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THE INFLUENCE OF PHYSICAL PARAMETERS OF MALT IN THE QUALITY OF WORT FOR BEER

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Abstract

Decisive to produce a good beer is the production of qualitative wort. The process of wort production requires coordination of operations (temperature / time / pH) in order that from the raw materials used, to handle and to extract the maximum capacity of the production of wort for kg malt. To obtain the optimum potential from malt we should know and interpret very well its parameters. Physical characteristics of malt are very important and affect the technological process of brewing. In this paper are presented the results of physical analyses performed on samples of maltand also is studied the impact of these results in the quality of wort. Each base malt should have mealy contentof 90%. If we will use the infusion method the mealy content must be at least 95%. The bigger are the size of barley grains the higher is their efficiency. The uniformity of malt grains shows how uniform will be its fragmentation. Good malt should have about 90% of its grains uniform in terms of size. Malt is classified by how much percent of its grains are glassy. Therefore it is checked if grains are mealy, half glassy, glassy ends and glassy. If the endosperm is not more than 25% glassy then the malt is called mealy. The malt grains are half glassy if 25-75% of endosperm is glassy. When the endosperm is over 75% glassy the malt is called glassy. Glassy malt produces less extract because the grains are not fragmented as well and hydrolysis occurs with difficulties in mashing process.

Key words: *glassy, grains, malt, physical analyse.*

INTRODUCTION

Barley (*Hordeum vulgare*) is the cereal grain most often malted. Wheat (*Triticum aestivum*) and sorghum(*Sorghum vulgare*) are also malted in notable quantities (the latter in Africa), but small amounts of rye (*Secale cereale*), oats (*Avena sativum*) and millets (various spp.) are also used. The barley grain or corn has a complex structure (Briggs, 1978, 1998), and is a single-seeded fruit (a caryopsis). Barley varieties differ in their suitability for malting. Grains vary in size, shape and chemical composition. It is important to understand that malts consist of mixtures of grains with differing properties. Before malting, grain is screened and aspirated to remove large and small impurities and thin corns. To initiate malting it is hydrated. This is achieved by "steeping", immersing the grain in water or "steep liquor". Later, the moisture content may be increased by spraying or "sprinkling" the grain (Briggs et al., 2004).

A malt analysis will typically list three types of data: physical analysis, wort analysis and chemical analysis. While each attribute uniquely impacts the brewing process or finished beer, some have a greater impact and significance than others. The physical analysis include: glassy of malt, rate of crystallization, friability and size of malt grains. These tests are very important because through them we know the physical characteristics of malt, which will be used for wort production. Data from the analysis conducted with different malt samples, we see that the quality of wort take from them varies depending on physical characteristics. The physical parameters of malt affect the efficiency of wort, the milling of malt and the method that should be used for mashing.

MATERIALS AND METHODS

The data on which this paper is performed are obtained from the analyses that are made for different samples of malt. The period analysed

in this study was 2014-2015. The physical Analyses made are: the determination of glassy, of friability and the size of grains.

Glassy of malt

It is the opposite of mealy character of malt. The experiments proceed by taking a small quantity of malt grains. Marked with: 1 glassy grain, 0.5 half glassy grains, 0.25 the grains that have endosperm with glassy ends and 0 the mealy grains. Then calculate the quantity and the average. The observation was subjective and random therefore the grassy and mealy character of malt may be discussed.

Friability

Friability indicate if malt is easy milled and is related with mealy character of grains. In this test which indicates the level of modification, malt is crushed using a friability instrument. The friability is the percentage (by weight) of material that passes through the sieve. Investigation of material remaining on the sieve can be informative and can indicate if the malt corns generally contain unmodified material or if a substantial proportion of wholly unmodified grains are present.We weighed 50 grams malt that is placed in the drum of sieve in the form of a net. During a fixed time (8 min) cereal is pressed against a rotating metal net through the pressure force of a rubber roller. The crushed malt (particles fragmented easily) falls through the sieve in a container, while the glassy grains (the strong part) remain inside the drum. After testing will be possible the following fractions:

- The content of the drum, the glassy part.
- The content of the contanier is not important for evaluation and may be removed.

We weigh glassy part exactly after test them with an accuracy of 0.1 g.

$$M = 100 - 2 \times A$$

M = friability in % ; A = weigh in g of the fraction remaining inside the drum.

Grain size

The grain size is determined by sieve. Sortimat is an instrument used to measure the size of grains. Grain size was measured according to the methodology described previously (Fox et al. 2006), where in the upper sieve we put a sample of 100g clean grain. During the registered time the grain is selected depending of their size in four (five or six) fractions, as a result of the movement front-back of the sieve. By leaning the sieves with 90º, by opening the sliding plan and by pulling the cleaner of the sieves, the grain will fall into the vesseles which are placed in the bottom. Then we weigh the selectionated malt according to the grain size, respectively:

- Grains with size >2.8mm
- Grains with size 2.5-2.8mm
- Grains with size 2.2-2.5mm
- Grains with size > 2.2mm
- Half grains
- Damaged grains and impurity.

RESULTS AND DISCUSSIONS

Analyses for determining of mealy character of malt

Definition of mealy character of grains is done by taking samples with a weigh of 50 g. Malt samples were taken during the 2014-2015 in the different furnishing malt of beer factory. The separation of malt is made in two categories: glassy malt and mealy malt through friability instrument. After categorization of malt were done the weighing and by the above formula was calculated the friability. The rezults of analysis for various samples are summarized in the following table:

Table 1.The results of analysis for various samples for determination of mealy character of malts.

Number of sample	Weigh of mealy malt (g)	Weigh of glassy malt (g)	Friability (%)
1.	41.4	8.5	83
2.	43.4	5.7	88
3.	44.7	4.7	90.6
4.	36.66	12.84	74.32
5.	40.64	9.22	81.56
6.	41.5	8.3	83.4
7.	30.76	18.6	62.8

A similar evolution of cattle and dairy cow Friability shows if malt mill easly and is recomended a friability about 80%. From the results obtained see that samples 1,2,3,5 and 6 have a friability above 80%, so that these malts can mill easily. Samples 4 and 7 have friability under 80%, so that these malts mills with difficulties. Friability affects the quality of wort having a direct impact on the amount of the extract. After milling, malt mixed with water

and formed the mash. The efficiency of mashing is often estimated by comparing the extract recovered in the brewery with that obtained in laboratory mashes when the hot water extract (HWE) of the grist is determined. The mash is wormed, to dissoved the important substances in the water, obtaining the sweet wort.The purpose of this process is to obtain a production of the extract as high as possible from the milling malt. If we use a common procces of wort production would deal only 10-15% of the extract, the amount of the extract would be 10-15%. We determined in laboratory for each sample of malt the quantity of extract obtained.

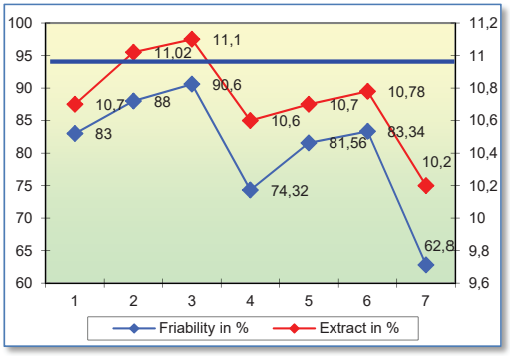

Figure 1.Friability performance for different samples of malts.

From this chart (Figure 1.) it is clear that the values of friability for different sample of malt are below the thick blu line. Since friability of malt is below 95% is not recommended to work with the infusion method. Friability walks in proportional to extract of wort.The chart shows that the much higher friability is, much higher extract of wine is produced. The above results in the wort production is the same and is working in relatively constant conditions.

Analysis for determinate the grain size of malt

In parallel with the analyses for determinate the friability were conducted the analyses for determinate the grain size for the same malts that furnished the beer factory. In this case were taken more samples of malt with a weigh of 100g. Samples were taken after the cleaning process. Through sortimatit the malt grains are divided depending on their size according to the method explained above. The results obtained from these tests are summarized in the following table (Table 2).

The experiments confirm that malt grains in general, 98% have greater size than 2.2 mm. Different samples of malt used for analyses have a constant performance in terms of size. Malt with grains size less than 2.2 mm should be returned because it meant that their grains have not made the modification. The larger are the grains of barley, the higher is their productivity.

Table 2.The results of analysis for various samples for determination of grains size of malts

Number of sample	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.
Weigh of grains with size >2,8mm (g)	77.98	89.90	89.90	74.08	69.28	87.84	69.70	82.02	72.32	89.52
Weigh of grains with size 2,8-2,5mm (g)	16.92	7.1	8.4	19.64	21.36	10.56	22.1	14.42	21.7	8.20
Weigh of grains with size 2,5-2,2mm (g)	3.54	1.3	1.0	4.4	5.70	0.98	5.3	2.28	4.46	0.9
Weigh of grains with size <2,2mm (g)	0.64	0.4	0.3	0.86	2.06	0.16	1.6	1.04	0.66	0.28
Weigh of half grains (g)	0.78	0.8	0.38	0.84	1.22	0.38	1.1	1.32	0.80	1.10
Weigh of damaged grains and impurity (g)	0.1	0.3	0.1	0.1	0.38	0.06	0.2	0.58	0.12	0.0

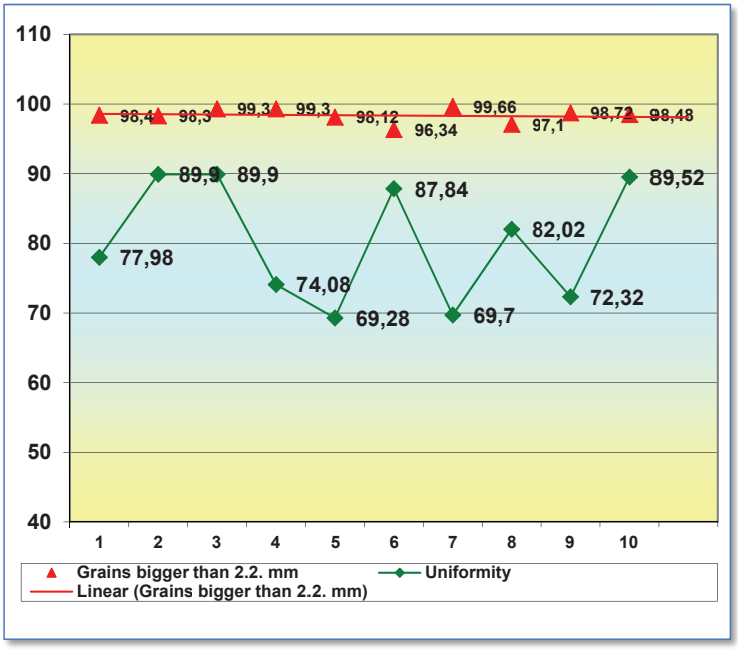

Figure 2.Grains size and uniformity performance for different samples of malts

However except this quality malt must complete the criteria of uniformity. Uniformity of malt grains shows how uniform will be its milling.Malt completes the standards, if the uniformity of its grains is 90%. As evident from the chart (Figure 2), in our case there is no sample that have a uniformity higher than 90%.

CONCLUSIONS

Good malt must have e mealy content. Every base malt should have a mealy content of 90%. If we have to use the infusion method to produce the wort, the mealy content must be at least 95%. For base malt where their composition is expressed through the proportion, mealy/half glassy/glassy, the ratio should be 92% / 7% / 1% for decoction method and 95% / 4% / 1% for infusion method.

Friability is the characteristic that is related with the mealy character of barley grains. Malt should have a friability about 80%. When we use the infusion method, malt should have a friability at least 95% or higher.

The size of the malt grains is physical parameter very important that is determined through Sortimati. In Europe generally used malt with grains size 2.2 mm. Malt with grains size less than 2.2 mm should be returned because it meant that their grains have not made the modification. The larger are the grains of barley, the higher is their productivity. Good malt should have about 90% of its grains uniform in terms of size.

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