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学 位 論 文 要 旨
Dissertation Abstract

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学位論文題目： Effects of Olive Leaf Water Extracts on Physical Properties of Gel Products Prepared from Chicken Meat and Hen Egg （オリーブ葉水抽出物が鶏肉及び鶏卵の加熱ゲル食品の物性に及ぼす影響）
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Olive, *Olea Europa*, is cultivated in many countries, including Japan. A primary agricultural product of olive is the fruit which is heavily used to generate olive oil. On the other hand, the utilization of olive leaf is limited to only a few applications. It is known that extracts from tea leaves (black tea, oolong tea, and green tea) improve the physical strength of egg white (EW) gel. The improving effects differ among the three tea extracts. This difference is probably due to the structural variation in tea polyphenol which is induced by the action of endogenous enzymes of plant leaf. Olive leaf contains a high amount of polyphenol, which is comparable to the amount in tea leaf. However, the structure of the olive leaf polyphenols is quite different from that of polyphenols (flavonoids) in tea leaf. The main polyphenol in the olive leaf is water-soluble non-flavonoid type polyphenol, oleuropein. In this study, olive leaf water extract containing polyphenols and active enzymes (OEx_4) and the counterpart containing polyphenols and inactive enzymes (OEx_{80}) were prepared at 4 and 80°C, respectively, and those were applied to the chicken breast sausage (CBS). OEx_4 was also applied to gels prepared from whole egg (WE) and egg white (EW) of chicken egg. The physical properties of gels fortified by the olive leaf water extracts were investigated by chemical and physical analyses.

Chapter 2 shows the chemical characteristic of OEx_4 and OEx_{80}. There are were no significant difference in pH, sugar content and salt content between OEx_4 and OEx_{80}. The polyphenol content differed between OEx_4 and OEx_{80}, with OEx_4 containing 138.5 mg GAE/g dry weight, which was 32% lower than that of OEx_{80}. Despite the 32% lower polyphenol content of OEx_4, the antioxidative activity of OEx_4 showed only 12% lower than that of OEx_{80}. HPLC analyses showed that a major phenolic compound of OEx_{80} is the oleuropein, the most abundant polyphenol in olive leaf, while that of OEx_4 was an aglycone form of oleuropein called 3,4-DHPEA-EDA. The aglycone probably has been

generated by the action of leaf enzymes (β-glucosidases) during extraction using water at the low temperature of 4°C.

In Chapter 3, OEx_4 and OEx_{80} were applied for manufacturing CBS and the resulting OEx-containing CBSs were evaluated their chemical and physical properties. 0.1% OEx_4-CBS showed much higher water-holding capacity (WHC), breaking strength and viscoelasticity than 0.1% OEx_{80}-CBS. The superb effects of OEx_4 were suggested to be ascribed to crosslinking activity of the major phenolic compound 3,4-DHPEA-EDA contained in OEx_4. 3,4-DHPEA-EDA causes polymerization of the meat proteins via non-disulfide-type covalent bonds, appearing to be involved in the gel properties' improvement.

The effects of OEx_4 on the quality deterioration of CBS by frozen storage were investigated. The drip-loss, breaking strength change, and viscoelastic change that are caused by frozen storage were significantly suppressed by the addition of OEx_4. Furthermore, OEx_4 suppressed the lipid oxidation caused by frozen storage. Thus, OEx_4 was shown to confer resistance to freezing-related damage of sausage.

In Chapter 4, OEx_4 were applied for the two types of egg gels of WE and EW. OEx_4 showed the enhancements in the physical properties (WHC, breaking strength, and viscoelasticity) of the egg gels, although the effect of OEx_4 to WHC was larger for WE gel than for EW gel. The preventing effects of OEx_4 on gel’s physical deterioration by frozen storage were investigated by freeze-thaw abuse of the gels. Thawing-loss, breaking strength change, and viscoelastic changes of WE and EW gels caused by freeze-thaw abuse were highly suppressed by the addition of OEx_4. Thus, OEx_4 is useful to improve the storage stability of frozen egg gel products.

In conclusion, OEx_4 and OEx_{80} both showed the enhancement of physical properties of the CBS. However, OEx_4 had much stronger effects than OEx_{80}. The effectiveness of OEx_4 was more noticeable when CBS was frozen-stored. OEx_4 showed excellent tolerance against the various deterioration of CBS, WE gel, and EW gel occurring during frozen storage, such as drip loss and physical changes. Although the present study showed the effectiveness of OEx_4 only for poultry protein gel products, similar effectiveness could be effective for other high-protein gel products, such as surimi-based products. Furthermore, OEx_4 has high antioxidant activity derived from phenolic compounds. Therefore, OEx_4 could be expected to be a new texture improver which is beneficial to human health.