FERMENTED BEVERAGES OF MEXICO: TRADITION AND NEW APPLICATIONS

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Key words: mezcal, tejuino, fermentation

Introduction. In general the generation of alcoholic beverages is a complex process where the raw materials have a great influence as so as all the processing operations. In particular, during the fermentation all the microorganisms involved in it play a fundamental role in developing the features of flavor and aroma of the final product. In Mexico there is a wide range of traditional fermentations (1, 2, 3), and the raw materials used are mainly corn and different species of agave. Since pre-Hispanic times *Agave salmiana* sap was fermented to produce pulque. Later, after the introduction of the distillation process emerges across the country, different kind of mezcal which are obtained from fermented must of different agaves species. Among the most common are: tequila, mezcal, sotol, bacanora and raicilla. In the case of maize a traditional drink is tejuino, obtained from fermentation of processed corn flour mixed with brown sugar, in this case not distilled. CIATEJ have several years working on traditional fermentation of different Agave musts in research and working with producers of these beverages aimed at standardizing and improving processes for obtaining these drinks without affecting the scale and traditional image. Recently began the investigation about tejuino.
This presentation aims to present a summary of the main findings both on the characterization of the microflora and on new applications found for these organisms isolated from these traditional fermentations.

Results. One of the success factors in studies of microbial consortia is the sampling step which must be carried out in situ with appropriate culture media. Furthermore it is essential today to make a study with the culture-independent techniques. In our case an important culture medium is WL (4) for differentiating yeast morphologies. As for the culture independent methods PCR-DGGE (Fig 1) as well as real-time PCR was used.

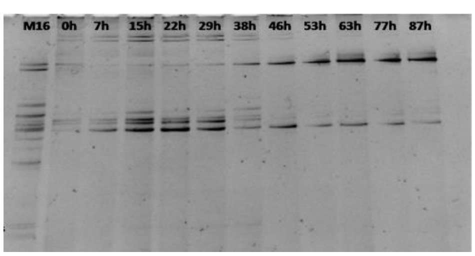

Fig.1 Typical migration profile of PCR-DGGE from mezcal fermentation. Each line corresponds to a different fermentation time.

In general, both the agave based beverages and tejuino present complex microbial consortia with both yeasts and bacteria.

In mezcal fermentation the composition of consortia are highly variable, in some cases with a significant presence of bacteria that can cause acidity problems in the final product. 27 different yeasts species were isolated in fermentation of *Agave angustifolia* (Oaxaca). Also various yeasts were present throughout the fermentation, contrary to what is described in the wine's fermentation where non-*Saccharomyces* disappear during fermentation. By contrast, a fermentation of *Agave salmiana* in San Luis Potosi only eight different yeast species could be detected. In this case the raw material appears to play a fundamental role in yeast selection, because of the presence of saponins (inhibitor of microorganisms). This selection has an impact on the characteristics of the final product; mezcal from San Luis Potosi has notes related to the raw material and Oaxaca mezcal dominant notes related to fermentation.
In the case of tejuino in the fermentation processes sampled, bacteria always dominate the fermentation. Great differences were related to the kind of process: fermentation with or without water at the beginning of the fermentation.
This great diversity is an interesting source of microorganisms of interest. For examples some strains of no-*Saccharomyces* (*K. marxianus* and *P. kluyveri*) are employed to improve the volatile compounds production in tequila fermentation; another strain of *K. marxianus*, *T. delbrueckii*, and *C. apicola* are very interesting source of enzyme particularly fructanase that could be used to hydrolyze agave fructans or synthesize FOS from sucrose. Tejuino seems to be an interesting source of probiotics.

Conclusions. These studies are important in order to preserve the microorganisms involved in this kind of fermentation. Also these traditional fermentation are an important source of microorganisms with specific functions and new applications.

Acknowledgements. Principal's financial supports: project SEP-CONACYT # 24556; project FOMIX-JALISCO 2009-05-123157 and Bilateral project # 147668.

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