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Effects of Burning and Time Taken from Cut to Mill on Cane Deterioration and Dextran Levels in Sugars and Molasses from Halfa Algadidah Sugar Factory, Sudan

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Abstract: Comprehensive chemical analysis was carried out for products of sugarcane in an attempt to find the effect of burning and the time taken from cut to mill on cane deterioration and dextran levels in sugars and by-products (molasses) from HalfaAlgadidah Sugar Factory for three varieties cane (V1, V2 and V3); corresponding to Co-6806, Co-527 and Co-986 at six periods (T_1, T_2, T_3, T_4 , T_5 , T_6)corresponding to (3 , 6 , 12 , 24 , 36 and 48) hours, respectively during 2007/2008 and 2008/2009 seasons. Randomized complete plot design with three replications was used in this study. After harvest, the dextran levels were the same in the three varieties for the same duration, but they were significantly different at $P \leq 0.05$ between burnt and green cane at different times. The average levels of dextran in sugars, juices and molasses were increased with the time taken from cut to mill. The dextran levels in sugar and molasses were ranged (296 – 1860, 412 – 2247) ppm for the duration of 3 to 48 hours after harvesting, respectively. The deterioration products, such as dextran, formed quickly and increased rapidly with the time taken from cut to mill, for burnt cane more than green cane.

Keywords: Dextran, sugarcane ,sugars, molasses, deterioration, green , burnt, varieties

INTRODUCTION

Sugarcane is one of the world's major food crops, providing about 75% of the sugar for human consumption [1, 2]. Sugarcane is one of the plants in storing sucrose (α, D-glucopyranosyl-1, 2-β-D-fructofuranose) – rather than polymeric compounds such as starch, proteins, or lipids – as the primary carbon and energy reserve [3].

Sugar from sugarcane is extracted today more than it was 40 years ago. It is processed as raw sugar at sugar mills and then further purified to refined white sugar in a sugar refinery, using energy intensive processes [4]. Sugarcane cannot be stored without deterioration, thus processing should be carried out immediately after harvesting, due to sucrose losses, sugarcane is commonly harvested during the cooler months in each hemisphere [5, 6]. The presence of dextran in the sugar factories leads to falsely high polarization rates, elongated crystals and increase of sugar loss to molasses, increase molasses yield oligosaccharides, polysaccharides colour, organic salts, lactic and other organic acids and increase the pH [7,8]. The rate of deterioration depends exponentially on temperature, and the duration between cutting and crushing of green cane, burning and crushing of burnt cane [9,10].

MATERIALS AND METHODS

Comprehensive chemical analysis was carried out for products of sugarcane in an attempt to find the effect of burning and the time taken from cut to mill on cane deterioration and consequently on dextran levels in sugars and by-products (molasses) from Halfa Algadidah Sugar Factory (Sudan) for seasons 2007/2008 and 2008/2009. Randomized complete plot design with three replications was used in this study.The analysis was conducted on juices from three varieties of cane (V1, V2 and V3); corresponding to Co-6806, Co-527 and Co-986 at six periods (T_1, T_2, T_3, T_4 , T_5 , T_6)corresponding to (3 , 6 , 12 , 24 , 36 and 48) hours, respectively.

Determination of dextran by thin layer chromatography (TLC)

It was determined according to the method described by [11, 12].

Determination of dextran by spectrophotometer

It was determined according to the method described by [13–15].

RESULTS AND DISCUSSION

Figures 1 and 2, exemplify the progression of dextran concentration in the green and burnt cane juices at different times from harvesting for the two seasons 2007/2008 and 2008/2009. The dextran levels were the same in the three cultivars (Co 6806, Co 527 and Co 986) for the same duration after harvest, but they were significantly different (at $P \leq 0.05$) between burnt cane and green harvested cane at different times after harvest. Moreover, the dextran levels were increased with time and it was significantly higher after harvesting at 48 hours than that at 3 hours. The increasing of dextran levels in burnt cane was more than twice as much as that in green cane juices. The results revealed that the dextran levels were found to be highest in burnt cane juice (increasing from 329 to 2012 for the duration of 3 to 48 hours after harvest) and lowest in green cane juice. In this regard itincreasing from 268.3 to 924 ppm for the same duration. These results are in agreement with the finding of [16], who reported values in the range from 1431.72 to 2279.23 mg/kg. The dextran level in the final production steps (sugar and molasses) of the three cultivars at different durations for the two seasons 2007/2008, 2008/2009 was shown in figures 3 and 4. The dextran level in sugar (figure 3) was found to be ranged (309 - 1855 mg/kg) at 3and 48 hours for season 2007/ 2008, also the level was increased from 296 to 1020 mg/kg for the duration of 3 to 48 hours after harvest, for the second season.

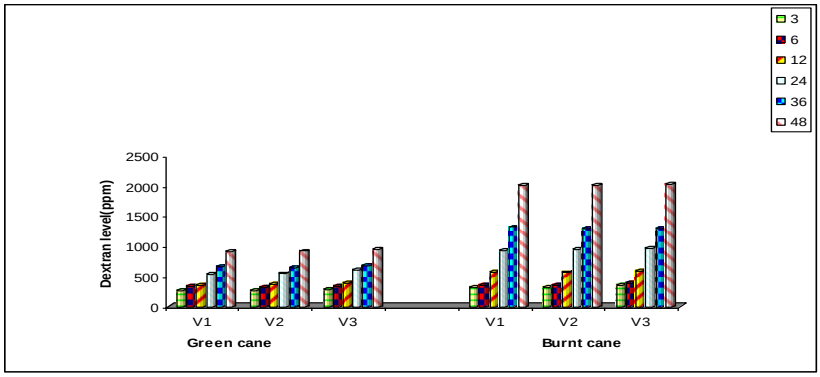

Fig-1: Dextran levels (ppm) in green and burnt cane juices at different periods after harvesting, season 2007/2008 V1= Co-6806; V2= Co-527; V3= Co- 986

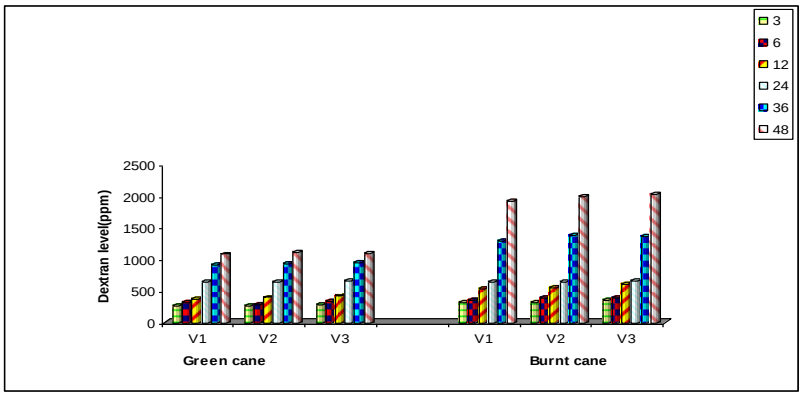

Fig-2: Dextran levels (ppm) in green and burnt cane juices at different periods after harvesting, season 2008/2009

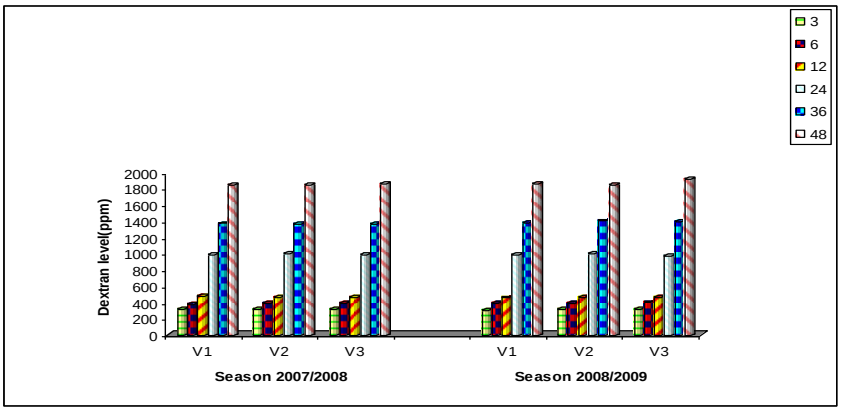

Fig-3: Dextran level (ppm) in cane raw sugar at different periods after harvesting, seasons 2007/ 2008 – 2008/2009

On the other hand, the dextran level (shown in figure 4) was ranged between 394 - 2250 mg/kg in molasses after harvest for the duration of 3 to 48 hours for the season 2007/2008, and ranged between 394 - 2250 mg/kg in molasses in same period and duration for the season 2008/2009. No significant difference at $P \leq 0.05$ was found between the three cultivars at the same durations after harvesting for molasses. However, the level of dextran in molasses was higher than that in the resulting product (sugar). This shows that the major amount of dextran was lost intothe molasses during the washing process. The high level of dextran at 36 and 48 hours after harvesting shows that the deterioration of sugarcane increased dextran levels during the processes due to biotic factors. The analytical data obtained revealed that the deterioration products, such as dextran, formed quickly and increased rapidly with the time taken from cut to mill, for burnt cane more than green cane.after a lag period, burnt cane deteriorated rapidly probably as a result of microbial infection.

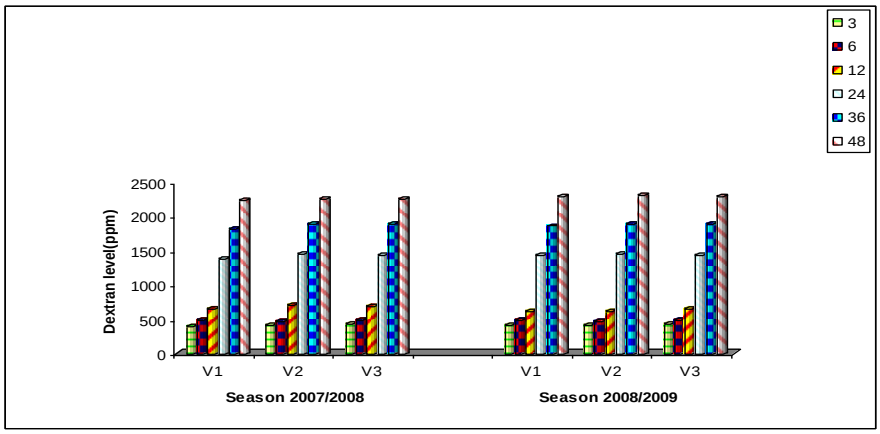

Fig-4: Dextran levels (ppm) in sugarcane molasses at different periods after harvesting, seasons 2007/2008, 2008/2009

In conclusion, the deterioration products, such as dextran, formed quickly and increased rapidly with the time taken from cut to mill, for burnt cane more than green cane. Also, more stringent measures would have to be employed in order to control incoming dextran and ultimately the quality of final sugar produced.It may become necessary to look at treating the dextran entering the factory in order to reduce the quantity in the final sugar.

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