ABSTRACT

Deep-fried gluten ball is a traditional Chinese food. Deep-fried gluten balls are produced by deep-frying wet gluten balls in soybean oil at three different temperatures, i.e., 135 ℃, 157 ℃, and 190 ℃. For its special taste and good mouth feeling, deep-fried gluten ball is very popular in Taiwan, especially for those vegetarians. The manufacturing processes of deep-fried gluten balls include gluten washing, gluten ball shaping by cutting, and gluten ball deep-frying. The quality of soybean oil used in gluten ball deep-frying is the most important factor affecting the quality and the flavor of deep-fried gluten balls. Deep-fried gluten balls are very easy to undergo lipid oxidation and produce rancidity odor to affect the acceptance of products by the consumers. Therefore, it's our purpose to study the stability of soybean oil used in deep-frying gluten balls under high temperature heating and to search for the best chemical or physical methods for the evaluation of the quality of the frying oil and deep-fried gluten balls. The relationships between the results of physical or chemical determinations and the quantity of volatile compounds produced in the frying oil or in deep-fried gluten balls were also studied. The effect of the addition of antioxidants to the oil or the combination of glucose and various amino acids to the wet gluten balls on the oil stability were also studied. The research works of this study include into five parts. First part of this study investigated the stability of soybean oil under different heating time and temperature combinations, and the relationships between each measured quality index of frying oil and the yields of volatile compounds in frying oil. It was found that there was a positive relationship between the heating level and the degree of oil deterioration. The major volatile compounds in heated soybean oil were found to be the volatile aldehydes. With increasing in the heating level, the content of volatile aldehydes increased. When the oil was heated at 135 ℃, there was a good linear relationship between the physical or chemical quality indices of the oil and the yields of the total volatile compounds, total volatile aldehydes, or total volatile ketones in the oil. When the oil was heated at 157 ℃, there was a good linear relationship between the physical or chemical quality indices of the oil and the yields of the total volatile hydrocarbons in the oil. When the oil was heated at 190 ℃, there was a good linear relationship between the physical or chemical quality indices of the oil and the yields of the total volatile ketones in this oil. The second part of this study investigated the effects of the addition of several antioxidant combinations to the soybean oil on the inhibition of oil oxidation during the heating of oil at high temperature. Among the antioxidants used, the combination of BHT and TBHQ at the highest use level permitted (100 ppm each) by law had the highest anti-oxidation effect. Through the determination of physical or chemical indices and the yields of volatile compounds in the gluten-fried soybean oil, the effects of the combination of BHT and TBHQ on the inhibition of oil oxidation was further proven. The third part of this study investigated the effects of the addition of the combination of BHT and TBHQ at the highest use level permitted (100 ppm each) by law into the frying oil on the storage stability of deep-fried gluten balls. Through the determination of the physical or chemical indices of the oil in the deep-fried gluten balls and the yields of volatile compounds in the deep-fried gluten balls prepared in the first day’s and in the twelfth day’s frying, the effects of the combination of BHT and TBHQ on the inhibition of oil oxidation in the deep-fried gluten balls was also further proven. The fourth part of this study investigated the effects of the addition of glucose and various amino acids in the wet gluten balls to the frying oil stability and the flavor improvement of the deep-fried gluten balls. Through the determination of physical or chemical indices of the frying oil and the yields of volatile compounds in frying oil and through the sensory preference evaluation test of the deep-fried gluten balls prepared in the first day’s and in the twelfth day’s frying, the addition of the combination of glucose and glutamic acid into the wet gluten balls was found to have both of the improvement effect on the flavor of deep-fried gluten balls and the stability of the frying oil. The fifth part of this study investigated the effects of the addition of glucose and various amino acids in the wet gluten balls to the oil stability of the deep-fried gluten balls. Through the determination of physical and chemical indices of the oil in the deep-fried gluten balls and the yields of volatile compounds in the deep-fried gluten balls prepared in the first day’s and in the twelfth day’s frying, the addition of the combination of glucose and glutamic acid into the wet gluten balls was found to have the improvement effect on the stability of the deep-fried gluten balls.