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QUALITY ANALYSIS OF MALTS OF DIFFERENT ORIGIN USED IN INDIAN CRAFT BREWERIES

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ABSTRACT

Malt is processed barley, produced from barley grains in a process called malting and is used in beer production as a source of starch, contributing to beer's color and other characteristics. in this study, Four different types of malts used in Indian Market for craft breweries were analyzed for Protein content, Hot water extract, diastatic power and friability of malt and evaluated the influence of variety and locality on malt quality.

Keywords: Malted barley, variety, locality, malt parameters.

INTRODUCTION

Barley (*Hordeum vulgare* L.), a most ubiquitous cereal, is used in the production of malt; the principal material for both alcoholic and non-alcoholic beverages. The most important use of barley is for malting purposes, most specifically for the brewing industry (Keenan *et al.,* 2007). Barley is the major source for brewing malts, which constitute the single most important raw material for beer production. Beer quality and the efficiency of the brewing process is highly determinative by malt's chemical composition and brewing procedure. Two-row spring and winter varieties are commonly used for malting industry (Gupta *et al.,* 2010).

Malt is processed barley, produced from barley grains in a process called malting and is used in beer production as a source of starch, contributing to beer's color and organoleptic characteristics. The quality of barley plays a major role in Malt quality. Malting quality is dependent upon genotype, environmental fluctuations of temperature and rainfall may also have a strong influence (Eagles *et al.,* 1995). Under different environmental conditions, overall malting quality can occasionally be reduced and superior genotypes are thus more difficult to identify. During brewing, Milled malt is mixed water called mashing, in which polysaccharides (starch, polymerized carbohydrates) of malt are degraded by enzymes at specific temperatures. Good quality malt is always required by brewers for a successful mash. Controlled malting effects barley's enzymes and several components that is responsible for the final quality of malt. Based on the fact that the malt is one of the main raw materials for brewing, its quality must be rigorously assessed (Savin and Molina-Cano, 2002).

The key factors for a good malting depend on the variety of barley. The necessary quality of raw material for each beer type by choosing a barley variety and its malt is determined by the brewer. The aim of this syudy was to evaluate the influence of variety and locality on the Protein content, Hot water extract, Diastatic power and Friability of malt

MATERIAL AND METHODS

Different types of malts were purchased from local vendors. Four different types of malts that used for brewing were analyzed. Malts were chosen on basis of their origin. 6 Row (Indian), Pilsner (Germany), Pilsner (Poland), 2 Row (Canada) were analyzed for following methods.

Moisture content

Moisture content of malt is determined on a ground sample, as a weight loss after oven drying at 110°C for 2 hr (AOAC, 1990).

Protein content

Nitrogen was determined using Kjedahl method and protein calculated as total Nitrogen x 6.25 (AOAC, 1990).

Hot-water extract

Hot-water extract was measured using a rapid, small-scale method, in which coarse ground malt (l.0g) was mashed in hot water (I0 ml) for 1 h at 65°C by mixing every 15 min. The extract was centrifuged at 3000g for 10 min (EBC, 2010).

pH

The pH of the malt was determined using standard assays (AOAC, 1990). The pH of the malt sample was determined using glass-electrode pH meter. About 50 g of dried malt was ground and homogenized in 100 ml distilled water. The water was decanted and its pH determined after calibration of the pH meter using pH buffer 4.0 and pH 7.0.

Diastatic power

Diastatic power was determined using the Ferricyanide Method (IOB, 1986). Malt extract was obtained by extracting with water for 2 hours in a temperature-controlled water bath. About 3 ml of the unfiltered malt-extract supernatant was transferred in to a 250 ml conical flask containing 100 ml buffered starch solution maintained

Table1. Analysis of Various Barley Malts & Others

	6 Row (Indian)	Pilsner (German)	Pilsner (Poland)	2 Row (Canada)
Moisture (%)	5.1	5	5.2	5.2
Protein (%)	13.2	11.2	11.5	11.6
pH	5.6	5.3	5.3	5.5
Hot water extract	77.2	80.5	80	80.2
Diastatic power	103.1	76	76	161
Frability (%)	63.9	79	80	76.5

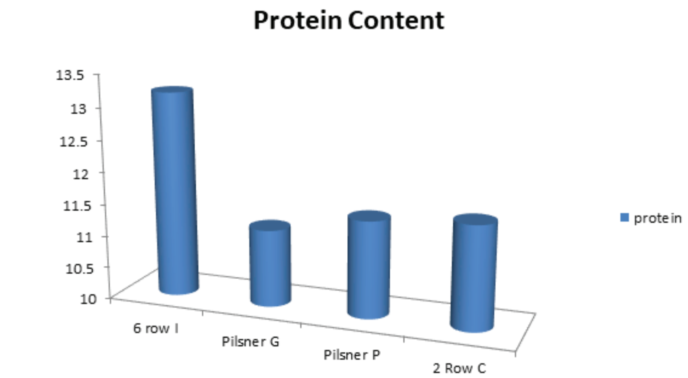

Figure 1. Protein Content of Malts

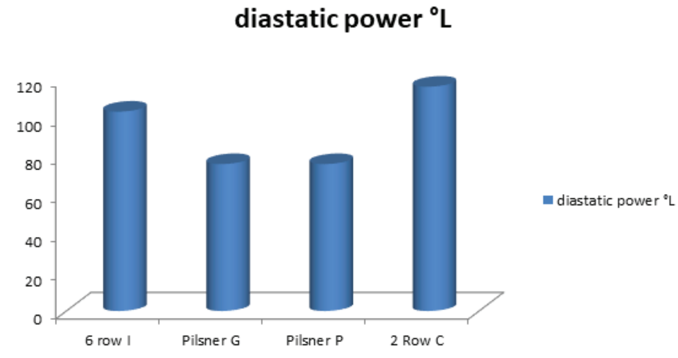

Figure 3. Diastatic Powers of Malts

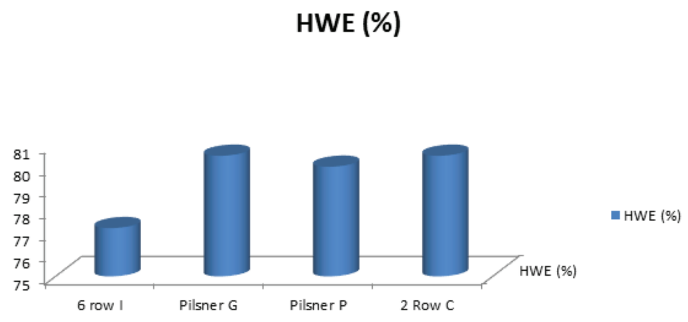

Figure 2. Hot Water Extract of Malts

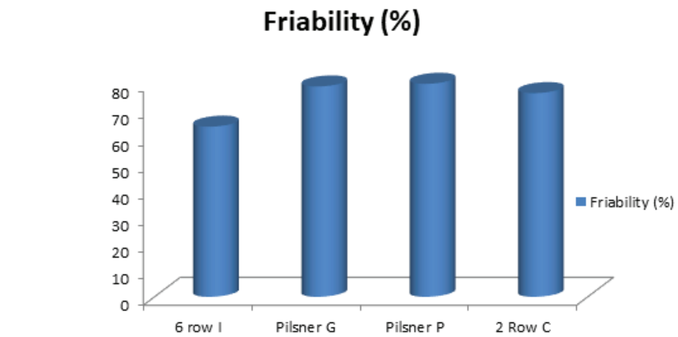

Figure 4. Friability of Malts

at 30°C in a water-bath. After 1 hr thorough mixing, 5 ml portion of digested starch solution was mixed with 10 ml of alkaline ferricyanide and left to stand in boiling water for 20 min. On cooling to 30°C, 25 ml acetic acid salt and 1 ml potassium iodide solutions were added and the solution titrated with 0.05 mol/l sodium thiosulphate solution to the complete disappearance of the blue colour thus formed. A blank was prepared of the unfiltered malt infusion and 2% buffered starch solution (Meredith *et al.,* 1962).

The diastatic power (Dp) was calculated as follows:

Dp (°IOB) = b-a (23×200/250×1/c)

where: a = volume of sodium thiosulphate used for direct titration.

b = volume of sodium thiosulphate used for blank determination.

c = volume of unfiltered malt extract used for the digestion.

The diastatic power Dp (°IOB) was converted to Dp (°L) as follows:

Dp(°L)`=DP (°IOB) × 1.1

Friability

Friability indicates 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. It measured on malt friability meter.

RESULTS AND DISCUSSION

Chemical composition of malt is very important for brewing; due to this fact the quality of malts must be strictly evaluated. The aim of this syudy was to evaluate the influence of variety and locality on the Protein content, Hot water extract, diastatic power and friability of malt and it was found that the variety of barley significantly influenced these parameters.

There are several factors that influence the quality of malt extract. The first one is environmental, such as growing conditions, temperature, fertilizer, available nitrogen, or moisture. There is no direct impact on extract but rather these factors affect traits that influence extract particularly protein and starch levels and composition. The second one is several genetic biochemical components that influence the final level of extract (Fox *et al.,* 2003). These include 2- or 6-row types, husk thickness, grain size, protein, starch, non-starch polysaccharides and enzyme production. The other important factors that influence extract are the malting process and mashing conditions (pH, temperature, mash time, grist/particle size etc).

Protein content

Protein content was highest for 6 row malt (Indian) and lowest for Pilsner (German). According to Ye *et al.,* (2016), all haze characteristics were significantly and positively correlated with total protein content. A high protein level indicates a thinner kernel with less starch that decreases the malt extract. Acceptable six-row malting barleys may range from 12 to 13.5% protein, whereas two-row cultivars range from 11 to 13%; barleys with greater than 13.5% protein are rarely used for malt.

pH

The degree of enzyme activity determines by the pH value. pH values to be maintained during amylase activity is between 5.2 to 5.6. We found satisfactory results for pH of all four different malts.

Hot Extract Malt (HWE)

Hot Extract is perhaps the most important quality parameter for brewers when selecting malted barley. During brewing, the amount of extract in the brew house, is always have a crucial economic importance, determines the amount of beer that can be brewed. That's why malt extract is also a major focus of breeding programs. Breeders, maltsters, and brewers are all striving to achieve high extract (Li *et al.,* 2008). The values of all varieties ranged in optimal limit, which is according to Psota and Kosař (2002) 40 to 48 %. We found that HWE was highest in German Pilsner. But apart from 6 row malts rest of malts have negligible difference in HWE.

Diastatic power (DP)

Diastatic power can be defined as the total activity resulting from the simultaneous action of alpha and beta amylases on malt starch during mashing. These activities are responsible for the generation or extract and fermentable extract during the conversion of starch.

A malt needs a diastatic power of approximately 35 °L to be considered "self converting". Acccording to Kreisz (2009), good malt should reach values of the DP above 61°L. Diastatic power values of samples as a parameter for the activity of amylolytic enzymes ranged from 76°L to 116°L (Fig. 4). The variety has a significant effect on the Distatic power (Eagles *et al.,* 1995). The results of our analysis confirmed the same. We found a great difference in DP of different malts.

Friability

Friability is a measure of the hardness of grains of malted barley or the modification of cell wall of malt grains. Friability of tested samples was in the range of 63.9-80%. Our results confirmed some authors point to the influence of genotype on the variability of friability. Edney *et al.,* (2012) point to a highly significant influence of the variety on the level of this parameter.

CONCLUSION

In the present study we found out that analyzed parameters of malt were significantly affected by the variety, namely: the diastatic power and Frability.

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