

Abstract

Free amino nitrogen improvement in sorghum malt brewing

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Although sorghum malt is relatively rich in free amino nitrogen (FAN), the 150 mg FAN/L threshold recommended for brewing is difficult to obtain. The vitreous nature of the sorghum endosperm hinders proteolysis during brewing. Hence, exogenous proteolytic enzymes are often required to increase hydrolysis of sorghum malt protein to produce sufficient FAN in order to support rapid yeast growth during fermentation. Ten exogenous proteases were examined for their production of FAN in sorghum malt mashing. Mashing was done at 55°C for 45 minutes. Levels of FAN, as determined by the ninhydrin method, showed great variation among the proteolytic enzymes, ranging from 96 in control to 182 mg/100 g malt with possibly of most effective proteolytic enzyme. The variation in FAN level was possibly due to different optimal mashing conditions of exogenous proteases used and perhaps due to low ratios of exopeptidase/endopeptidase in the enzyme preparations. Low temperature (40°C) and long duration mashing for (7 hours) gave good FAN production during mashing to a total of 113 and 138 mg/100 g malt in control and the treatment with exogenous proteolytic enzyme Flavourzyme plus malt, respectively. The exogenous enzyme (Flavourzyme) plus potassium metabisulphite (PMB) increased FAN production during mashing in the ratio of 2 to 1 in a treatment where PMB was added compared to one without. Similarly, hot wort extract (HWE) increased by 8% during mashing with exogenous enzyme plus PMB compared to one without PMB, respectively. PMB was involved in destabilizing the disulphide bonds in the sorghum protein iv polypeptide chains allowing proteolytic enzymes better accessibility to proteins. The increase in HWE was possibly due to the starch being freed from the sorghum protein matrix. Sodium dodecyl sulphate-polyacrylamide gel electrophoresis (SDS-PAGE) showed some oligomeric and polymeric kafirins after mashing. With transmission electron microcopy (TEM), protein bodies of varying sizes with partially degraded peripheral edges and some holes were seen after mashing. SDS-PAGE and TEM results suggest insufficient proteolysis. High protein digestibility sorghum's potential for brewing was examined with reference to FAN production. Although during mashing FAN increased by approx. 82 and 115% for unmalted normal and high digestibility sorghums, respectively, the 150 mg FAN/L threshold, recommended for brewing was not achieved. FAN production to levels above 150 mg/L may only be realized if normal sorghum malt or high protein digestibility sorghum malt is mashed with exogenous enzymes containing sufficient exopeptidases coupled with appropriate mashing conditions.