 Scavenger and O3 packaging (250ppm v/v). Ozone gas was easily decomposed in these packagings and half-life of O3 gas in packaging with O2 Scavenger was very short, lapsed about 2 min., compared with treatment of O3 alone. Inhibitory effect of O3 gas with O2 Scavenger on microorganisms was greater than that of other treatment groups. After 21days storage, total bacteria count of vienner sausage packaged with O2 Scavenger + O3 packaging were 102/g, but in the vacuum and other packaging the values were 107/g. During the experimental period, no changes in TBARS and pH were observed, statistically. Nitroso-hematin value of O3 packaging treatment group, however, was lower than that of other group.There were no difference among other treatments.

Introduction

Ozonization has been the method for the treatment of wastewater. In the food industry, ozone has been used to preserve fruits, vegetables, cheeses, eggs and crops, and to treat flour and color. Especially, ozone have a biocidal effect against microorganisms and viruses (Singer, 1990). It is believed that its principle mode of action is the oxidation of the fatty acid double bonds of cell walls and plasma membranes, thus causing changes in cell permeability and eventual cell lysis. Viruses are inactivated by ozone through oxidation of polypeptide chains in the viral capside. Roy (1981) suggested that the primary cause for viral inactivation is a damage to the viral RNA. Vegetative bacterial cells are generally more sensitive to ozone than yeasts and molds. For instance, ozone exposure times of less than 30 seconds at 0.4ppm were found to be sufficient to reduce the lactic acid bacteria, whereas the exposure times of 1-5 minutes were necessary for yeasts under the same conditions (Naito et.al., 1982). Bacillus spp, spore forming bacteria, are the most resistant to ozone.

Ozone has a strong causic and oxidizing effects. Ozone of low concentration is used for the storage of food because of its strong causic and oxidizing effects. This experment was carried out to extend the shelf-life of meat products by using of ozone gas of high concentration to kill speedly the meat product surface microorganisms and the use of O2 scavenger to make the anaerobic condition.

Materials & Methods

Sample used to in this experiment was vienna sausage and ozone generator was made from Korea Ozone Co., manufactured for Lab. experiment. Material of packaging films was a polyaluminum (1cc/m2 24hr atm), and O2 scavenger was a small size type to absorb oxygen only. Packaging methods were divided into vacuum packaging, O2 scavenger packaging, O3 packaging (250ppm) and O2 scavenger packaging + O3 packaging (250ppm). Vacuum packaging was treated with vacuum packager (Multivac, Switzland) and O2 scavenger packaging sealed with sample and O2 scavenger. O3 packaging and O2 scavenger + O3 packaging (250ppm) injected O3 gas used to syringe through latex rubber attached to polyaluminum bag.

Determination of ozone gas concentration

Ozone generator was controlled to generate ozone gas (250ppm) for 20 second, followed after analysis this concentration by the KI method. Generated ozone gas was injected to the empty bag for 20 second and this concentration was confirmed by using Gastic (Japan). Ozone decomposition time after packaging was also determined by using Gastic. Volume of injected gas was 180cc.

Microbiology(bacterial enumeration)

Bacterial enumeration was carried out at each storage of 0.5, 3, 6, 9, 12, 15, 18 and 21 days. Samples of 10g were excised with sterile knife and diluted with 90ml D.W in a vinyl bag, followed with stomaching using a stomacher(England) for 2min. The following bacteriological assays were done on the suspensions of with 1ml corresponded to a sample 1g; total count bacteria and psychrotrophic bacteria in poured plates of SI (Difco); Lactic acid bacteria in poured plate of MRS agar(Difco).

Nitroso-hematin & TBARS value

Nitroso-hematin of cured vienna sausage was evaluated by using the method of Horngey(1963), and TBARS was evaluated by modified extraction methods (Salib, 1987).

pH value

After homogenizing 3g sample with D.W 20ml, the pH was determined by pH meter (9HM-7E, Japan),

Statistical analysis.

Differences in ozone gas and physico-chemical changes among treatmints were examined by Duncan's multiple range test.

Result and Discussion

The differences of the rate of ozone decomposition between at the ozone solely packaging and the ozone combinated with O2 scavenger were shown in Fig 1. The decomposition time of ozone, thoroughly, was 14 min. in the O3 packaging but 8 min, in the ozone combinated with O2 scavenger packaging. This resulted from the oxidation of iron dust in the O2 scavenger by ozone. The growth of bacteria exhibited a variable difference among the packagings at 5í£. As shown in Fig 2. total visible bacteria (TVB) from vacuum and ozone packagings was 107-108 cfu/g at 21days, its growth started after 3 day storage. But growth of bacteria from O2 scavenger + O3 packaging was less than 102 cfu/g at 21days. Microbial growth at vacuum packaging is due to facultative anaerobic rather than aerobic bacteria but rapid growth of aerobic bacteria is due to oxygen produced by decomposed ozone. However, inhibitory effect of O2 scavenger + O3 packaging against bacterial growth resulted from oxygen absorption of O2 scavenger. Fig 3., growth of psychrotrophic bacteria, seems to be similar to Fig 2.

The lactic acid bacteria from vacuum, O2 scavenger and O3 packaging were grown to 104-106 cfu/g at 21days, but sless than 102 cfu/g in the packaging of ozone combined with O2 scavenger. Nitroso-hematin test is carried out to investigate the degree of decoloration by ozone gas.

The value of nitroso- hematin to ozone treated sample showed a low value, and somewhat, similar pigment value at other treatment(Table 1). There were no significant differences in nitroso-hematin value. As shown to Table 2, there were no significant differences among the all treatments. Rodel reported that oxidation was accerelated when carcass was exposed to ozone gas of high concentration for a long time, but we couldn't confirm oxidizing effect of ozone because of too short time for samples to have been exposed to ozone gas of high concentration. We expected that there's an accerelated oxidation in the ozone gas packaging caused of oxygen produced by decomposed ozone and that O2 scavenger can act as a anti-oxidant. Howevere, there were no signifficant differences of TBARS among the all packagings pH value had a stable value like a TBARS, respectively.

Conclusion

We carried out this experiment to extend the shelf-life of vienna sausage by the ozone gas. The treatments of this experimant were divided into 1) vacuum-packaging 2) O2 scavenger packaging 3) O3 packaging (250ppmv/v) 4) O2 scavenger and O3 packaging (250ppmv/v). After packaging, shelf-life of vienna sausage

was investigated on the condition of different packaging methods at 5íF. Reduction of sausage surface was outstanding at the packagings of O3 gas combined with O2 scavenger. But there were no significant differences between the O3 only packagings and the vacuum packagings. Inhibitory effect of O2 scavenger packaging against bacterial growth were higher than those of the forward two packagings. Especially, at the experiment to investigate the oxidation during the storage. there were no differences in TBARS

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