



## UV radiation effect of on the sugar cane juice and alcoholic fermentation

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**Introduction.** Despite the importance of ethanol for fuel in Brazil the industry still have high contamination in the fermentation process. This contamination is well described in literature as well as the damage they cause: reduction of income, increasing the fermentation time and costs of proceedings (1). In the industrial conditions contamination control uses acid treatment of yeast together with antibiotics. Ultraviolet radiation has long been used for sterilization of surfaces, due to its low penetration. Recently continuous systems are used to treat water for drinking and swimming pools, but little has been done on disinfecting liquid cloudy or colored. Special lamps were developed to destroying microorganisms with reduced oxidation effect. The proposal of the research was to evaluate the effect of UV radiation of these lamps on the sugar cane juice microflora and on the subsequent fermentation.

**Methodology.** The research was conducted in 08/Set./2008 in the Center Technologies for Agribusiness from Catholic University, Campo Grande, Mato Grosso do Sul, Brazil. The sugar cane juice was extracted from the cultivar RB-7515 stems from the first cut. The stems were collected manually and without burning and the juice extracted by grinding. Near 100 liters were collected and characterized for microorganisms groups by (2): total aerobic mesophilics (TAM), yeasts and molds (YM), and mesophics aerobes spores (MAE). The counting was expressed as colonies forming unities (CFU). The total (TC) and fecal coliforms (FC) were evaluated by MPN. The pH, Brix, reducing sugar (RS) and total reducing sugar (TRS) by the method of Somogyi-Nelson. NRS = TRS-AR was calculated. The crude juice was submitted to treatment with a UVC 254.1 nm lamps of 1000 Joules (J) in a Surepure Latin America reactor equipped with tanks and pumping systems in continuous time providing 0, 250, 500, 1000, 2000 and 4000 Joules.liter<sup>-1</sup> (J.l<sup>-1</sup>). Untreated tap water was treated with the same lamp using 4000 J.l<sup>-1</sup> and used to dilute the juice to 12. Brix. Volumes of 1.5 liters in triplicate were inoculated with commercial dehydrated yeasts **Pedra 2** and **Itaiquara**. Bottles were adapted to avoid the air to entry but allow the CO<sub>2</sub> to escape. Bottles without inoculation (control) and all the others were incubated at 25°C (BOD). The alcoholic fermentation was followed by Brix reduction and samples were taken for analysis.

**Results and Discussion.** Crude sugar cane juice presented the average Brix value 21.0 and pH 5.3. The non-reducing sugars (NRS) predominated (average of

545.78 g.l<sup>-1</sup>) while the average values of RS was 61.94 g.l<sup>-1</sup>, values similar to reported in the literature for this season. The juice had counts of TAM and YM in the order of 10<sup>4</sup> CFU/ml and EAM to 10<sup>5</sup> CFU/ml. Coliforms (TC and FC) had counts (MPN/100mL) around 10<sup>6</sup>. While rarely linked to the sugar cane juice the coliforms are reported in the literature (3) as being the habitat of the leaves and stem of the sugar cane plant. The radiation eliminated the TAM with 500 J.l<sup>-1</sup>, however, the MAE and YM resisted until 4000 Joules.liter<sup>-1</sup> (10<sup>4</sup> CFU/ml). The TC and FC were found up to 10<sup>4</sup> MPN/100mL with 1000 J.l<sup>-1</sup>. Typical alcoholic fermentation occurred in all juices submitted to treatment and present alcohol content ranging from 5.0 to 7.0 GL. In the control (without inoculation) the fermentation was longer with lower alcohol content (2.0 to 4.4 GL), but with increased alcohol content proportional to the time of radiation. The bottles inoculated with commercial yeasts **Pedra 2** showed higher alcohol degree than **Itaiquara** yeast. The **Itaiquara** yeast was fermented faster and presented lower residual sugar content (RS and TRS) that the yeast **Pedra 2**. It was observed a tendency of UV radiation effect to make fermentation time decrease with exposition, most evident between 250 and 500 J.l<sup>-1</sup>.

**Conclusions.** The UV radiation dosage used did not alter the profile of sugars and was able to reduce counts in the order of 1 to 2 log cycles of juice contaminants. These reductions affected the time of fermentation, and in some cases, the alcohol content. The survival of fecal coliforms was unexpected and research should be conducted to explain this result.

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