IJFAAS International Journal of Food and Allied Sciences
ISSN:2415-0290 (Print)
ISSN: 2413-2543 (Online)
DOI:10.21620/ijfaas.2018220-23

Review Article

EFFECT OF STORAGE CONDITIONS ON WHEAT QUALITY

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History

Submitted: May 14, 2019
Revision: Oct 13, 2019
Accepted: Oct 13, 2019

Keywords

Storage condition, Wheat quality, Storage method. Moisture, Temperature

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Abstract

Wheat is used as common staple food in South Asian country. Every year large amount of wheat losses occur because of improper handling after harvesting and inappropriate storage conditions. By increasing population, wheat production and storage has become the major concern in food security by maintaining the temperature, moisture, relative humidity of storage houses. Quality of wheat is improve during storage and it became accessible whole year. Wheat is non-perishable cereal crop, and for the storage, there are a few requirements. Method of wheat storage differs in temperature and moisture. In this review, studies focus on effect of storage on wheat quality, moisture percentage, colour, protein, lipids, lipoprotein content, free lipids, biochemical, metabolic changes and germination rate at end of the storage. During storage, the moisture of wheat must be least to prevent from germination and insect infestation. Traditionally, the wheat storage depends on environmental factor but new improved method do not depend on environmental condition and implication of these factor occur at large scale.

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1. Introduction:

Cereal crops are largely grown all over the world. Wheat is among the most important cereal crop. Cereal grain storage has been practiced from ages with the establishment of civilization. Production of cereal crop is major problem as it grows in specific environment and defined season (Sawant, 1994).Wheat storage is important in order to obtain continuous supply and utilization during offseason and under extreme conditions. Certain prerequisite principles are required to maintain the safety and commercial standard that ensure the organoleptic property of product. (Evans et al., 2000). Most of the cereal crops are lost because of improper storage conditions. Main principle of storage is to maintain the quality of wheat and to preclude wheat grain deterioration. Proper maintenance of moisture percentage, humidity and averting microorganisms attack and pests (Sawant et al., 2012) can accomplish it. Quality of wheat during storage is improved by storing al low temperature (10℃ - 15℃), retained grain moisture content at a favorable level (10%), plus it has excessive level of sprouting potential to a substantial period of 270 days (Prabhakar and Mukherjee, 1977)

Different volatile compounds are produced during storage (Zhang and Wang, 2007). These volatile compounds contain, primarily carbonyl chemical compounds such as ketones, aldehydes, chemical compound and alcohol. As storage period increases, slowly medium-polarity of volatiles increases and small-polarity volatiles decreases. (Olsson et al., 2000; Zhan et al., 2003). If storage condition of cereal grains are not proper then deterioration start. Off odour produces and it overall effects the quality of grain. Ingestion of infected grain causes several diseases and it overall reduces the consumer acceptance. Improper storage conditions cause certain enzymatic changes in wheat, which deteriorates the quality.

2. Wheat Storage Method:

Galvanized Iron Corrugated (GIC) silos (can be used whole year). Another storage method is cover and plinth (CAP)and grains are stored in godown, where grains are in excess (suitable to use under humid climate). Mostly wheat is stored by these methods and these are used to estimate its quality and shelf-life.

Different types of instruments were used to measure storage condition, which grain privilege during storage such as temperature, relative humidity (RH). Special sensors are situated in silos, (at uppermost part and in hub position) to estimate the relative humidity, moisture percentage and temperature. There is an association of moisture contents in grain when stored in galvanized iron corrugated, cover and plinth and godown storage, which differs in storage interval and results also vary. Freshly harvested grains have 11.2 % moisture contents, which surges as storage time increases. Temperature of storage house increases with time, as wheat is non-perishable stable food, chances of contamination increases due to improper storage and environmental condition, likelihood of occurrences of insect increases and as a result respiration rate increases which ultimately source of high temperature in storage house. Grains are living entity, they breathe and evolved energy. In air tight storage method, initially relative humidity of wheat grains is higher and it gradually decrease a storage period increases while in godown storage method, relative humidity of grains increases as storage period increases (Sawant et al., 2012).

3. Wheat Storage Environment:

Different varieties of wheat grains harvested in 2005, having the moisture content of 13.7%, were divided into 4 bags of equal quantity, packed and stored in different conditions: (a) shelf of unconditioned warehouse (b) warehouse condition (c) refrigerator (d) saturated solution of calcium chloride or potassium nitrate are used to maintain 45% relative humidity during storage (O and B, 1999)**.** Hygroscopic nature of the seeds sustains equilibrium moisture percentage with the given relative humidity of the storage air that initiate drop or rise in the initial seed moisture level during the storage until equilibrium reached. By storing wheat under different conditions, the decrease in moisture is observed (1) 3.7% to 4% moisture content reduction (ii)2.6 % moisture content reduction (iii) 0.6 to 0.9 % moisture content reduction (iv) 0.2 to 0.4 % moisture content increases (Strelec, et al., 2010)

4. Wheat Grain temperature:

Wheat grains stored in silos has longer shelf life as compared to wheat grains stored in Cap and Godown storage. The initial temperature of wheat storage is 29.3 ℃ and at end of storage increase up to 42.9 ℃. Temperature of wheat grains does not increase suddenly it remain constant up to 4 months, then temperature start to increase after four months of storage, the reason behind increase of temperature is insect infestation in wheat grains that not only consume grains as a source of growth (energy), but also respirate and evolved heat in surrounding (Sawant et al., 2012).

5. Wheat Grain Moisture:

Initial grain moisture is less than (29.1 %) but it increases at end of storage (39.94%) by using different methods. In cover and plinth (Cap) storage method, the storage container is not sealed, in rainy season, water penetrate into the storage container and wheat storage bags (sack) were water-logged which result in high moisture contents. While in go down storage method, moisture contents fall only in two months mostly April and May because these two months are not suitable for insect infestation, as the favorable temperature reach, insect infestation is optimum and temperature of grain increases (Sawant et al., 2012)

6. High moisture Grain:

Wheat crops that mostly cultivate near high humid area, lead to increase moisture contents in grains. Higher moisture content of grains are more susceptible to micro-organism, mould and insect infestation. Clean, wholesome and less mechanical damage grains during threshing were stored on farm, having 98% initial germination rate. To obtain desire moisture contents of wheat grains they were conditioned. Visible mould growth in stored grains were observed at room temperature while from 25-208℃ (sprouting dropped to 90%). However, grains when stored at 35 and 108℃ (germination dropped 70%). Safe storage moisture contents of grains is 19% and germination decreased to 90% (if stored at 10°-358℃ retain). At low temperature the germination curve is shifted and joined with high temperature curve. (Karunakaran et al., 2001). About, 85% of grains are lost due to germination (Wallace et al., 1983), visible mould grown is shown after90 % germination (E, 1996). Best wheat storage condition require, about 17% moisture content at 30°, 35°, 258℃ for 7, 5, and 15 days respectively (Karunakaran et al., 2001). Rate of respiration is increase by gain of moisture content about 15, 18, 19% (greater amount of wheat losses occur at high humid environment and improper storage condition) (1994), but less losses were occur at 16 and 17% moisture contents. Respiration rate is kept constant at 15 and 16 % moisture contents. Wheat can stored about 45 days at 258 ℃. However, respiration rate increase linearly with time and with moisture contents at 17, 18, 19%. Studies on grain storage indicate that there is certain reasonable changes occur during storage such as respiration, chemical configuration variations, and microbiological sustainability on contaminated and non-contaminated wheat grain. (1954)

7. Protein and lipid content:

Intensity of respiration is determined by two aspects, moisture contents and temperature (Storage of cereal grains & their product, 1954). The growth of mould is inclined by moisture content, temperature, oxygen (O_2) concentration and nutrient factor. The purpose of research findings were to determine the effect of mould growth on wheat flour having 18% moisture contents by variation in temperature. Two varieties of wheat flour packed in polyethylene bags with centre filled, small beaker with water and stored for six weeks at room temperature and 37℃. Slight increase in moisture contents of sample 1 stored at room temperature as a result change in metabolic process. Prior to storage, initial mould count per 100g is less as compared to after storage. Highest mould count of sample one, stored at room temperature than stored at 37℃. Mould count initially increase at 37 ℃, than growth rate decreases because high temperature spress the mould. Growth. Fungi has ability to grow at all temperature but specific fungi specie can grow at 37℃. There is negligible moisture difference between 2 sample when measured, protein value unidentified decrease at 37℃. Level of free lipids in flour is substantially higher when stored at 23℃ than stored at 30-37℃. (D. Daftary, Poemeranz and B. Saucer, 1970)

8. Biochemical Changes:

Wheat harvested from field has 14% moisture contents, cleaned, free from microbial contamination and chemical residues, were stored under different storage temperature for 6 months at 10, 25 and 45℃. Biochemical changes in wheat happen with variation in storage temperature, under protected atmospheric environment storage temperature increases upto 45℃. Initially when grains are kept at 10℃ there is no change in titratable acidity and pH. However, certain considerable changes appear when stored at 25 ℃ and 45℃ temperature for different time period. Instant bio-chemical changes arise after a month of storage period (titratable acidity and drop in pH) (UR REHMAN and SHAH, 1999)

9. Mechanical Damage:

Clean wheat grains free from microbial contamination are manually harvested and less mechanical damage take place. They are stored in warehouse having moisture contents of 9%. Low moisture content percentage indicates less insect infestation and fungal damaged grains. At different ratio of mechanical damage wheatgrains were stored under different temperature, moisture contents of grains Result of stored grains is 0.5% dry matter loss and germination growth was increasedby higher ratio of mechanical damaged to wheat grain. Germination percentage reduce to half at 30% mechanical damage. When wheat grains were stored for 14 days or 6 days at 15℃ or at 25℃ having moisture contents of 24 %, Dry matter loss was 0.5% respectively. (Al-Yahya, 1999)

10. Conclusion:

Wheat stored at air tight container in which temperature is maintained and humidity and moisture content are kept constant. The storage house should be well established to reduce microbiological contamination and improve the quality of grains. Grains selected for storage have low level of contamination should be cleaned and pass through specific test for selection. By storage we can inactivate microbial and metabolic changes but cannot permanently stop these reactions. Advance storage method are most convenient to use, it increases the shelf life as well as improve the organoleptic properties during storage. Advance storage method are independent to external factor, less time consuming, processing easy, reduce cost.

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