**Industry Visit Report**

1. **Milling Operations**

With an average yearly worldwide consumption of more than 600 million pounds, wheat is one of essential crops in the world. Due to its agricultural variety, ease of storage, nutritional value, and capacity of its flour to generate a wide range of delicious, fascinating, and enjoyable dishes, wheat is a staple in the majority of meals across the world. The viscous qualities of dough created from the flour of wheat differ from those of dough made from other types of grain, due to this characteristic; it is responsible for wheat's wide usage in a number of goods. Pan, bread, noodles, cakes, cookies, steaming bread, pizza, and flat breads are a few of them (Khan, 2016). The endosperm, the bran and the germ, which are the major parts of wheat grain, are separated at the mill during the refining process. This technique produces white flour made from wheat, which can be used in the manufacture of wheat-based goods (Liu et al., 2015).

The key stages involved are discussed below:

1. **Cleaning**

Cleaning is initially done upon the arrival of wheat in the mill, which undergoes the cleaning process to eliminate the contaminants such as dirt, stones, straw and other foreign matters. Machines such as sifters, sievers, and air aspirators are used to remove pollutants based on the size, shape, magnetic characteristics. Small and shrivelled grains are also removed during this process (Kent, 1994).

1. **Conditioning and Tempering**

The method of conditioning, also known as tempering, is another way to raise the moisture or water content of the grain. Conditioning makes the bran less flexible and easy to separate from the endosperm. It further changes the hardness of endosperm which makes the milling process simpler to minimize the particle size and improve starch damage. The variety of wheat will determine the degree of conditioning. The conditioning time varies from 6 to 24 hours (Pagani et al., 2014).

1. **Milling**

The grains then go through the milling process which is the main step to convert grain to the flour. Although, there are several processes involved in the milling process, the primary stages are: breaking, separation based on particle size and density, and reduction.

* The Break system: This is the initial stage of milling process, in which the grain go through the series of corrugated roller mills, which further splits up the endosperm from the germ and the bran, respectively. Breaking system has opens, slices and breaks the grains, separates the endosperm from the coatings and leaves the bran as large flat flakes for easy disposal going through 4-5 break rollers (Pagani et al., 2014).
* Separation based on particle size and density: The breaking phase is followed by separation of grain. The particles are divided by plain sifters based on the size and density. The progressive sifting of bran, semolina and flour depends upon the size of sieve. On the basis of size, density, and specific gravity, the fine bran is removed by the help of purifiers from the granular endosperm particles known as ‘Semolina’, using the sieves and air currents. The coarse and fine endosperm particles are separated in the purifiers before they are transported to the reduction system (Wrigley, 2010).

* The Reduction system: This is one of the final stages of milling, in which the reduction mechanism tries to lower the size of endosperm fragments while generating necessary amounts of starch damage. Between reduction roll passes, flour is removed in multi-section plain sifters, this method further removes and flakes the germ. Any remaining endosperm, fine bran and the germ are also removed consequently. This system lessens the endosperm to flour from the huge particles for which the wheat grain is subjected to a number of rolls and sifts. The system comprises a chain of smooth roll mills up to 8-12 depending on the size and connected sifters (Pagani et al., 2014).

The above mentioned phases of the milling process produce the several varieties of flour. Pan bread is made from the hardest wheat’s, which are often the greatest in protein. Likewise, other types of bread and noodles are made with common wheat’s of medium hardness and reduced protein content. Cakes and cookies are made from wheat’s with softest texture and lowest protein content can be used for making Chinese style noodles. Similarly, pasta is made from semolina due to its large vitreous grain and unique mix of storage proteins