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Ferment ability of Wort from Two Nigerian Millet Varieties: Pearl Millet (Pennisetum Glaucum) and Proso or Common Millet (Panicum Maliacuem)

Agu, Virginus. O*

Department of Food Technology, School of Applied Science and Technology, Federal Polytechnic, Oko, Anambra State, Nigeria
***Corresponding Author:**
Email: Virginusagu @ gmail.com

Abstract : *The ferment ability of wort from millet malt was studied using external enzymes. The was necessitated by the ban on importation of barley into the country as a result of economic meltdown being experienced in Nigeria. Millet malt grits were used in the study using decoction mashing technique. The external enzymes fungamyl and Termamyl were used during mashing. Bottom fermentation was adopted using the yeast Saccharomyces Carlsbergensis. Fine filtration was done with kiesulger as filter aid to obtain a milky liquor (wort). The wort was evaluated for colour, pH, specific gravity and the results were obtained accordingly. This work also determined both real and apparent fermentability for both varieties, as well as their diastatic powers.*

Keywords: *Fermentability, wort, millet, varieties: pearl millet (pennisetum glaucum), common millet (panicum maliaceum)*

INTRODUCTION

Millet is a collective name for several cereals whose seeds are small in comparison to those of maize, rice, sorghum etc. The plants according to Agu et al. (1996) are also generally smaller. They are classified as the minor cereals not because of their smaller sizes but because they generally do not form major components of human food. Millets are however handy, being tropical and subtropical crop, will tolerate greater drought and heat, grow on poor soil and mature quickly. This is the reason attention is being turned to them. It is the same reason also that millet could become potential source of cereal for use in industrial microbiological media. Millet is all over the world and has various varieties including Pennisetum glaucum, Pannicum maliaceum (that were used as a case study in this research work), Steria italic, Technochloa trumentacea, elevsine corcuna, and Paspatum scrobifatum. The grain is a staple food crop in dry areas of Northern Nigerian and is used in local formulations or beverages like Pito, Burukutu, Otika and in large production as adjunct (Okafor, 1997). Millet is also a popular grain in Cameroom, Siri lanka, South Africa, Kenya as well as Nigeria. It has a small kernel, which makes it less susceptible to insect attack (Nout et al; 1992). In spite of its brewing potential as reported by Nout and Davies (1992), Malleshi and Desikachar (1986), Agu and Okeke (1991), Nzelibe and Nwasike (1995), there is a measure of dislike among the major brewers in Nigeria

towards the total utilization of these cereals in brewing. Nout and Davies (1992), on their research on millet, sorghum and barley malting characteristics noted that the qualities demanded by brewers of good malt such as maximum development of amylase (hydrolytic enzymes) within the smallest possible time and relatively low malting loss within two days of malting at 15 – 20^{oc} were found to be possessed by millet.

Material and Methods

Source of raw material

Millet grain varieties, pearl millet (pennisetium glaucum) and common millet (Panicum maliaceum) were purchased from the Institute of Agriculture and Cereal Research centre Zaria, Kaduna State. Brewing yeast (Saccharomyces carlsbergensis), kiesulgher powder, hop extract, brewing enzymes, (Termamyl and fungamyl) were got from Nigeria Breweries (Ama Breweries) 9th mile corner, Ngwo, Enugu state.

Methods

The method of the analysis of the varieties of millet used was the method of analysis of the institute of brewing (1997) together with the analysis committee of the European conversation (EBC) (1995) 4th edition. Hence, the analysis carried out on the millet grains include the determination of mould, moisture content, germinative capacity, germinative energy, one thousand corn weight, water sensitivity, malting loss, malting yield, diastatic power, hot water extract.

Wort Production

The processes involved in producing wort from barley were adopted for wort production from millet malt.

Millet grains
⇩
Milling
⇩
Mashing
⇩
Mash filtration
⇩
Wort builing
⇩
Wort cooling

Figure 1. The diagram of wort productions

Wort Analysis

Wort yield, wort colour, wort P^{H}/ mash p^{H}, original gravity of wort, specific gravity, apparent fermentability and real fermentability of the wort were determined

Results

Results of analysis of millet grains

Table 1A. Pennisetum Glaucum

Parameters	Results (%)
One thousand corn weight	20.13
Moisture content of the gravity	10.8
Germinative energy	94
Germinative capacity	95

Table 1B. Panicum Maliaceum

Parameters	Results
Corn weight	20.11
Moisture content of the grain	10.6
Germinative energy	93 (%)
Germinative capacity	94.8 (%)

Table 2. Millet Malt Analysis

Table 2A. Pennisetum Glaucum

Parameters	Results
Malt yield	97
Malting loss	2.6 (%)
Diastatic power	13.68 (%)
Hot water extract ("as is") $L^o\ kg^{-1}$	480
Cold water extract	45.6 (%)
Moisture content	5

Table 2B. Panicum Maliaceum

Parameters	Results (%)
Malt yield	96
Malting loss	2.9
Diastatic power	13.42
Hot water extract	476
Cold water extract	44.8
Moisture content	6

Table 3. Millet Wort Analysis

Table 3A. Pennisetum Glaucum

Parameters	Results
Wort Ph	5.6
Mash Ph	6.0
Wort colour (EBC)	5
Original gravity of the wort before boiling	13.3®p
Temperature of the wort at O.G 13.3op	18.1®C
Filteration time (Minutes)	15
Original gravity of the wort (O.G) after boiling	14®P
Temperature of wort at 0.G 14op	28®C
Volume of the wort before boiling (liter)	1.49
Wort yield) (%)	75
Wort pH after boiling	5.3
Wort colour at 45mm after boiling (minutes)	8.6
Iodine test	Yellow
Volume of wort after boiling (litre)	1.34

Duration of boiling (minutes)	30

Table 3B. Panicum Maliaceum

Parameters	Results
Wort PH	5.8
Mash pH	6.0
Wort colour (EBC)	5.8
Original gravity of the wort before boiling	13.1 ®P
Temperature of the wort at O.G 13.1op	18.®C
Filtration time (Minutes)	15
Original gravity of the wort (O.G)after boiling	14®P
Temperature of wort at 0.G 14op	26®C
Volume of the wort before boiling (liter)	1.49
Wort yield) (%)	7.3
Wort pH after boiling	5.4
Wort colour at 45mm after boiling (minutes)	8.8
Iodine test	Yellow
Duration of boiling (minutes)	30
Volume of wort after boiling (minutes)	1.32

Table 4A. Result of Real Fermentability

Raw Millet Grains	Results
Pennisetum glaucum	76.0%
Pennicum maliaceum	74.0%

Table 4B. Result of Apparent Fermentability

Raw Millet Grains	Results
Pennisetum glaucum	86.0%
Pennicum maliaceum	84.0%

Discussion

The result obtained in The table 1 (A and B) showed the analysis on the raw millet grains. These results are similar to the results of other researchers, (Okolo, 1995) and (Ezeogu, 1996). The values of germinative energy and capability for both varieties revealed that the millet grains used for this work were variable. These germinative energy and capability results are very close to the ones obtained by Agu, (1996) and Ezeogu, (1996).

The result on the moisture contents of the grains are appreciative and acceptable as it indicated that the millet grains can be stored for a very long time without loss in their quality and acceptability.

The results of the analysis presented in the Table 2 (A and B) were equivalent to those performed by Uriah et al, (1990) and Agu et al (1996). The difference in the results on malt yield, malting loss, moisture content, diastatic power, cold water extract, and hot water extract are very negligible, indicating that the malt from the millet grains was malted very well. The diastatic power which were almost the same with the work done by Uriah et al, (1990) showed that the energy composition of the millet malt is good.

The result on the Table 3 (A and B) showed the analysis of the wort and marsh. The pH of the marsh was determined using universal indicator paper. The pH of the wort was 5.8 which differs slightly from the result of the work done by Eneje, (1999) which showed that the pH of wort is 5.0. This difference in pH can be attributed to substandard brewing water.

The result in Table 4 (A and B) showed the real and apparent fermentability of both millet varieties. From the table, the apparent fermentability of Pennisetum glaucum is 86.0% while that of Pannicum maliaceum is 84.0%. There was slight difference between the two varieties. This could be as a result of fermentable sugars present in Pennisetum glaucum, which fermented partially to produce the end products- alcohol and carbon (iv) oxide. The real fermentability of Pennisetum glaucum is 76.0% while that of Pennicum maliaceum is 74.0%. This corresponds with the findings of Bruce, (1997).

Conclusion

This research has revealed that the general properties of beer produced from barley including its organoleptic properties are equally obtainable from millet malt especially when a suitable mashing techniques is used. It can therefore be inferred from Tables 1, 2, 3 and 4 that the values of the results were very close to the results obtained on work done by other researchers (Agu, et al, 1996; Bajomo, M. F 1994). This indicated that the exact result can be obtained if the constraints that militated against the working conditions are strictly rectified.

Therefore, this work has shown that the failure of barley to grow in Nigeria and the ban on its importation into the country by the Federal Government of Nigeria has been a blessing in disguise to the brewing industries. This will make them harness their indigenous cereals in their brewing process. And the ability to brew beer from millet has shown that beer which has exactly all the qualities as that of barley, will be produced when the brewing technology of the indigenous brewers are improved.

Recommendation

From the findings of this work, the following recommendation is made:

Decoction mashing technique is the most suitable for brewing with poorly modified and low diastatic power malt like millet.

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