

CHAPTER II

LITERATURE REVIEW

2.1 Bread as Staple Food

Bread is reported to be one of the most ancient human foods that its historical back to Neolithic age. The bread was produced with helping of microorganisms at an ancient Egyptian bakery at the Giza pyramid in the year 2575 B.C. (Yabaya and Jatau, 2009). They used grains as the backbone of making bread, during that time, bread required only stone to grind grain into flour, and mix it with water to make dough and then baking the dough into an oven.

The bread was developed in each society and that led to occurrence of different types of bread (Anonymous, 2010). Although people produced bread for a long time, the understanding of all its processes is still not clear. One of the most reasons is that several fundamental complex physical processes happen during baking such as: evaporation of water, volume expansion, gelatinization of starch, denaturation of protein, crust formation. Many experiments and mathematical models are developed for clear understanding of baking (Arpita and Datta, 2007).

2.2 Bread Formulation

A professional baker uses baker's percentage for making bread. In this recipe the amount of ingredients are expressed as a percentage. The amount of flour in baker's percentage is implied to be 100%, and the amount of water which mixes with flour to prepare the dough is the most important measurement in a bread recipe, because it influences on texture and crumbs of bread. Hard US wheat flours absorb about 62%

water, while softer wheat flours absorb about 56% (Finley and Phillips, 1989). Different types of bread formulations were developed in different regions based on the traditional food habits of the people. The main bread formulations can be classified as the following categories:

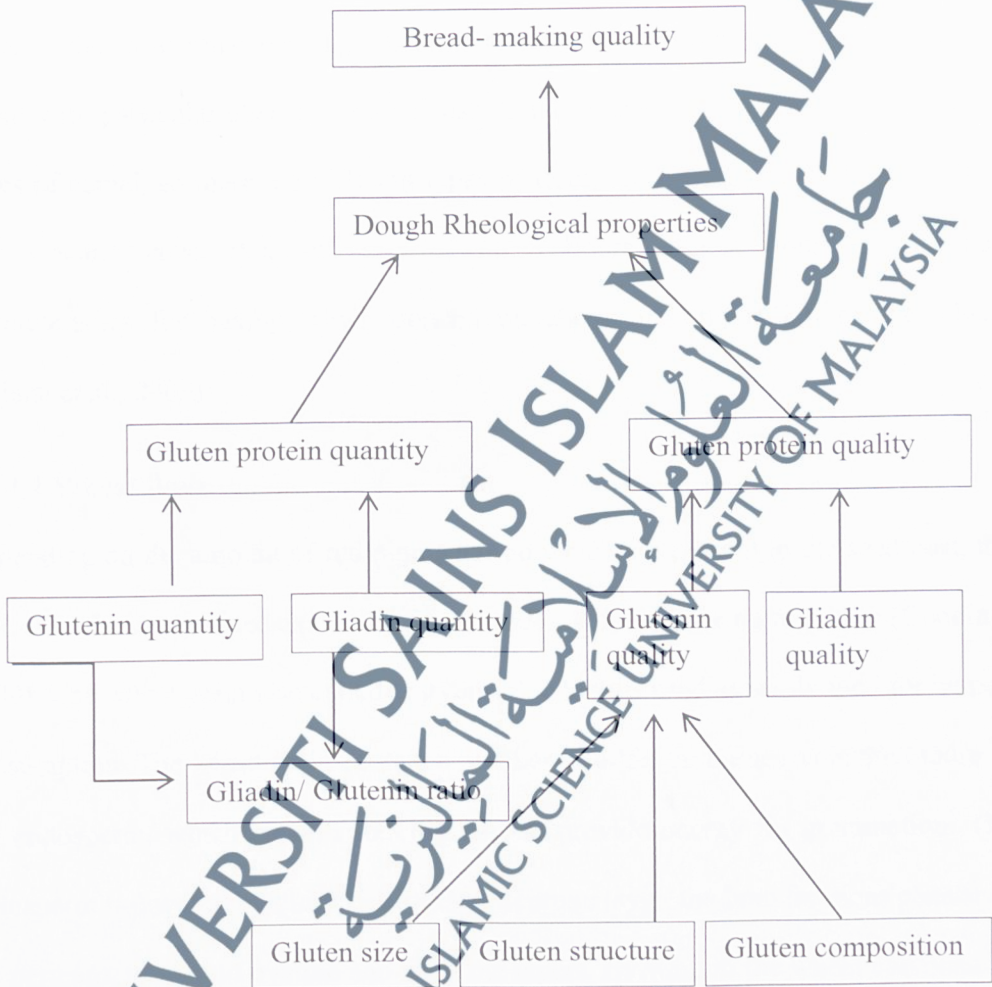
- Pan bread: This type of bread is popular in the economically developed countries.
- Hearth bread or sour bread: lactic acid fermentation is used to produce this type of bread, hearth breads are baked in an open hearth. This bread is popular in France
- Flat bread: it is popular in Asian countries. The product is unfermented and flat, because it is baked on a flat hot pan.
- Rolls and other small fermented breads: These types of bread have higher amount of sugar and fat, so it has sweeter taste and softer bite characteristics. (Pomeranz, 1998).

2.3 Bread- making quality

Quantity, quality, type and visco-elastic characteristics of wheat gluten protein are important in bread making, gluten protein determine rheological properties of dough bread and gas retention property of fermenting dough (Scheme 1). Gluten protein wheat is influenced by environmental and genetic factors; hence they will have impact on the quality of bread making.

The ingredients of bread such as flour, water, salt, yeast, lipid and sugar are mixed to prepare visco-elastic dough, which is fermented and then baked into oven. During all steps of bread-making, complex chemical, biochemical and physical transformations

occur and are influenced by different flour ingredients. For bread –making process the suitable ratio and interaction of different components like proteins, fats, carbohydrates, water, which comprise the flour, are of critical importance (Ali, 2009).



Scheme 1: Factors affecting rheology and bread making characteristics of wheat (Ali, 2009).

2.4 Basic ingredients of bread and their role in bread making

The ingredients which are used in bread making are flour, water, salt, fat and sugars. Leavening agents such as yeast or chemicals can be added to dough. (Gujral and Singh, 1999).

2.4.1 Flour

Flour is the most important ingredient in making bread, because it will produce the bread with particular characteristics (Bushuk and Rasper, 1994). There are different types of cereal, so there are different types of flour. According to that, kinds of flour are: wheat, maize, rye, and mix of those flours. Wheat flour has the best characteristics for baking which depend on chemical composition of the wheat. (Dijana et al., 2009).

2.4.1.1 Wheat flour

Depending on the amount of red pigmentation which are present in the seed coat, the wheat can be categorized as red or white, hard or soft, and spring or winter (Gooding, 2009). The wheat grain also called 'caryopsis', which is used as staple food for human consumption. The wheat grain contain a number of different tissues as in the Figure 1: the endosperm, which contain starch grains to provide energy for germination. The endosperm is covered by thick cell-walled aleurone layer, the bran fractions consist of the pericarp, testa, and hyaline and aleurone layers. By weight, the wheat caryopsis is made up of an outer branny husk (14–16% of the grain), the germ or embryo (2–3%), and the central endosperm (mainly starch: 81–84%) (Pomeranz, 1998).

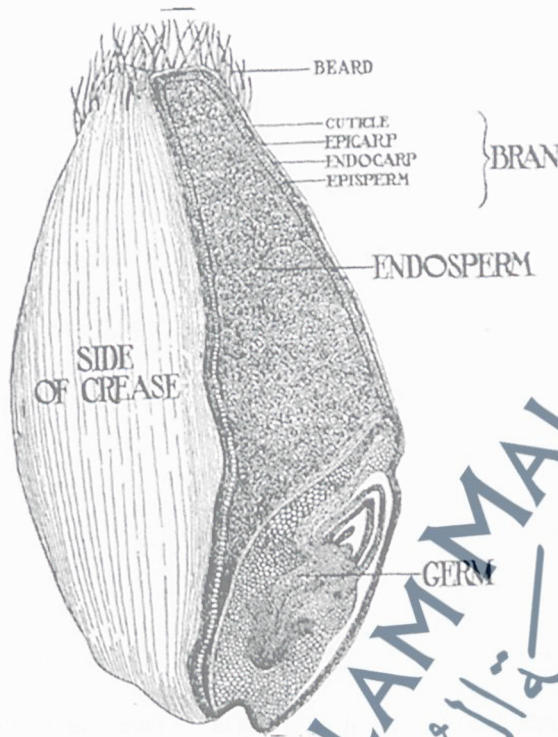


Figure 1: Wheat Kernel Composition

The characteristics of the wheat flour which include the content of protein, the condition of starch (damage) and the enzyme activity are used to evaluate its quality. These characteristics of flour are influenced by diversity, the year and the condition of harvest, and the milling technology, so the quality of final product of wheat flour depends on all previous mentioned (Marie and Dana, 2002).

The wheat flour has to stand for some time after grinding because it is not ready for use immediately; it has to stabilize under storage condition. There are some changes that are happening inside the flour when standing. These changes are very significant to determine the suitable structure and relation between main ingredients primary protein (gluten) and water and also ash. The flour is earning characteristics for using in the bakery after standing. During standing, characteristics of flour are influenced by storage conditions which are mainly temperature and humidity (Dijana et al., 2009).

2.4.1.2 High Gluten Flour

This type of flour is milled from hard wheat; it has high protein content, and that making it high in gluten. The bakers add this type of flour to other types which are low in gluten to give them more strength and elasticity. It is also used for predominantly crusty bread dough. It does not darken the color of the final product. Gluten flour enhances baking quality and produces high protein bread (Palmatier, 2000).

2.4.2 Yeast

Saccharomyces cerevisiae is the most popular yeast which uses in bread making. Under anaerobic conditions, yeast cells are able to metabolize fermentable sugars like glucose, fructose, sucrose and maltose. Carbon dioxide is produced as waste product which leads to increase dough volume. Yeast also can support both gluten network and aromatic compounds production (Charley and Weaver, 1998).

2.4.3 Water

Water is used to form the dough, and it is responsible for the flexibility. It is necessary for the distribution of leavening agent and for dissolution of salt and sugars. Water is essential for Starch gelatinization which occurs during baking, so the water is necessary to hydrolysis of starch and sucrose. Water is also needed for flour enzymes to act. The moisture content and the physicochemical properties of the flour are the main parameters to determine of the amount of added water (Gil et al., 1997).

2.4.4 Sugars

Sugars are used by yeast in the fermentation process. Afterwards, by the action of enzymes in the flour, more sugars are released for gas production in order to increase gas production and to improve the crust color and to sweeten the bread (Faridi and Faubion, 1990).

2.4.5 Salt

Salt is important ingredient in many of bakery products, because it plays important roles in the production. Some of them: strengthens the gluten, controls the action of yeast and thus influences volume of loaf. It enhances flavour, and it prevents flour proteases, which depolymerize proteins of the gluten complex (Charley and Weaver, 1998).

2.4.6 Lipids

Shortening is used in bread making either in the form of fats or oils. It improves the texture of the finished product (Demiralp et al., 2000).

2.5 Methods of making Bread

There are three methods to make bread. The first method is called as straight dough method; it is the most popular method to produce bread. In this method, all ingredients are mixed together in one step. The Ingredients used in bread making can differ, and that depend on the choice of manufacturer and available equipment. The second, is sponge and dough method, there are two steps in this method. Leavening agent is prepared; yeast and adequate amount of water and flour are mixed together. The mixture is allowed to develop and then it is mixed with the rest of the ingredients.

Chorleywood method is the third method, where all the ingredients are mixed in an ultrahigh mixer for few minutes (Giannou et al., 2003).

2.6 Gluten as a Standard of Wheat Flour Quality

Gliadin and glutenin are two basic types of protein in wheat flour. Both prolamin (gliadin) and glutelin (glutenin) are responsible on the visco-elastic behavior of wheat dough. These two proteins form a network known as gluten when the water is added and mixing to form the dough. This network determines the rheological properties of the dough (Shewry and Halford, 2002).

Gluten is the cohesive, visco-elastic proteinaceous material which is prepared by isolation of starch from wheat flour (Day et al., 2006). Generally, the higher a flour's protein content, the higher the gluten formation. Previous studies have also proved this statement (Al-Saleh and Brennan, 2012). Gluten is responsible on unique baking quality of wheat by giving water absorption capacity, cohesiveness, viscosity and elasticity on dough (Wieser, 2007).

2.7 The Chemistry of Baking

The four important elements that provide the basic structure to the bread dough are water, gluten proteins, starch granules, and gas bubbles. Cohesive, semi-solid, gluten-starch matrix developed through mixing and kneading. The microscopic gas bubbles which release from sugar during fermentation process will form temporary structure with the matrix. When the dough is cooked, the starch granules absorb water and swell, leaving behind a permanent solid network of starch and protein infiltrated with tiny air pockets. Bakers refer to this as the “crumb”, both starch and gluten is responsible on strength and elasticity to the dough. At the same time, the process of

gas bubbles are brought about, referred to as “leavening” (McGee,2004) as this process dominates cycle time in bread production.

2.8 Physicochemical Properties of Bread

Many techniques have been used and developed to understand bread material and its components such as water, fat, protein, carbohydrates that change chemically or physically during baking (Vodovotz et al, 1996; Fessas and Schiraldi, 2000; Haines, 1995; Hatakeyama and Quinn, 1994; Hallberg, 1996 and Hamann et al, 1990); The physicochemical properties of white bread include many aspects of quality in a loaf. Texture of crumb is a physical characteristics, the development of bread cellular structure in the dough which pertaining to crumb appearance that is visual texture, with emphasis on the mechanical properties that is physical texture of crumb (Gibson and Ash, 1997). Other physical characteristics such as colour and volume are considered as aspects of quality.

The chemical composition of the bread is related to the nutritional content of breads, hence protein content and starch composition are important when considering the dietary impact of the breads (Al-Saleh and Bremner, 2012). The chemical properties of bread mainly are the proximate analysis of the bread which includes determination of the moisture content and ash content in the bread. Proximate analysis includes also determination of the protein, fat and fiber contents in the bread sample. All these analyses are based on the Association of Official Analytical Chemistry (Rouzaud and Martinez-Anaya 1993; Gobettiet et al., 1994).

2.9 Health aspects of wheat and Bread

Wheat is used as second staple food after rice, because it contains higher protein content. Protein wheat provides all amino acids, including essential amino acids with decreasing in lysine, methionine and tryptophan (Davidson, 1999). Wheat grain contains a number of different tissue, each one of them contain the basic elements for human. The aleurone layer contains protein, total phosphorus, fat, niacin, thiamine, and riboflavin, while the germ is mostly high in oil, proteins, and vitamins E and B (Hoseney, 1990), which have consequences both for the baking process, bread sensory and nutritional qualities and for consumer health.

Bread is a significant source of carbohydrate, protein, fiber and minerals (Chaudri et al., 1993). White bread contain on average 3g/100g fibre, while dark bread contain on average 8g/100g fibre. However, white bread is still a good source of energy, carbohydrate and it contains protein, pentosans and other hemicellulose and B-glucans (Hoseney, 1990; Meuser and Suckow, 1985).

Bread is not only the source of energy and nutrients, it also provides a safety risk associated with the presence of harmful substances like mycotoxin, heavy metals (cadmium) or pesticides residues (Reijnders, 2004). Bread contains the highest amount of cadmium, compared with other main foods (Olsson et al., 2002).

2.10 Sensory Characteristics of Bread Quality

Different professionals have identified the "Food quality" by many meanings in the food industry. According to the nutritionists; food quality related to the nutritional value of the food, while it means safety of the food to microbiologists. On the other hand, it refers to the stability of the food to chemists. However, consumers are the

major judges of food quality due to their purchase and/or non-purchase of the food (Cardello, 1995).

In general, the characteristics of food which are used as the main quality parameters are flavour, appearance, taste, texture and nutrition. However, the overall perception of bread is influenced mainly by the freshness, color, texture and biting properties besides the flavour characteristics (Heiniö, 2006), so the key attributes are flavor and texture in the case of bread consumption.

In leavened bread, the texture is important attribute in the quality aspect, it has been used to evaluate the food quality (Lawless and Heyman, 1999a). Protein content and quality affect on the texture (Finney and Barmore, 1948). There are attributes that are associated with the textural properties such as hardness to describe the crumb of bread. Thus, textural properties play important roles to determine bread quality. Flour possessing extra strong dough mixing characteristics gives a strong bread crumb (Scanlon et al., 2000). Protein and lipids have gas holding capacity, and starch is important for the structure of the crumb during fermentation and at the end of baking, as a factor stabilizing the bread structure (Eliasson and Larsson, 1993).

Sensory characteristics of bakery products such as bread are very attractive especially when they are freshly baked. There are some factors which have impact on the sensory characteristics such as dough ingredients, processing methods and duration of fermentation and baking (Schieberle, 1996).

The components of flour have a strong influence on bread quality. Bread baked with flour from whole wheat, compared with bread baked with white flour, results in products that are perceived as very different in terms of comparable quality attributes such as color, texture and flavor. Thus, extraction rate of flour and its ash content influence the sensory quality of bread (Iwona, 2004).

The descriptive sensory test and consumer test are used to give the best using of wheat from organic production for human consumption. In this study, the descriptive sensory analyses was used as objective method to evaluate Sensory quality, acceptance test was also used as subjective method. In the descriptive test, a panelist evaluates the products. The attributes that have been evaluated were colour, aroma, hardness, taste, dryness and appearance. This led to evaluation of the sensory quality of bread (Stone and Sidel, 1993). In the acceptance test (hedonic test), the consumer is asked "how much do you like this bread?" (Meilgaard et al., 1991a). The sensory quality is used as the most important parameter in quality evaluation even for buyers of organic products (Torjusen et al., 2001; Wandel and Bugge, 1997).

