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Effect of Exogenous Enzymes on the Sugar Content of Wort of Different Sorghum Varieties

C.I. Owuama and M.O. Adeyemo

Department of Microbiology, Federal University of Technology,
P.M.B. 2076, Yola, Adamawa State, Nigeria

Abstract: Four different sorghum varieties "Moskwar" MSK, "Yellow short kaura" YSK, "Jigari" JGR and "Kilburi" KLB were malted at room temperature. They had different malting losses, ranging from 5.4% to 10.6%, `moisture content of malt varies from 5.2% to 11.1%. The values of hot water extractable was from 4.0g/l to 6.7g/l. Similar values of cold water extractables of 2.0g/100g was observed in all the varieties. The diastatic power (dp) ranged between 13°L to 18°L. The mashing of four sorghum varieties with exogenous enzymes sources, sweet potato (*Ipomea batatas)* and yellow yam *(Discorea cayenesis)* showed an increase in the amounts of reducing sugar compared with the untreated malt. The disastatic power of sweet potato was 99°L and that of yellow yam was 69°L.

Key words: Sorghum · DP · Reducing sugars · Exogenous enzymes

INTRODUCTION

Sorghum (*Sorghum bicolor*. L) moench is a cultivated tropical cereal grass and a major cereal in the semi-arid regions of the world where it is an important food and feed crop [1]. It is an important food cereal in many parts of Africa, Asia and semi-arid tropics. It has distinct advantage compared to other major cereals for being drought resistant. Sorghum plays a crucial role in the world economy as it has contributed to rural household food security [1]. The potential of sorghum as an alternative substrate for beer brewing was recognized over six decades ago [2]. Over 10,000 varieties of sorghum exist and more new varieties of sorghum and developed though continuous plants breeding research. Among these new varieties are some whose malts possess beneficial qualities for beer brewing, such as good diastatic power, alpha and beta-amylase activities and extract recovery [2]. The traditional grain for brewing conventional beer has been barely, but many non-barely producing countries are replacing barely with local grain limitations in their certain brewing properties, such as low level of β-amylase and high gelatinization energy, it has been possible to produce acceptable European -type beer with these grains. Therefore, this work report on malting characteristics of four sorghum varieties and the effect of mashing with crude exogenous enzymes from *Ipomea batatas* and *Discorea cayenesis*.

MATERIALS AND METHODS

All the four sorghum varieties used were directly obtained from the farmers in Yola, Adamawa state. The varieties were Yellow short *karua (*YSK), Moskwar (MSK), 'Jigari' (JGR) and 'Kilburi' (KLB). *Ipomea batatas* (sweet potato*)* was obtained from the main market in in Yola. Adamawa state while *Discorea cayenesis* (yellow yam) was obtained from Arochukwu, in Abia State.

Analysis of Sorghum Grains: The grains were cleaned and broken kernels and stones were removed. The thousand grain weight germination energy and germination capacity were determined following the procedure described by Okafor and Aniche[3].

Malting of Sorghum: The grains were steeped in tap water for 18 h and germinated on floor for three days at room temperature (28°C to 30°C). The green malt was kilned at 55°C for 8 h and then at 65°C for 16 h until the rootlets was friable. The samples were kept in desiccators until when required for further analysis.

Corresponding Author: M.O. Adeyemo, Department of Biotechnology, Federal University of Technology,
P.M.B. 2076, Yola, Adamawa State, Nigeria

Determination of Moisture Content and Malting Losses of Malt: The moisture content of malts, germination energies and capacities and malting losses of different sorghum varieties were determined using the method described by Okafor and Aniche [3]. Hot and cold water extractables were determined using the method Subramania *et al*. [4].

Determination of Diastatic Power: The diastatic power of the sorghum malt and the crude enzymes were determined by the *Institute of Brewing* (IOB) method as described by American Society of Brewing Chemist [5]. 25g of finely ground malt was mixed with 500 ml of 0.5% sodium chloride and allowed to stand for 2.5 h at 20°C±2°C with shaking at 20 minutes interval. At the end of 2.5 h, the mixture was filtered using Whatman No1 filter paper.

Mashing: Three step decoction method was used to mash the sorghum malt as described by Owuama and Okafor [14] during which 70% of the mash was maintained at 55°C for 30 mins and at 65°C for 1 h and lastly at 70°C for 1 h [6]. Exogenous enzymes were added when the temperature has been raised to 55°C.

Sugar Determination: The reducing sugars values were determined using Lane and Eynon constant volume method [7]. The non-reducing sugars values were were obtained from the total sugars, from which the reducing sugars were subtracted.

RESULTS AND DISCUSSION

The thousand grain weight of the four sorghum varieties ranged from the 35.0g to 46.7g. The observed thousand grain weights were considerably higher than those previously reported by Agu [8], Owuama [6] and Owuama and Asheno [9]. The differences could be attributed to the size and quality [6,9,10]. The percentage germination energies vary, ranging from 91.0% to 97.0% likewise the percentage germination capacities varied from 92.0% to 97.0%. The values recorded for germination energies and germination capacities are higher than values earlier reported [9,10]. The germination energies recorded were however comparable to that previously reported by Owuama and Iliya [10]. These differences in germination energies and germination capacities could be attributed to differences in the varieties sorghum, storage periods and conditions and germination temperature [11]. The diastatic power (D.P) of malt ranged from 13°L to 18°L (Table 4). The recorded values of diastatic power (D.P) of malt are similar to those earlier reported by Del pozo-Insfran *et al.* [12] and Etim and Etokakpan [13] but lower when compared to that of barely malt [12]. The diastatic power of crude enzymes ranged from 69°L to 99°L.

Table 1: Analysis of four sorghum gains MSK, YSK and KLB varieties

Sorghum Varieties	Thousand grains weight (g)	Moisture content of grain (%)	Germination energy (%)	Germination capacity (%)
MSK	36.3	8.3	91.0	92.0
YSK	46.7	8.5	91.0	93.0
JGR	35.0	8.8	93.0	93.0
KLB	38.3	7.7	97.0	97.0

Table 2: Analysis of sorghum malts of MSK, YSK, JGR and KLB varieties

Sorghum varieties	Malting loss (%)	Moisture content of kilned malt (%)	Hot water extractable (g/100g)	Cold water extractable (g/100g)
MSK	7.1	9.1	4.0	2.0
YSK	5.4	9.9	6.0	2.0
JGR	8.1	11.1	6.7	2.0
KLB	10.6	5.2	6.1	2.0

Table 3: Reducing and non-reducing sugars of malts of sorghum varieties (MSK, YSK, JGR and KLB)

Sorghum variety	MSK		YSK		JGR		KLB	
Treatment	Reducing sugars (g/l)	Non-reducing sugars (g/l)	Reducing sugars (g/l)	Non reducing sugars (g/l)	Reducing sugars (g/l)	Non reducing sugars (g/l)	Reducing sugar (g/l)	Non- reducing sugars (g/l)
Untreated wort	20.0	6.2	20.0	8.0	21.0	6.9	21.0	9.1
Wort + *Ipomea*	23.0	5.3	31.0	2.6	36.0	3.6	43.0	2.0
Wort + *Discorea*	128.0	7.7	97.0	1.4	119.0	1.7	120.0	1.5

Table 4: Diastatic power of sorghum malts in degree in Lintner °L

	Diastatic power °L	
Sorghum malt	As is	Dry basis
MSK	13	14
YSK	14	16
JGR	14	16
KLB	18	19
Ipomea batatas	99	N.A
Discorea Cayenesis	69	N.A

N.A = not applicable

Mashing different sorghum malts yielded varying reducing sugars values, ranging from 20.0g/l to 21.0g/l in untreated mash. Treatment with *Discorea cayenesis* produced more reducing sugars ranging from 97.0g/l to 128g/l than that of *Ipomea batatas* which was from 23.0g/l to 43.0g/l.

There was considerable increase in reducing sugars in wort mashed with exogenous enzymes compared to untreated malt (Table 3). The activity of crude enzymes extract from *Ipomea batatas* yielded lower reducing sugars compared to that from *Discorea cayenesis*. The difference in reducing sugars during mashing can be attributed to different diastatic activities of exogenous enzymes and also the amount of starch available for hydrolysis [3]. The increase in sugar yields when mashing is done with exogenous enzymes from industrial amyloglucosidase and *Ipomea batatas* has been reported earlier by Del pozo-Insfran *et al.* [12] and Etim and Etokakpan [13] respectively.

CONCLUSION

The result showed that more reducing sugars could be released into wort, during mashing with exogenous enzymes. The enzymes sources are recommended for mashing sorghum malts to yield more sugars in wort for yeast fermentation during beer production.

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