

The Importance of Determination of some Physical – Chemical Properties of Wheat and Flour

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Summary

The content of the some ingredients, such as proteins, ash, etc. is important in food products, either they are present in raw materials or in final products. As wheat is also very important food raw material, and flour as the final product of milling, it is important to know their specific physical – chemical properties. The importance of knowing the physical and chemical properties of wheat and flour is due to the determination of quality and kind of flour which is produced after milling process.

In this work, some physical – chemical properties are determined and some comparisons of characteristics were performed in both wheat and flour.

Characteristics that were observed in this work are moisture content, ash content, protein content, Zeleny sedimentation value, gluten content and water adsorption values. On the base of results obtained in this work, some conclusions are made that could be useful for milling industry.

Key words

physical – chemical properties, flour, wheat

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Introduction

Wheat is mill raw material, which is today together with rice the most important food raw material. Wheat's chemical content and economic production have made it the main resource for multi phase production of different food, chemical and pharmaceutical products. Beside that, the wheat is also used for production of alcoholic and other drinks, as well as cattle food production. However, the wheat is mostly used for flour production; thus, the biggest problem of missing food is solved by using it. Wheat, as well as other corns presents the cheapest source of energy and calories (Bešliagić et al., 1999).

Determining moisture content is an essential first step in analyzing wheat or flour quality since this data is used for other tests. Flour millers adjust the moisture in wheat to a standard level before milling. Moisture content of 14 percent is commonly used as a conversion factor for other tests in which the results are affected by moisture content.

Moisture is also an indicator of grain storability. Wheat or flour with high moisture content (greater than 14.5 percent) attracts mold, bacteria and insects, all of which cause deterioration during storage.

Wheat or flour with low moisture content is more stable during storage. Moisture content can be an indicator of profitability in milling (Trajković et al., 1983).

Having it in mind, mill industry needs to make experiments on quality and determination of some important constituents such as protein, wet gluten content, ash, moisture content etc., because the ingredients dictate the intended use of flour.

Wheat flour is an excellent source of complex carbohydrates. Other than gluten flour, all types of wheat flour derive at least 80 percent of their calories from carbohydrates. Depending on the flour type, the percent of calories from protein ranges from 9 to 15 percent, except from gluten, which has 45 percent protein content. Calories from fat are never more than 5 percent. Although protein content is traditionally recognized as the most influential factor affecting wheat bread making quality (Shewry et al., 1986) protein quality is also an important consideration. The two protein fractions that constitute gluten protein, namely glutenins fraction and gliadins fraction, each have unique effects on end-use quality (Gupta et al., 1992). Gliadins fraction, which is a very heterogeneous protein fraction, is responsible for the viscous properties of dough during mixing (Fido et al., 1997). Conversely, glutenins fraction is polymeric protein that exhibits a high degree of inter-molecular bonding (Gianbielli et al., 2001), reduces dough extensibility (Wieser et al., 2001) and is the protein fraction responsible for dough strength.

In Bosnia and Herzegovina, one of the main energy and nutrient source is the bread so the quality of wheat is especially important in the agricultural practice, therefore the focus is on the technological parameters like rheological properties and gluten content. Some investigations show the effect of sampling or harvesting time on the element content of winter wheat flour and energetic values of flour which

depend on the content of some important constituents such as protein, ash, moisture, etc. (Stipos et al., 2004). Based on wheat composition and gluten quality, corresponding flour and end-use product can be estimated. Wheat and corresponding flour quality are assessed in order to predict main flour characteristics from the wheat ones in conditions of commercial mill (Čurić, 2001). The research of the group of authors, which were performed on different Croatian varieties of wheat, found out that there was no significant correlation between the glutenins fraction quantity in the flour and the gluten index value and consequently between the gluten index and the volume of the finished product that mainly depends on the glutenins fraction quantity. They concluded, on the basis of obtained results, that the gluten index is a good and reliable measure for the technological quality of Croatian wheat varieties (Čurić, 2001). The ash content in wheat and flour has significance for milling. Millers need to know the overall mineral content of the wheat to achieve desired or specified ash levels in flour. Since ash is primarily concentrated in the bran, ash content in flour is an indication of the yield that can be expected during milling. Ash content also indicates milling performance by indirectly revealing the amount of bran contamination in flour. Ash in flour can affect color, imparting a darker color to finished products. Some specialty products requiring particularly white flour call for low ash content while other products, such as whole wheat flour, have high ash content (Trajković et al., 1983). The Zeleny sedimentation value test provides information on the protein's quantity and the quality of ground wheat and flour samples. The Zeleny sedimentation value test is used as a screening tool in wheat breeding as well as in milling applications (Trajković et al., 1983).

In this work, five samples of different varieties of wheat were tested, where each sample was ten times tested and an average values calculated. The aim of this work was to show the importance of determination of quality of wheat and corresponding flour, type T 500 and type T850, which are the most used in many food processes. Measurements of wheat characteristics were performed during its' storage.

Material and methods

Different samples of wheat are chosen in order to determine dependence of it's' quality and quality of flour. For experimental work different samples of wheat and flour are used to determine quality through some parameters. Five different varieties of wheat and flour are chosen, and marked as the samples from p1 to p5. Two types of wheat flour, type T500 and type T850 were also chosen to test. Both wheat and flour are marked in figures as series such as wheat – series 1, flour type T 500 – series 2 and flour type T 850 – series 3. Those two types of flour are the most produced in our mill industry of all other types.

The following parameters of wheat and flour are tested: Zeleny sedimentation value, gluteins fraction content, moisture content, water absorption, ash content and protein content.



Picture 1. Instalab used for chemical analyses of wheat and flour constituents

All results were expressed as percentage, with exception of Zeleny sedimentation value that was expressed in milliliters.

100 g of wheat was ground and mixed it in original glass test tube. Glass test tube was filled to the top, closed and put in device for determination. The above mentioned parameters of wheat and flour were determined by Instalab, Dickey John (Picture 1).

Results and discussions

The content of the moisture in both, wheat and flour was the highest for wheat, 16.03%, sample 2, but the lowest for wheat in sample p4, 9.28%. According the above results, showed in Figure 1, the moisture content for flour type T500, ranged from 13.48%, sample p5 to 13.88, sample p1. The moisture content in flour type T850 was similar and ranged from 13.43%, sample p5 to 14.12%, sample p1. According to valid regulations in B&H, the maximum allowed moisture content is 14% in wheat and 15% for flour.

An average ash content in wheat variteies and two types of flour, T 500 and T 850, is presented in Figure 2.

The highest value of ash content in wheat was in sample p4, 1.63%, and the lowest in sample, p2, 0.92%.

The lowest value of ash for flour type T500, was in sample p4, 0,50%, and highest for sample p5, 0,60%. Values of the ash content for type T850 were higher regarding the type of flour.

The content of proteins in wheat and flour products is presented in Figure 3.

The highest value of protein content was in samples p4 and p5 for flour type T850, 12.26% in both, while the lowest was 8.89% in sample p2. The protein content in wheat ranged from 8.89% in sample p2 to 11.4% in, sample p5. In flour type T500, the protein content ranged from 10.63% in samples p4 and p5, to 11.72% in sample p1.

Considering the of Zeleny sedmination values showed some important differences, as shown in Figure 4. The Zeleny sedimenatiton value was the lowest for flour type T850, 17.90 ml for sample p1 and highest for wheat, sample p5, 44.98 ml.

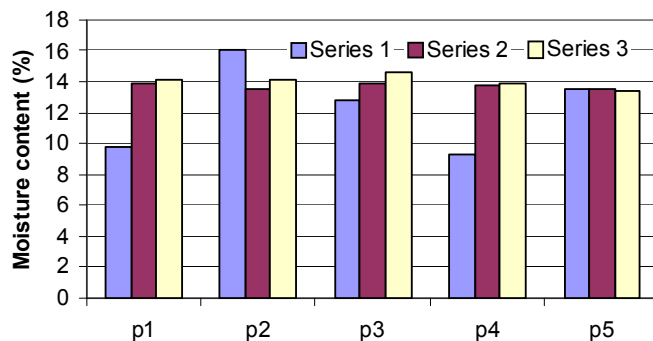


Figure 1. An average moisture content in flour and wheat samples

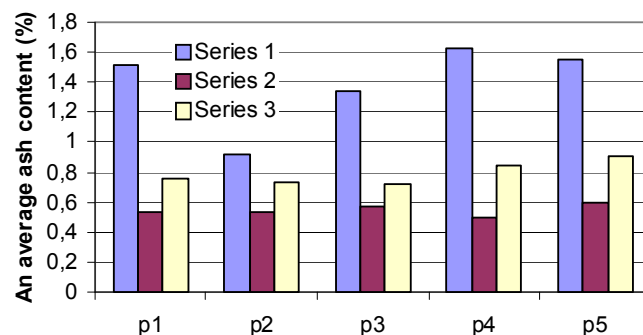


Figure 2. An average ash content in flour and wheat samples

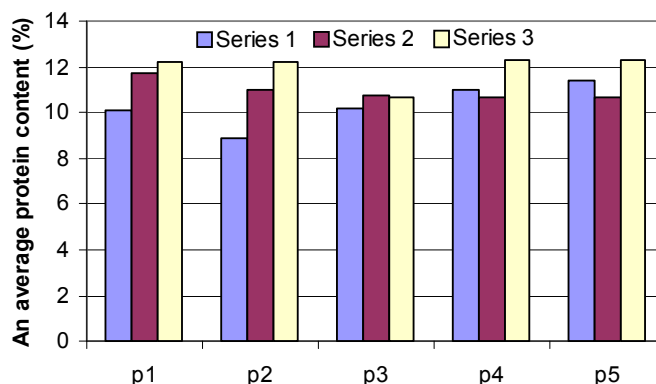


Figure 3. An average protein content in flour and wheat samples

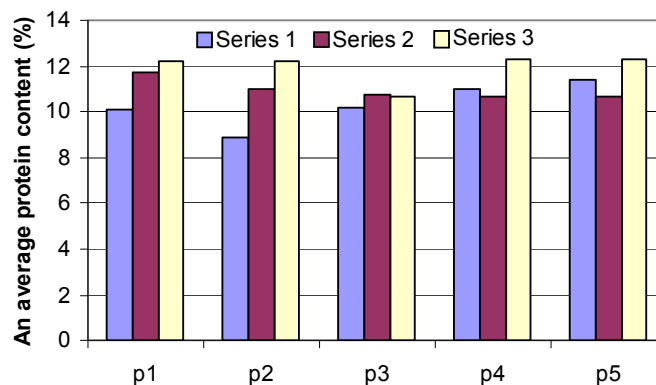


Figure 4. An average Zeleny sediemntation values in flour and wheat samples

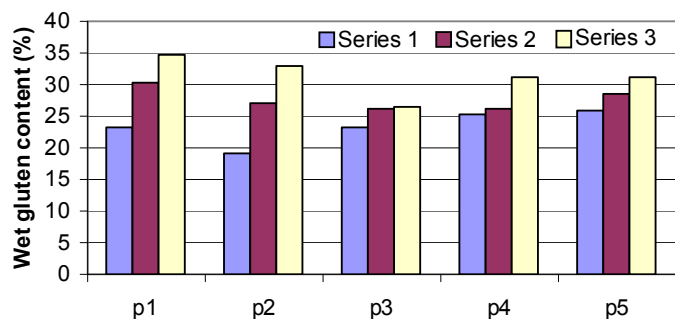


Figure 5. The wet gluten content in flour and wheat samples

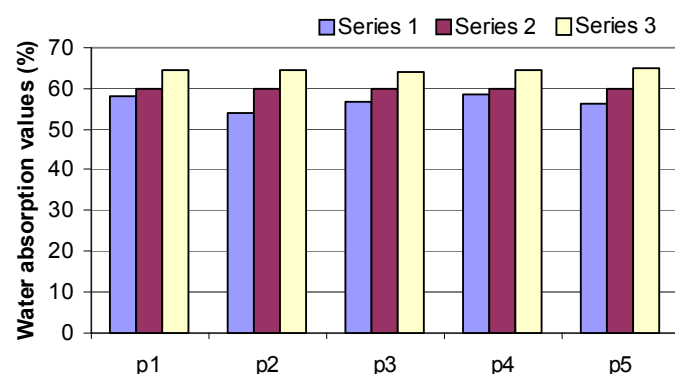


Figure 6. An average water absorption values of flour and wheat samples

As the gluten fraction is of great importance for flour and wheat, it is also important to determine it (Figure 5).

An average wet gluten content for wheat was the highest in the sample number 5, p5, 25.8%, while it had the lowest value in sample p2, 19%. Regarding the results obtained by analyses, the wet gluten content in flour, was the highest for type T850, sample p1, 34.75%, and the lowest value was 25.4%, sample p4, flour type T500.

The results of an average absorption values for five wheat varieties and two types of flour are shown in Figure 6.

The water absorption value was the highest for flour type T 850, sample p5, 64.75%, but the lowest was determined for the sample p2, 53.90%, flour type T500. According the results obtained by the analyses, the absorption value for flour type T500 ranged from 59.70%, sample p3, to 60.10%, sample p5. Values for flour type T850 were similar as well as for wheat and flour type T500.

Conclusions

Based on experimental data obtained through chemical analyses of wheat and flour the following can be concluded:

- It is very important to establish permanent control of wheat as well as flour, because as it has been seen from the data, some samples had higher moisture content then it is allowed regarding the regulation.
- Wet gluten content is particularly important to determine, because some people can have negative consequences to health if they consume flour containing it;
- The most important parameter to monitor input values of wheat quality is control of moisture content, which gives information on possible microbiological contamination,
- The influence of moisture content on proteins in tested samples showed that wheat has optimal value of moisture content, as well as very good quality.
- The moisture content of wheat in sample p2, 16.03% was higher then it is allowed by valid regulation for wheat and mill products in B&H, which means that this wheat can be microbiological contaminated and probably not good for use in milling process.

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