Unique Carbohydrate Profiles In Different Brands of Tequila

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Abstract

Due to the popularity of tequila and the large number of varieties available, manufacturers are finding it increasingly important to protect their brand identity. This means more attention to raw materials quality/selection, the manufacturing methodology, and analysis of the end product. Agave cores from different regions produce magueys with differing carbohydrate concentrations, colors, and minerals that give each its unique characteristics. Tequila distillers can bottle the end product but almost all add additional processing steps to enhance taste, aroma, and appearance. The initial raw materials, specific manufacturing processes and resultant end product all have unique carbohydrate profiles that are specific to the brand name of the tequila. All of these carbohydrate profiles can be monitored via HPLC using ELSD (Evaporative Light Scattering Detection). In this qualitative survey we will compare the presence and relative concentrations of carbohydrates in different brands of tequila.

Introduction

Due to the popularity of tequila and the large number of varieties available, manufacturers are finding it increasingly important to protect their brand identity. This means more attention to raw materials quality/selection, the manufacturing methodology, and analysis of the end product tequila. The official Mexican standard or NOM defines tequila as the product of fermentation and distillation of the blue agave juices obtained at the distillery from agave cores (containing starch that has been broken down into sugars by roasting). Different agaves from different regions/states produce a sweet liquid (maguey) that is the roasted product where inulin is converted to mono di and trisaccarides via hydrolysis, and additional processing by ion exchange and filtration occurs. Each regions agave cores produce magueys with differing carbohydrate concentrations, colors, and minerals that give each its unique characteristics. Magueys from different regions/states produce a fermented product that is identified by different names throughout Mexico: stotol in Chihuahua, mezcal in Oaxaca, and bacanora in Sonora. This undergoes additional distillation to produce tequila where the alcohol content must be between 70 to 110 Proof. Tequila distillers can then bottle the end product but almost all add additional processing steps that add sugars, carmel coloring, or may involve storage in wooden barrels, all to enhance taste, aroma, and appearance. The initial raw materials, specific manufacturing processes and resultant end product all have unique carbohydrate profiles that are specific to the brand name of the tequila. All of these carbohydrate profiles can be monitored via ELSD (Evaporative Light Scattering Detection).

Methods and Materials

HPLC system: Hitachi L-7100 HPLC pump, Hitachi L-7200 autosampler, and Allchrom data collection software.

Detector: Alltech ELSD 2000ES, Drift tube 85C, Gas Flow 2.0 SLPM, Gain 1

HPLC column: Alltech® Carbohydrate ES, 5µm, 250x4.6mm

Mobile Phase: 75/25 acetonitrile/water

Flow rate: 1 ml/min

Injection Volume: 10µL

Samples: Sierra tequila, El Jimador® tequila, El Conquistador® tequila, Mezcal® tequila, Jose Cuervo Especial® tequila, Jose Cuervo Tradicional® tequila, Glucose, Fructose, Galactose, Lactose, Maltose, Sorbitol, Mannitol, Sucrose, Raffinose, Stachyose

Results

An examination of the chromatograms generated from the 6 different brands of tequila reveals striking differences in sugar content. All six contain varying amounts of fructose, sucrose, and glucose, but content may vary amongst the brands by vast amounts. As an example, sample 4 (Mezcal tequila) had ~0.00292% of the sucrose content sample 5 (Cuervo Especial® tequila) had when compared at equal volumes. These differences in sugar content could come from many factors:

- The different sources of agave within the same species, such as location, altitude, degree of irrigation, and age of the core could influence sugar production.
- The different roasting processes used to breakdown the plant starches could potentially result in varying amounts of sugars, although the predominate sugar in the core starch is inulin and the predominate sugar in the roasted and hydrolyzed syrup is fructose (see **table 1**).

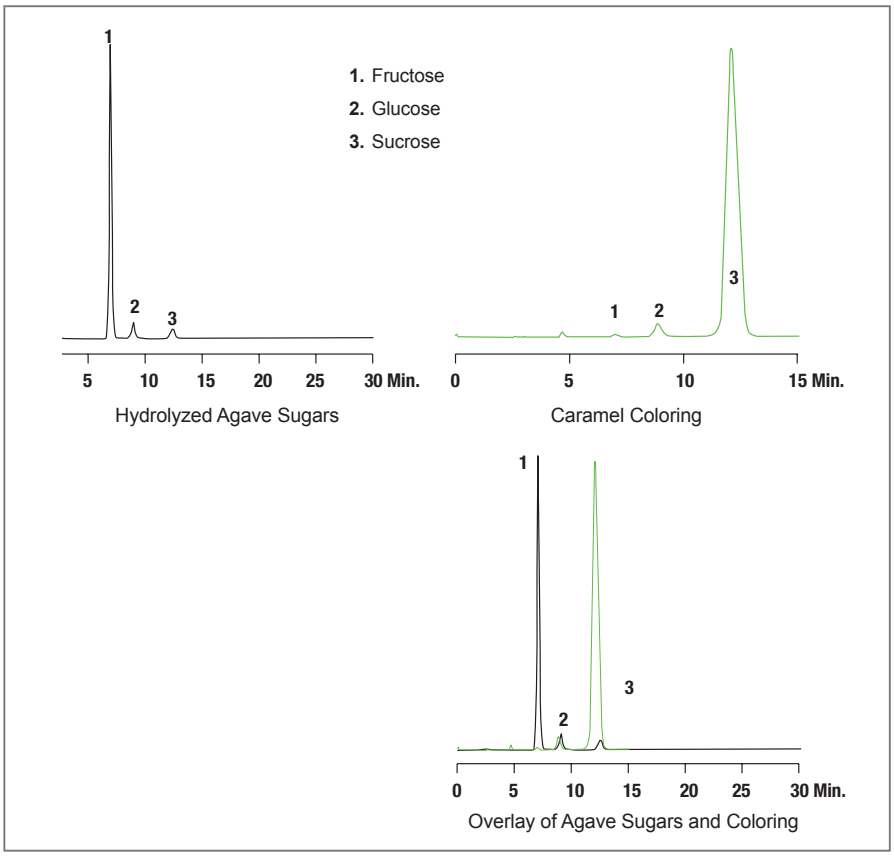
Table 1

	Agave Azul Crude juice	Tequilana Hydrolyzed juice
Insulin	79.22 mg/mL	1.0 mg/mL
Sucrose	7.21 mg/mL	1.0 mg/mL
Dextrose	2.38 mg/mL	5.49 mg/mL
Fructose	2.39 mg/mL	83.72 mg/mL
Maltose	0.0 mg/mL	0.0 mg/mL
Raffinose	0.0 mg/mL	0.0 mg/mL

Data courtesy of Edward Ceinufuegos
University of Mexico

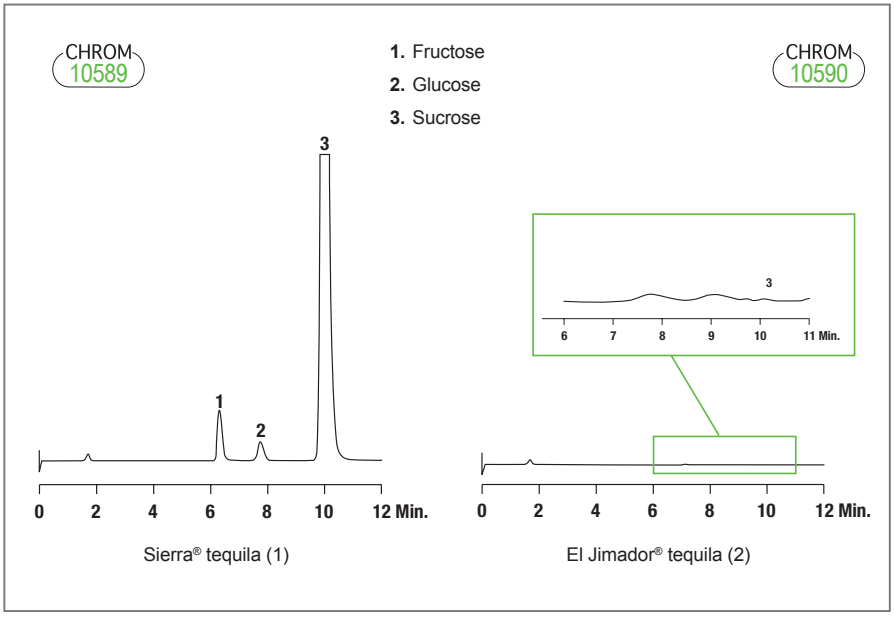
- The color of the tequila can be influenced by several factors, such as the addition of caramel coloring to give a clear tequila a more amber-like coloring. Aging the tequila (as in some premium brands in wooden casks) would also empart an amber color but without the carbohydrate signature of the caramel coloring (see **figure 1**).
- Color may also be influenced by the species and mineral content of the source agave, being either clear (white), a straw-like color, or a slightly greenish color.

Figure 1



Data courtesy of Edward Ceinufuegos
University of Mexico

Figure 2

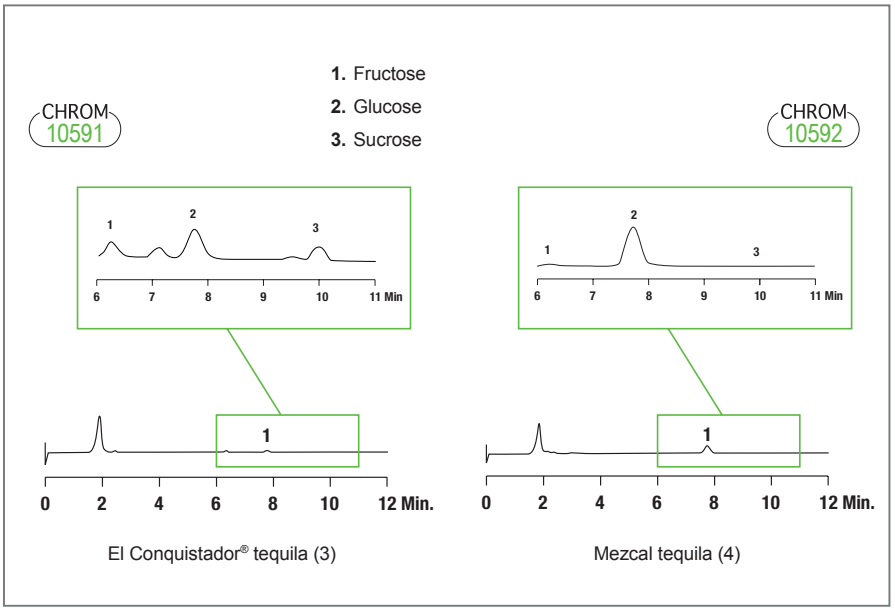


The mixing of different species of agave, different species of yeasts used during the fermentation process, the addition of sugars by the manufacturers and the number of distillation steps used in refining the tequila all add to the unique characteristics of these distillates.

Figures 2, 3, and 4 show several brands of tequila and their unique carbohydrate profiles:

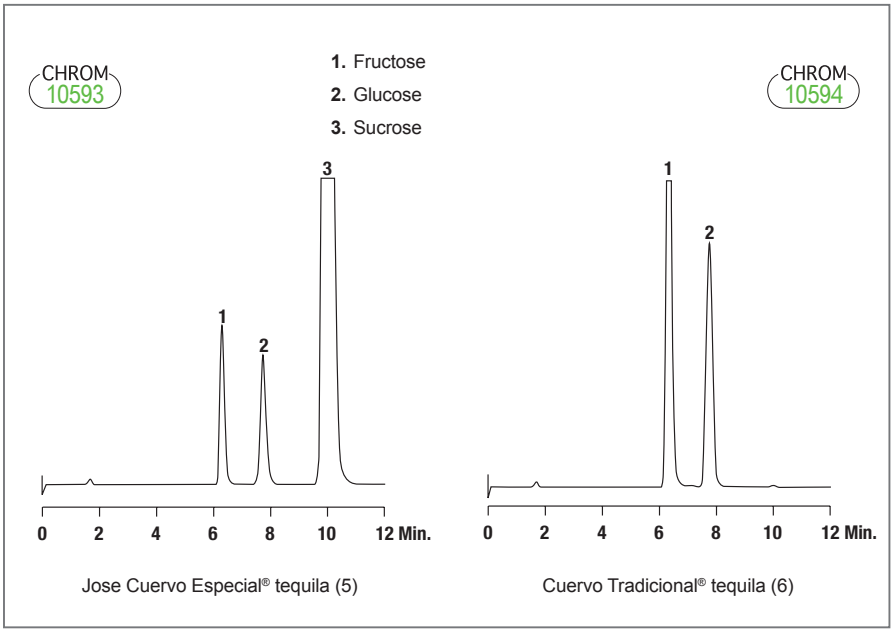
Sierra tequila (**figure 2**) is amber with a caramel coloring profile while El Jimador® tequila is clear and slighlty greenish with no added sugars (same scale, including a zoom on the El Jimador® tequila showing minimal amounts of residual sugars from the distillation process and the lowest sugars and salts content of the brands sampled in this study).

Figure 3



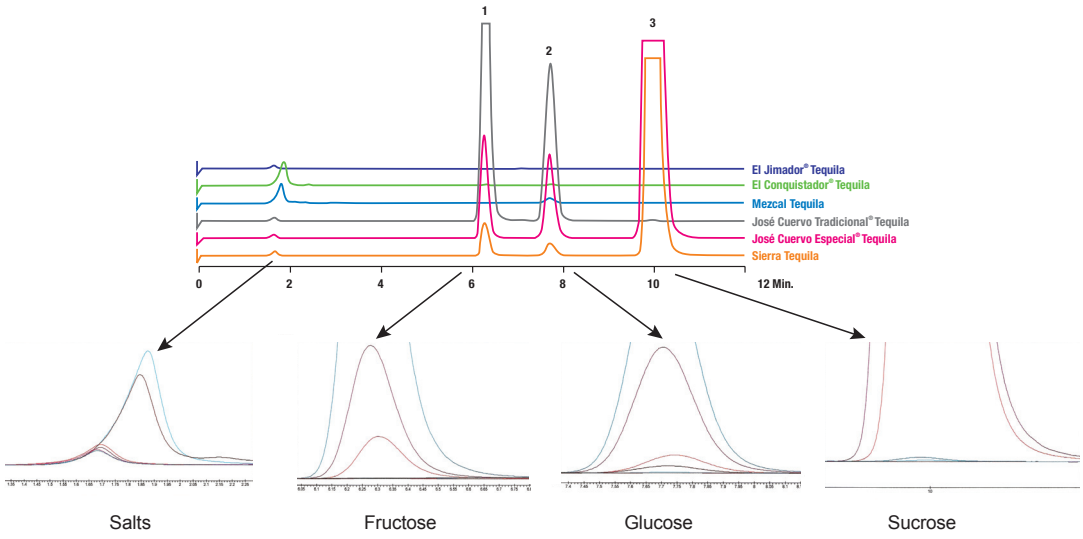
El Conquistador® tequila (**figure 3**) is clear and straw colored with a low sugar content, the Mezcal tequila is more yellow colored and also possess a low sugar content suggesting color by agave/ minerals or by storage in casks.

Figure 4



Jose Cuervo Especial® tequila (**figure 4**) is amber with a caramel coloring profile while Jose Cuervo Tradicional® tequila is straw colored but still with a high sugar content when compared to tequilas such as Mezcal and El Conquistador® (all sugar profiles shown in same scale).

Figure 5



Overlays of all 6 brands of tequila, notice the highly variable contents of salts, fructose, glucose and sucrose in these products.

Figure 6

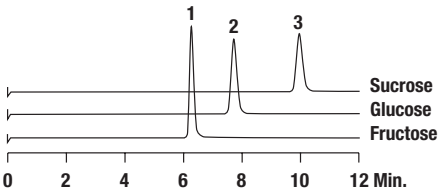


Figure 6, Individual sugar standards for fructose, glucose and sucrose.

Conclusions

- Tequilas contain complex mixtures of carbohydrates.
- Different brands of tequila can be identified by their carbohydrate content.
- Carbohydrate profiles are unique and depend on the source of agave, fermentation process, and final packaging/coloring which are controlled by the manufacturer.
- HPLC with ELSD detection may be a useful tool in themanufacturing and quality control process of tequila distillation.