CHAPTER VI
DISCUSSION

6.1 Fresh corn silk

Fresh corn silk, a by-product from the corn milk processing facility of the National Corn and Sorghum Research Center in Nakhon Ratchasima Province was high in moisture content (67.9%). It was removed from the fresh corn along with the husk by the producer and left in piles. The color of corn silk was not uniform because of its heterogeneity in cultivars and maturity. Furthermore, enzymatic browning reaction may occur during peeling. Many research revealed that corn silk is a source of phenolic compounds (14, 89, 90). In terms of dietary fiber, corn silk contained 17.2% TDF on a fresh weight basis or around 54% on dry basis with the main fraction being insoluble fiber. Hence, it showed a potential as a starting material for preparation of a dietary fiber food ingredient.

6.2 Extraction of dietary fiber from fresh corn silk (FDF) and from dried corn silk (DDF)

Fresh corn silk was boiled in water to remove impurities, water soluble components (e.g. starch) and chlorophyll pigments in order to make the dietary fiber more purified (66). Then it was extracted twice with 95% ethanol, dried and ground in order to obtain FDF. In considering the feasibility of handling a large amount of fresh corn silk which can be spoiled easily, dried corn silk was prepared and used as a starting material for dietary fiber extraction to yield DDF. Both resulted fibers were compared for their yield as well as physical and chemical properties.

The yield of DDF and FDF was not significantly different meaning that the pre-treatment of dietary fiber extraction did not have any effects. Nevertheless, when considering on a dry weight basis of its respective fiber content, FDF contained more fiber than DDF. FDF contained mainly TDF at 85% dry weight with the major fraction being IDF (72% dry weight) whereas DDF contained 53% TDF (dry weight) with 46% IDF (dry weight). This may be due to the difficulty in extracting fiber out of the dried material than its fresh counterpart. Similarly, the study of Burkus & Temelli in 1998 revealed that a small modification of the extraction procedure may cause a marked effect to the composition, functional behavior, viscosity, color, molecular weight and the physicochemical properties of the extracted β-glucan (97, 98). Moreover, according to the data of Yalcin, *et al.*, the quantity and extraction of β-glucan was influenced by cultivar and location (99).

McCleary and Prosky quoted in 2001 that the physicochemical characteristics like molecular, structural and functional properties of dietary fiber could be changed by the processing that commonly are the effects from hydrolytic enzymatic reactions and chemical degradation or crafting reactions (100). The amount of water and thermal energy used could be effect to the enzymatic reactions and chemical degradation. Moreover, the reports by Glitso and Knudsen and Harkonen *et al.* indicated that the chemical composition of dietary fiber components can vary in the various parts of the raw material tissue. The different dietary fiber characteristics were also obtained from the fractionation of plant raw materials by milling, for example in rye (101, 102).

Mechanical energy caused by the shear force in decanting process was reported to affect the polysaccharide structure (100) as found in depolymerization of oat beta-glucan resulting in the loss of its viscosity (103).

Thermal processing, such as steaming, cooking, baking were referred to as factors that could influence the various changes of dietary fiber properties like an increase and a decrease in the total dietary fiber content. Heat was also found to cause a change in extractability that leads to redistribution between the quantity of soluble and insoluble dietary fiber (36). Similarly, Svanberg in 1997 showed that heat processing could degrade polysaccharide dietary fiber by deletion of the lower molecular weight and the lower viscosity fiber (104).

The result of these previous studies may explain the difference in dietary fiber content (TDF, SDF and IDF) of FDF and DDF. In short it may be caused by the heterogeneity of cultivars of corn sample, the maturity of the corn silk tissue and the difference of pre-treatment used in the extraction of dietary fiber including thermal processing and mechanical energy from grinding even though all the corn silk used in this study was collected from the same corn processing facility.

Total dietary fiber content of FDF and DDF was comparable to other fibers prepared from by-products from the food industry as given in Table 15 for example, rice bran (27%), citrus peel (57%) and corn bran (88%).

The ratio of IDF/SDF of FDF and DDF make them an interesting raw material for fiber preparation in order to enrich dietary fiber content in food products due to its high insoluble dietary fiber content. According to the study of Sanchez-Zapata, *et al.*, the high insoluble dietary fiber content made the fiber suitable to apply into food products because ingestion of insoluble dietary fiber can cause the sensation of satiety, from its ability to adsorb water and increase bolus size. It could improve the functions of human digestive system. Moreover, it also lowers the risk of some chronic diseases such as colon cancer (105).

In terms of application, dietary fiber from several sources (vegetable, fruit, cereal, etc) could be added in food products, e.g. bread, cookies, muffins and cake (106), meat products (107), fish products (108) and milk products (109).

Table 6.1 Dietary fiber content of some agricultural by-products (%) compared with FDF and DDF

DF source	TDF content	IDF content	SDF content	Reference
Brewer's dried grain	91.4	91.4	0	(110)
Soybean hull	88.86	83.14	5.72	(111)
Corn bran	87.87	87.47	0.40	(112)
Passion fruit seed	85.9	84.9	0.97	(113)
FDF	76.94	65.04	11.90	(This study)
Coconut residue	63.24	58.71	4.53	(114)
Apple residue	60.1	46.3	13.8	(115)
Artichoke residue	58.8	44.5	14.3	(114)
Citrus peel	57.01	47.60	9.41	(113)
DDF	50.86	44.32	11.90	(This study)
Asparagus residue	49.0	38.6	10.4	(115)
Wheat bran	44.46	41.59	2.87	(112)
Orange residue	37.8	24.2	13.6	(115)
Pear residue	36.1	22.0	14.1	(115)
Peach residue	35.8	26.1	9.7	(115)
Rice bran	27.04	24.99	2.25	(73)

(Source: 110)

6.3 Determination of properties of dietary fiber extracted from dried corn silk (DDF) and fresh corn silk (FDF)

6.3.1 Particle size distribution

The major portion of FDF fiber was retained on 120 and 140 mesh screens (totaling around 60%) while the portion of DDF fiber retained on 60 and 80 mesh screen (totaling around 50%). The extraction procedure also had an effect on the particle size of corn silk fiber. Particle size, surface area and porosity can be affected by the shear forces in mechanical and physical processing. Differences in shape and size of fiber particles produce the heterogeneity in size distribution and influence the functional and physiological properties of dietary fiber. Application of fiber with various particle sizes in food product had a particular effect on the mouth feel characteristics (33). Desirable particle sizes could be obtained by the variation from the grinding and separating methods. These processes could be optimized to get a fiber ingredient with the suitable physicochemical properties for food product applications.

6.3.2 Physical and chemical properties of dietary fiber extracted from dried corn silk (DDF) and fresh corn silk (FDF)

Water holding capacity

Water holding capacity is a physiological property of dietary fiber which is important in a technological point of view that it can be a determinant factor to apply dietary fiber in food production as the new health ingredient to reduce calories and modify the physical properties and texture of food products (115). Water holding capacity (WHC) of FDF was 9.80 g/g fiber which was greater than the value obtained from DDF, 4.94 g/g fiber.

FDF seemed to have ability to trap water inside the fiber matrix more than DDF. This assumption can be explained as follows.

Chaplin reported that dietary fiber bind with water by the interaction between polar and hydrophobic interactions. These reactions varied with the flexibility of the fiber surface (32). The environment condition such as pH, ionic strength, temperature, nature of the ions can also make the hydration properties of dietary fiber change (116). Mechanical properties such as shear force and drying process can also influence the surface of dietary fiber as the kinetics of water uptake, the decrease of water retention and water absorption capacity (116).

According to Wongmethinee, an increase of WHC could be explained by the effect of processing like stirring in the step of boiling which may open up the fiber structure by mechanical shear that the available free hydroxyl groups of cellulose can bind with surrounding water (33). Raghavendra *et al*. also reported that the WHC of fiber also was influenced by the fiber particle size. The particle size of fiber in their study ranged from 550 to 1127 µm, and water holding capacity had a negative relationship with it. The reduction in size of fiber beyond 550 µm resulted in a decreased WHC (114). This might be the effect from the rupture of the fiber matrix and the destruction of pores during grinding (117).

Another evidence in support of the finding that the pre-treatment step had an effect on WHC was the reported of Lebesi and Tzia that the WHC of cereal bran, both of oat bran and rice bran, was significantly decreased ($p \leq 0.05$) with the the enzyme endoxylanase treatment. They concluded that the decrease could be related to the amount of IDF in the cereal bran that is responsible for the WHC of dietary fiber materials (118). In this study the content of IDF of DDF was lower when compared with that of FDF. Hence, it resulted in a lower WHC value of DDF.

Overall, the WHC of FDF (9.8 g/g sample) and DDF (4.9 g/g sample) was comparable to other fiber sources reported in previous research such as seedless grapefruit (9.70), pear DF (6.8), apple DF (6.3), rice bran (4.94), citrus husk (3.60) and pineapple peel (3.50). Examples are given in Table 16. High WHC of FDF corn silk fiber showed its feasibility to be used in food products requiring hydration, viscosity development and freshness preservation, e.g. baked foods and cooked meat products while DDF could work well in systems with less water.

Table 6.2 Water holding capacity (WHC) of some agricultural by-products (g/g fiber) compared with FDF and DDF

Agricultural by-product	WHC	Reference
Orange processing waste	16.2	(119)
Artichoke DF	13.2	(120)
Carrot pomace	12.9	(121)
Peach DF	12.6	(120)
Orange DF	12.4	(120)
Apple processing waste	11.7	(119)
Asparagus DF	11.2	(120)
Wheat bran	10.0	(122)
FDF	9.80	(This study)
Seedless grapefruit	9.7	(123)
Pear DF	6.8	(120)
Apple DF	6.3	(120)
Oat bran	5.5	(122)
DDF	4.94	(This study)
Rice bran	4.9	(73)
Citrus husk	3.6	(123)
Pineapple peel	3.5	(124)

Oil holding capacity

Oil holding capacity (OHC) is the one of dietary fiber properties that could be affected by the particle size of dietary fiber and the mechanical sheer from grinding process and also related to the content of insoluble dietary fiber (125). The importance of OHC is that when fiber is added to food products, it can absorb the oil. The absorbed oil can be determined as fat absorption capacity.

OHC of FDF was 5.41 g/g fiber and DDF was 2.84 g/g fiber. The OHC value of DDF was lower when compared to the other literature of some agricultural by-products, such as sugar beet fiber, sugarcane bagasse and coconut fiber (5.10, 5.06 and 4.80 g/g fiber, respectively) (125, 126, 114). The results agreed well with other studies. The difference in OHC could be observed in this study ($p \leq 0.05$) was due to the effect from pre-treatment to corn silk fiber like the above explanation for water holding capacity. High OHC of FDF and DDF could be useful for flavor and fat retention in food products as cooked meat products since normally the flavor of meat could be loss after cooking. (105)

Emulsifying activity and emulsion stability

The emulsifying activity (EA) is the ability of molecules to act as an agent and make two immiscible liquids solubilized or dispersed in two different phases. Emulsifying stability (ES) is the ability to maintain the integrity of the two phases in the emulsion (105). Normally, polysaccharides do not have a function like an emulsifier, but they are usually used for providing emulsion stability (127). The emulsifying activity of FDF and DDF corn silk fiber was 4.45% and 4.59% while the emulsion stability was 13.03% and 2.08%, respectively. EA and ES values of FDF and DDF revealed that they may not act as a good emulsifier probably because of their low SDF content from the boiling step in extraction. Some EA and ES of FDF and DDF in this study may happen because of some protein fractions that still remained in it. The difference of EA and ES between FDF and DDF may arise from the effect of pre-treatment step like stirring in the boiling step and grinding as mentioned earlier. The reduction of the porosity of fiber in DDF may reduce its ability to hold oil and water then affected its emulsion stability. Low EA and ES of corn silk fiber, both of DDF and FDF, mean that they may not be used as an emulsifier in food products.

Water activity (A_w)

Food processing like drying is one of the preparation processes of fiber to lower its water activity and improves the shelf-life without an addition of any chemical preservatives. The minimum level of water activity required for bacterial growth is as follows. For bacteria the value is 0.91, for yeast is 0.88, for mold is 0.80, for xerophilic mold is 0.65 and for osmophilic yeast is 0.61 (116). The water activity of FDF and DDF was 0.49 and 0.14 which is lower than the minimum requirement for bacterial growth so the fibers could be considered safe from any microbial spoilage.

Moisture content

Moisture content of the two corn silk fibers was low and different significantly ($p \leq 0.05$) (about 4% for DDF and 11% for FDF) due to difference of the pre-treatment and raw material drying step of DDF. Moreover, the moisture content was low in both fibers. The low moisture content was required when producing dietary fiber because drying improves its shelf-life and reduces its bulk, which in turn increases the ease of packaging, handling and transporting. The dry powder of dietary fiber was convenient to apply to food products as well. (128)

Color

The color of FDF and DDF was both dark yellowish-brown that may happen because of the non-enzymatic browning reaction during step of extraction and also the chlorophyll degradation. (33) The color of corn silk fiber was much lighter than the color of either FDF or DDF.

pH

The pH of DDF was 6.7 and FDF was 6.5 close to neutral pH. According to the Food Chemical Codex, the pH of cellulose and insoluble fiber should be between 5.0 and 7.5 (129). Hence, the two types of corn silk fiber could be applied in food products without any effect on the functional properties of foods as a result of pH alteration.

6.4 Color properties of bleached dietary fiber from dried corn silk compared with FDF and non-bleached DDF corn silk fiber

The result of L*, a* and b* of bleached DDF fiber showed that the bleached fiber had the similar L* to DDF and FDF fiber. In contrast, their a* and b* values were significantly different ($p \leq 0.05$) compared to the original one before bleaching and its b* was in the same range with FDF fiber. The bleaching process of corn silk fiber can increase the lightness of DDF fiber but not enough to detect the difference when used the statistical analysis. It also increased the redness and yellowness of fiber.

In the summary, the preliminary bleaching experiment showed that the bleaching method for corn silk fiber needs further study in order to reach an optimum condition of the concentration of alkaline hydrogen peroxide, time and temperature used in the bleaching process.

6.5 Application of corn silk fiber (FDF and DDF) in food products

6.5.1 Cakes

In this study, FDF and DDF corn silk fiber was incorporated in the cake formula by partial substitution of wheat flour at 15% level without changing other ingredients, to observe the effect of corn silk fiber on cake; volume, water activity and color. The decision to incorporate corn silk fiber at 15% level came from the preliminary study that adding the corn silk fiber at 10-20% (data not shown) in cake product resulting in 15% being the highest possible level that can be added with an increase in cake volume and did not make the color of cake much too dark. The addition of FDF was effective to significantly increase the volume of cake compared to the control formula. In 2010, it was suggested from the study of Gomez *et al.* that the incorporation of wheat bran, oat bran and microcrystalline cellulose at 36% with a different particle size resulted in a decrease of cake volume while adding at 12-24% increased the volume significantly compared to the control formula (130). Normally, volume of cakes depends on the capacity of the batter to incorporate air during mixing and baking and on starch gelatinization temperature. This may be explained by the results of Caprises *et al.*, 2008 which stated that the addition of dietary fiber could slow down the rate of gas diffusion of batter viscosity and give enough strength for the cake to hold the expanded air cells during baking and retain the cells during the early stage of baking (131). Hindering the change of batter from a fluid aerated emulsion to a solid with porous structure came about by an increase of starch gelatinization temperature. Then air bubbles were allowed to properly expand by the carbon dioxide gas and water vapor before the cake set and finally increased its volume (132).

Furthermore, the batter viscosity had to be sufficient to retain the air incorporated during mixing. Therefore, an increase of batter viscosity by the addition of fiber would help in gas retaining of the batter that result in the increase of cake volume. Hence, this study showed that to increase the volume of cake, FDF would be an appropriate choice.

The color of the control cake was light yellow while the color of fiber-supplemented cakes, both of crust and crumb, was clearly different from the control. The color of FDF and DDF-added cakes became darker. Many research found that crust color can be affected from the Maillard reaction. Adding fiber did not seem to have an effect on the reaction between the sugars and amino acids, even though the lower proportion of flour was used in the formulation. Color changes could also happen by the alteration of pH from the ability of dietary fiber to act as a buffer and a change in water availability. However, no clear evidence has been elucidated about the different kinds of fiber to use to make the reaction happen (133). On the other hand, crumb color commonly depends on the color of raw materials because the increase in temperature inside the cake is not high enough for the Maillard reaction and caramelization to occur (133).

Considering the water activity of the cake, addition of both FDF and DDF did not significantly alter this property compared to the control. Therefore, it could be assumed that the fiber-supplemented cakes would have the same storage ability and shelf-life as the control cake.

The sensory quality of FDF and DDF-added cakes were inferior to the control formula in all characteristics. Color and appearance seemed to be the major factors leading to this result (r = 0.575 and 0.693). However, the fiber-supplemented cakes were still acceptable to a certain number of panelists. According to the research by Schafter *et al.*, dietary fiber extracted from corn bran was used to increase the fiber content of widely consumed foods like bread. They found undesirable changes of the product quality when fortified at 200 g/kg. The sensory acceptability scores including texture, color and flavor were all decreased (134). Furthermore there are reports on the utilization of corn bran fiber in muffin. The results found a decrease in flavor, mouth feel, texture and overall acceptability compared with the muffin containing the same level of wheat bran (135). Ayadi *et al.* also studied about the effect of the incorporation of cladodes flour in cake product and found that it affected the sensory scores of cake when substituted at 15% and 20% level resulting in poor sensory scores. (6) As a consequence, the product was unacceptable by the panelists using 5-

point hedonic scales. Similar results were also observed by Sudha *et al.* (136) in their study on apple pomace fiber-added cake. Another report about the use of dietary fiber that resulted in a decrease of the sensory acceptability scores was the study of Mendonca *et al.* They found that the extruded snacks containing corn bran at 150-320 g/kg received lower scores of appearance and general acceptability (137). Other research informed that an enrichment of bread with less than 10% of non-modified sugar beet fibers accompanied with a few percents of gluten, was highly recommended (77).

Corn silk fibers (FDF and DDF) were applied in cakes primarily for the purpose of nutritional benefit through increasing the dietary fiber content. Both products could be labeled as “a source of”, “contain” or “have” dietary fiber according to the Ministry of Public Health Notification No. 182 (138). One serving of the formulated cakes provided more than 10% of the Thai RDI for dietary fiber (2.5 g). FDF and DDF-supplemented cake contained around 2.7 g dietary fiber per 80 g reference amount.

6.5.2 Fried batter-coated chicken

In terms of fried batter-coated chicken product, 3% level of FDF and DDF were added to the batter suspension to improve the batter-picked up, technological yield and reduce the oil absorption in the final products. Altunakar *et al.* recommended that the moisture and oil contents were the important parameters to determine the quality of fried product (139). Most of the quality characteristics of FDF and DDF-added products were not significantly different when compared to the control formula except the final moisture content and the water removed.

Many chemical reactions exist during frying process, for example; dehydration, starch gelatinization, protein denaturation, aromatizing and coloring and eventually oil uptake (140). The mechanisms of oil uptake have been described differently by several reports. To some oil uptake is a complex incident happening by the interation of oil and food products in relation to the numerous physicochemical reactions and the transformation of raw material structure during the time of frying. (141). The reaction of oil uptake nowadays still does not have a clear explanation. Many factors are involved in the mechanism. The various interchanges could be found by the variation of product and oil properties that are the main requisite of the reaction.

Water commonly escapes from the food following by the moving of oil into products providing nutrients and flavors. In the process of frying, oil usually acts as a heat transfer medium and an ingredient of the final products that can increase the total mass like in chip products (141). The first review of the frying process was refered by Farkas *et al.* in 1996 that the process should be described as a complex phenomenon occurred from the compled heat and mass transfer that was the consequence of a moving vaporization front separating two dynamic regions; a dehydrated crust and a humid core. The crust displayed the low thermal conductivity that affected heat and mass transfer. Moreover, the presence of crust also took part in the decrease of dehydration rate (142). Another reviewer like Gamble *et al.* claimed that the existed results in the frying process from the mass transfer reaction were the removing of water from the food matrix surface and oil absorption. Loss of moisture and oil uptake were inter-related in the linear functions to the frying time. More than that they also made a hypothesis that the entering of oil to the products came from the removing of water (143). More explanation was water escape was caused by the creation of cavities in the surface of food materials according to the report of Vitrac. Dehydration occurred at a temperature above 100° C (140). The water steam passed through the surface of cellular adhesion that the capillary pathways were formed and increased the surface porosity. Some water could be trapped within the pores following with the restrictive intercellular diffusion and expansion. Then the vapour became superheated, twisting the pore walls and conducing to the porosity of the product. Some reports claimed that there was a connection between the increase of porosity and the amount of oil uptake (143, 144).

When the fluid displacement occurs from the loss of water and the oil absorption begins, the reaction also makes the microcanals like crust pores on the product surface. The phenomena that influenced this result are the capilary forces. Moreira *et al.* also explained that the pore radius of product can be the dominant factor to the oil absorption. The small pores cause the higher capillary pressures and result in the higher amount of oil. Further than that the lower contact angle between oil and the product surface cause the higher adhesion forces and the oil uptake (145).

The cause of oil penetration to the surface of the product could be from the decrease of core temperature while removing after frying process. Steam condenses and suddenly the pressure in the product decreases resulting in the difference between inner and outer pressures, creating a ‘vacuum effect’ then leading to the migration of surface oil into the product (146, 147). The supporting results from Vitrac in this theory were from his measurement in a food model gel that was at 35 kPa a moment after removing of the product from the oil bath. He concluded that the vacuum effect was the most influencing force that led to the oil uptake in the porous media (140). Many supporting studies concluded that the water removal mode and intensity depend on product properties and process parameters that have an impact to the amount of oil absorption in relation to the importance and geometry of the porous structure, oil properties, adhesion and drainage forces and the conditions of product removal from the fryer (148, 149, 150).

Coating is a common preparating process before frying that is composed of dipping the material in a coating suspension for a short time instantly before beginning of frying process. Normally it is one of the surface treatments that have a feasibility in the reduction of surface porosity by making a barrier and then preventing oil uptake. In addition coating technique also decreases the water loss during frying (141). Moreover, the high water binding capacities of hydrocolloids in coating generally develop viscosity in batter systems and prepare the batter to catch the gas released by fast-acting leavening agents. Reduction of oil absorption is achieved by reducing the porosity in the surface of batter (151).

The mechanisms of addition of dietary fiber in batter coating system was explained by Ang *et al.* that the longer cellulose fibers had a capacity to bind the water molecules and reduced the fat content by increasing the number of hydrogen bonding between water molecules and longer cellulose fibers. These reactions resulted in the limitation of the displacement of fat during frying process (96). In this study, the addition of corn silk fiber, both DDF and FDF, in batter suspension could not form a good enough hydrocolloid as well as affect the water removal process as refered in the other research such as Mohammad and Garcia *et al.* that French fries coated by coating contain cellulose reduced oil uptake by 40% (141, 152).

There are many factors influencing the results in this study. Size, shape and surface of products are the determinant factors to the oil uptake as the uptake of oil is a surface phenomenon, the specific dimensions of raw material influence to the oil to be sucked up. The results from Guillaumin stated that oil absorption increased significantly due to reduction in the thickness and increase in the surface of the product (153). The example was like french fries could absorb less oil than chips because of a smaller surface/volume ratio (154). The effect of size, shape and surface of the product can be found in this study since the fried chicken pieces were not uniform which was reflected by a large variation in the results of water removal and oil uptake. Hence, no definite trend could be illustrated. Another factor that can influenced the oil uptake and may be related to this study is the components of food raw materials used in deep fat-frying process. The oil uptake of products by the could be affected by the initial solid content that influenced the correlation of water loss and oil uptake (155, 156, 157, 158). For example; french fries or eggplant cubes that had the high initial water content before frying and the intermediary water content when fried, resulted in the high final oil uptake according to Mohammad *et al* (141). The potential of raw material to give high porosity during frying was also the result from its high level of initial water content or a large amount of water exchange to the environment during frying. Moreover, the oil type used in this study (palm oil) may be one of the factors to increase the oil uptake because it was refered in some reseach that the solid contents of fat in frying oil may make the oil absorbed on the food surface. It would be harder to drain or shake off from the food while cooling and in the same time attached strongly with the product pore (141).

Cooling condition is another factor that affects the oil uptake depending on the method of cooling process that is going on. A forceful shake to the basket of fried food immediately after removal from the fryer can lead the oil out of the surface if the the oil is still in liquid phase and has not diffused to the crust pores (159).

In this study oil that was retained on the oil draining sieve covered with paper towel may allow oil to be sucked up to the crust pores. The type and level of fiber added may influence the kinetic of fiber in absorbing oil and water. The 3% level used may not be sufficient to provide the desirable effect. Furthermore, the internal structure of corn silk fiber may not support this application. WHC and OHC definitely played an important role. Sanchez-Zapata *et al.* in 2009, described that their dietary fiber extracted from tiger nut waste by-product (having a similar OHC as FDF) could be a potential ingredient to apply in cooked meat product for flavor and fat retention (105). since this type of foods ordinarily lose fat during cooking. It might also be possible to apply corn silk fiber in the kinds of products mentioned in their study

In terms of sensory acceptability, the addition of FDF and DDF corn silk fiber in fried batter-coated chicken showed that only the color and general appearance scores were poor. All other sensory characteristics were accepted at a similar level to the control. Hence, a further study on bleaching may be carried out to expand the application of corn silk fiber in various foods.