SOI: 1.1/TAS DOI: 10.15863/TAS
International Scientific Journal
Theoretical & Applied Science

p-ISSN: 2308-4944 (print) **e-ISSN:** 2409-0085 (online)

Year: 2021 **Issue:** 02 **Volume:** 94

Published: 28.02.2021 http://T-Science.org

QR – Issue QR – Article

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CHEMICAL ELEMENTS IN GRAIN PRODUCTS AND THEIR EFFECT ON ITS QUALITY

***Abstract**: Every grain consists of different vitamins, with a variety of chemical elements human body need. Bread we need to have consists mainly of chemical elements such as proteins. Water enriches the grain, promote it to be ripen, giving more elements. We highlighted scholars' views on the chemical composition of grain and grain products such wheat and its chemical properties. As a consequence, wheat grain protein concentration (GPC) is a determinant of wheat quality for human nutrition.*

***Key words**: vitamins, grain, wheat, water, protein.*
***Language**: English*
***Citation**: Khidirova, M. M. (2021). Chemical Elements in Grain Products and Their Effect on Its Quality. *ISJ Theoretical & Applied Science, 02 (94),* 329-332.
***Soi**: http://s-o-i.org/1.1/TAS-02-94-64 ***Doi**: crossref https://dx.doi.org/10.15863/TAS.2021.02.94.64
***Scopus ASCC**: 1100.*

Introduction

Grain has lots of chemical elements as it consists of some substances which are necessary for the needs of the human body. Substances in cereals and oilseeds are divided into two major groups: organic and inorganic. The group of organic substances includes proteins, nucleic acids, carbohydrates, lipids, enzymes, vitamins, pigments and other substances. Inorganic substances include minerals and water. Furthermore, chemical composition of a grain product always contains a needed amount of water depending on the type of grain, ripening level, anatomical structure, location of hydrophilic colloids, harvesting conditions, methods of transportation, storage and many other factors. Water in the anatomical structure of the grain and its relationship with the substances varies. Wheat is the third most important cereal crop in the world by production, providing 20% of daily protein and calories for 5 billion people [1]. In the past, wheat yield and quality have maintained pace with global consumer demand through both breeding efforts and management practices [2,3]. However, ensuring wheat grain quality, especially under extreme high temperature stress (HTS) is challenging, as it is crucial to human nutrition, commodity value, and end-use functional properties [4–6].

The relationship of the amount of water in the grain to the substances in the grain is divided into the following types according to the P. A. Rebinder classification:

1. Chemically bound water - it is mainly present in a clearly defined amount in the molecule of the substance contained in the grain;

2. This water can be separated from the grain only by chemical action. In this case, the structure of the substances in the grain is disrupted;

3. Physic-chemical bound waters include mainly adsorption-bound, osmotic absorbed waters. This amount of water in the grain varies depending on the type and condition of grain products. Besides, water is located in the micro and macro capillaries of the grain and can increase and decrease depending on environmental conditions. That is why this water (moisture) in the grain is called free water. Because when the grain is dried, the moisture content decreases due to this, and if the air humidity increases, the grain moisture can also increase due to moisture.

Irrigation schedules and technologies greatly influence crop growth and yield [17,19]. Compared to conventional surface irrigation practices, advanced irrigation systems, such as drip or sprinkler irrigation technologies, simultaneously improve water use efficiency and grain production in winter wheat [20]. Micro-sprinkling technology, which is based on surface drip irrigation and sprinkler irrigation, efficiently produces high yields. Its use in wheat production has increased gradually in recent years, and more efficient use of nitrogen (N) fertilizer can be achieved by combined application of water and fertilizer [18,21].

Nitrogenous substances

The main part of nitrogen in grain is protein, and the amount of non-protein nitrogen should not exceed 2-3% in fully ripe, unheated, non-sprouted in grain that meet the standard requirements. The amount of protein-free nitrogen is high in immature grains, which increases sharply when the grain mass is heated during storage and as a result of the development of microorganisms, which leads to a decrease in the quality of flour and bread from grain. Protein-free nitrogenous substances are mainly composed of amino acids and amides. However, protein content of grain consists of simple proteins and complex proteins. Complex proteins are present in small amounts in grains and are composed mainly of lipoproteins and nucleoproteins. Not only the amount of protein but also its biological significance varies depending on the variety of amino acids in the grain. Proteins are divided into water-soluble (albumin), saline-soluble (globulin), alkaline-soluble and alcohol-soluble. Additionally, water-insoluble proteins (glumin, glutein, gliadin) are called gluten. Gluten is an elongated and pliable substance that remains after washing the starch in the dough with water. It is of great importance in baking bread. The size and porosity of the bread depends on the amount of gluten, which traps the gas in the dough, as a result it expands well, increasing the porosity of the bread. For example, the proteins in wheat are well stretched when the dough is made, which has a positive effect on the quality of the finished product.

Life-needed proteins

Protein plays an important role in the vital processes of human and animal organs. Grain is one of the main products that provide the human body with protein. Protein is made up of completely non-replaceable (non-replaceable) and non-fully replaceable, and amino acids. Proteins that contain all the essential amino acids are called biologically essential proteins, while the rest belong to the group of non-essential ones. Similarly, without the synthesis of essential amino acids in humans and animals, they are found in foods and are readily available. Non-biologically complete proteins in grains do not contain sufficient amounts of essential amino acids lysine. Protein governs the end-use quality of grain products, as it is considered the principal component of wheat grain quality [5,7]. High-temperature stress (HTS) events have been projected [8,9] as a risk in the near future for deteriorating grain quality, in particular grain protein concentration (GPC). The effects of HTS on wheat have been previously quantified in terms of duration, level, and growth stage at which stress occurs [6,10,11]. Specifically, HTS influences wheat quality by altering grain starch content and GPC [5,6,9]. However, increase in GPC under HTS despite reduced grain protein accumulation indicates that the reduction in grain mass is greater than that of protein [4,12,13]. Simulation analysis is considered to be a powerful tool for examining and interpreting the impacts of environmental and management factors on grain quality [14]. Sirius Quality [16] accounts for structural proteins (albumin-globulin and amphiphilic proteins) and storage proteins (glutenin and gliadin) under normal temperature [4].

Importance of Vitamins

The chemical structure of vitamins varies. These include relatively low molecular weight organic compounds that are required in very small amounts for the nutrition of humans and animals, as well as plants and microorganisms. All vitamins have the following specific properties that distinguish them from other substances:

1. Their biosynthesis occurs mainly in plants, they enter the living organism along with food.

2. Vitamins are biologically active in small amounts and are extremely necessary for all vital processes.

3. Lack of vitamins in the body or their excretion from the body leads to the development of pathological processes in the form of hypovitaminosis (diseases caused by vitamin deficiency).

The effect of vitamins is based on the fact that when they enter the body, they become their active form and are usually coenzymes or prosthetic groups that are part of the most important enzyme systems. Lack of thiamine vitamin (B1) in diet causes accumulation of pyruvic acid in nervous system, and polyneuritis (disorders of the sensory and motor spheres, muscle atrophy, edema, etc). Niacin (vitamin RR) is a component of oxidation-reduction enzymes, which accelerates the release of hydrogen from oxidized organic matter.

Water-soluble vitamins

The grain contains eight water-soluble vitamins: thiamine, riboflavin, niacin, pyridoxine, biotin, ascorbic acid, pantothenic acid, myocytes.

Thiamine (vitamin V1) is a compound of hydrogen bromide. The enzyme is part of pyruvate decarboxylase and plays an important role in the conversion of carbohydrates into other substances in animals, plants and microorganisms.

Lack of riboflavin (vitamin V2) leads to loss of appetite, weight loss, weakness, irritability, pain in the mucous membranes of the mouth.

Niacin (nicotinamide vitamin RR) is a component of the enzyme pyridine dihydronase, which is involved in the transport of hydrogen. The amount of niacin is 45-70 mcg g in wheat, 120-325 mcg g in bran, etc.

Pyridoxine (vitamin V6) is a component of enzymes that catalyze changes in amino acids. The amount of pyridoxine is 3.5-4.3 mcg / g in wheat grains and 8.9-16.2 mcg / g in bran.

Biotin (vitamin N) is an important growth factor for yeasts and other microorganisms.

Lack of ascorbic acid (vitamin C) causes sinus disease.

Minerals in grain: Dried, dehydrated grain consists of two groups of elements: group 1 - S, O, N, H, S - 9-98%. The rest of the substances (1.5-2.0 percent) are all other elements (group 2). The mineral elements of the second group are divided into 3 groups:

1. Macronutrients - the amount of elements in this group is expressed as a percentage value from one thousand to one hundredth (10-1 - 10-2). This group includes the elements P, K, Mg, Na, Fe, S, AI, Si, Ca;

2. Micronutrients - the amount of elements in this group ranges from one thousandth of a percent to one hundredth of one thousandth (10-3-10-5). This group includes Mn, B, Sr, Cu, Zn, Ba, Ti, Li, J, Br, No, Co, and other elements;

3. Ultra microelements - the amount of elements in this group in the grain is measured in percent and less. These include Cs, Sr, Cd, Hg, Ag, Br, Ra.

The ash content and composition of different varieties of grains (such as phosphorus, sulfur, potassium, sodium, calcium, magnesium and iron) contain moderate chemicals.

Conclusion

In cultivating and seeding grains in the ground, farmers must pay attention the water sufficiency and climate influence because these two factors may change the chemical composition and quality of the wheat as it may help plant to grow and be ripening. Wheat is rich in proteins which we can find more to have than other products in our daily life.

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