PEARL MILLET MALTING: FACTORS AFFECTING PRODUCT QUALITY

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PEARL MILLET MALTING: FACTORS AFFECTING PRODUCT QUALITY

by

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I declare that the thesis herewith submitted for the Ph.D. (Food Science) degree at the University of Pretoria, has not been previously submitted by me for a degree at any other university or institution of higher learning.

[Signature]
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DEDICATION

I dedicate this Ph.D. thesis to my friend for life Lucília “Lucy” for her love and encouragement.

I also dedicate this thesis to my late father, Augusto Mutomene Pelembe "Wata Funucula/Vovo Mbizo", (20/09/1933 - 26/02/1997). I wish you were here to share this.

"The road of success is always under construction"

- Ghodonyana Waka Sibiya (04/03/1964 --- )
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¹Khanimambo /kanεəməmbə/boo/n - thank you in southern Mozambican languages.
ABSTRACT

PEARL MILLET MALTING: FACTORS AFFECTING PRODUCT QUALITY

by

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Pearl millet (Pennisetum glaucum (L.) R. Br.) is a drought tolerant cereal crop grown primarily as a food grain in southern Africa. In this southern Africa region, the grain is traditionally processed either by germination or fermentation prior to consumption. Malting involves the limited germination of cereal grain in moist air under controlled conditions.

Malts were prepared by malting two varieties of pearl millet, SDMV 89004 and SDMV 91018. The grain was steeped for 8 h with a cycle of 2 h wet and 2 h dry (air rest) and germinated at four temperatures, 20 °, 25 °, 30 ° and 35 °C over 5 days. The malts were then dried at 50 °C for 24 h.

Modification of starch granules and protein bodies in pearl millet grain structure due to germination was found to start at the germ-floury endosperm interface and move in the direction of the peripheral endosperm. Aleurone layer, cell wall and vitreous endosperm were not greatly involved in modification process.

Ungerminated pearl millet grains do not exhibit Diastatic Power (DP), α- or β-amylase activity. DP, α- and β-amylase activity increase as germination time and temperature increases. DP, total and soluble β-amylase activity increase with germination time and watering treatment probably because high moisture promotes high metabolic activity.
Free amino nitrogen (FAN) increases as the germination time, temperature and watering treatment increases. This may be related to the fact that high temperature and moisture promote the growth of roots and shoots, which are a good source of malt FAN.

Malt extract increases with germination time and watering treatment. This increase in hot water extract is an indication of the progress of modification of the malt during the germination process. The increase in malting loss with germination time, temperature and watering treatment observed is related to the high respiratory activity during germination.

A germination temperature of 25-30 °C and germination time of 3-5 days, medium watering treatment are optimum for pearl millet. These conditions result in high DP, α- and β-amylase activity, good FAN and moderate malting loss. The levels of DP, FAN, α-amylase activity and malting loss of pearl millet malts, which are similar to sorghum malts, represent an excellent potential for utilisation of pearl millet malt for sorghum beer brewing purposes. Additionally, pearl millet malt could be a better alternative than sorghum for lager beer brewing due to the fact that it has higher β-amylase activity.

Phytic acid decreases during malting, probably due to phytase activity. Soluble proteins and the Nitrogen Solubility Index increase due to partial hydrolysis of storage proteins by endogenous proteases. This is complimented by an increase in in vitro protein digestibility of pearl millet malts. A reduction in the viscosity of flours made from pearl millet malts, which is due to increased α-amylase activity, may contribute to the use of this malt to improve the energy and nutrient density of porridges for young children.

Germination significantly reduces the mousy odour, characteristic of ground pearl millet meals when stored. This is probably due to the growth of lactic acid bacteria which decrease the pH in the grain affecting the water soluble phenolics which leached out. These phenolics are believed to be responsible for the mousy odour of the stored pearl millets meals.

Pearl millet malt represents an excellent potential for utilisation of pearl millet for sorghum beer and it appears that it can be used in lager beer brewing. The improved nutritional and functional properties of pearl millet malt are an indication that the malting process, a low-
cost processing technology, usable at both rural and industrial level, can be successfully applied to prepare nutritious and functional food products.
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