DETERMINATION OF THE OPTIMAL CONDITIONS FOR THE PRODUCTION OF BIOETHANOL FROM SWEET SORGHUM JUICE.

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Introduction Nowadays, the pollution caused by burning fossil fuels heavily affects the environment. Consequently, alternative sources of energy are key important not only for reducing CO_2 emissions, but also for being independent of petroleum. One of the crops most used to produce Bio-ethanol is the corn; however, this plant is an important source of food in Mexico. For this reason, it is necessary to use a non-edible crop such as Sweet Sorghum which is a suitable alternative for producing energy.

Methodology Microorganisms used for this study were *Saccharomyces cerevisiae* (LSC) and isolated yeasts from fermented grape (LU) and from pineapple juice (LP). The strains were grown in YPG-sweet sorghum juice medium at different concentrations 10, 30, 50, 75, 100 % at 32°C during 48hrs. The screening for temperature and ethanol tolerance was carried out growing yeast strains on YPG medium during 72 hours at 37, 40 and 45 °C and YPG medium containing ethanol at 4, 6, 10, 12, 14, 15 % (v/v). The analysis of total and reducing sugar content of SSJ were determining by phenol-sulfuric acid and DNS method, respectively. The ethanol concentration in fermentation was measured by a simple distillation method. The evaluation of the ethanol production in the isolated strain was carried out with a working volume of 500ml. Once selected the strains with the best yields we proceed to obtain the optimal pH as well as the optimal temperature for the fermentation, which was carried out in 450 ml of SSC and 50 ml of pre-culture at different pH (3, 4, 5, 6, 7 y 8) and different temperature (30, 32, 34, 36, 38), respectively. The pre-culture, which total volume would inoculate the fermentation, was prepared inoculating a loopful of yeast in 50ml of YP-Sorghum juice at 2 °Bx and it was incubated during 12hrs at 30 °C. The total and reducing sugars, ethanol concentration, viable and total cells were measured each 12hrs. A statically analysis was carried out to evaluated the interactions between this conditions

Results LSC and LP yeasts could tolerate until 14% of ethanol, and they could grow at 100% of sweet sorghum juice which had 111.5g/l of reducing sugar and 15°Brix, therefore only these 2 strains were evaluated for ethanol production in which the LSC strain had better yields than the LP. The ethanol concentration at different pH (3, 4, 5 & 6) using the bread yeast (LSC) was 20g/l, 40g/l, 48g/l and 33g/l, respectively. Regarding to the temperature screening, the LSC was only capable to grow and produce ethanol at temperatures of 30, 32 and 34°C. Using these data, statistical analysis was carried out with a split-plot model using the program Minitab 16 (fig 1 and 2).

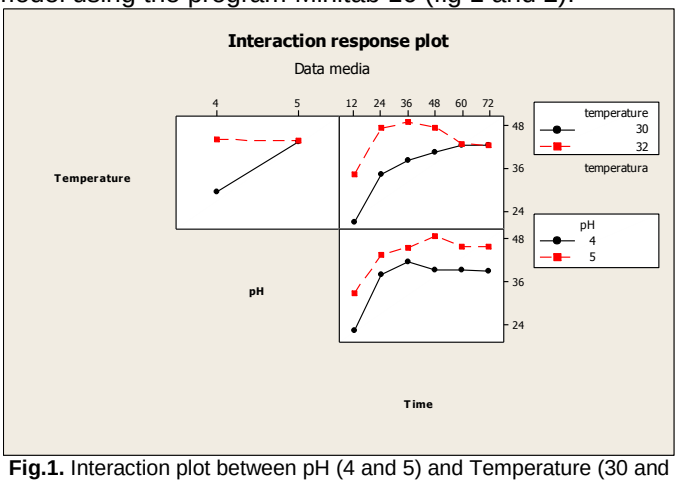

Fig.1. Interaction plot between pH (4 and 5) and Temperature (30 and 32°C)

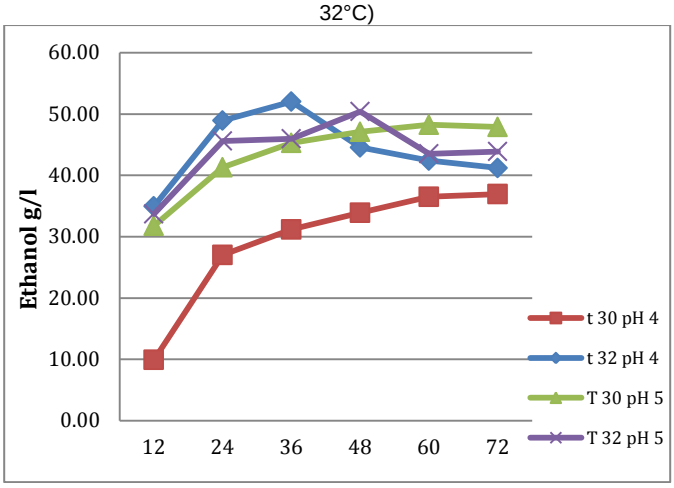

Fig.2 Fermentation curves using the statistical analysis

Conclusions Optimal production of bio-ethanol was found to be at pH 4 with a temperature of 32°C in which the ethanol production and the sugar consumption using *S. cerevisiae* was greater, the best yield was Yp/s (.47) and efficiency (87.7%). Therefore, the cell viability was reduced in 60% of the total viability, which could be caused by ethanol inhibition.

References

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