KOMBUCHA:
AN ALTERNATIVE FERMENTED BEVERAGE

Kombucha (konbu cha (昆布茶), seaweed tea) is an ancient Asian drink that is being introduced in Western markets, with a slightly sour, refreshing taste produced from the fermentation of sweetened tea by yeasts (Saccharomyces, Picchia, Medusomyces) and acetic bacteria (Acetobacter, Gluconobacter,).

This beverage has experienced an enormous growth in demand in recent years, with growth of more than 20% per year as a healthy alternative to sugary soft drinks due to its contribution of antioxidants from tea (detox function), its probiotic characteristics (a large part of the demand is for unpasteurized product) and the perception of a bio/natural product. Due to this rapid growth, the industrial processes involved are still poorly characterized, which poses a real challenge in maintaining a standardized product over time.

As in other fermented beverages, the transformation of the sugars present takes place through the action of bacteria and yeasts. While in wine, for example, these yeasts are natural (or, where appropriate, specifically selected for their characteristics), in kombucha they come from an external mother inoculum called SCOBY (SCOBY, Symbiotic Culture Of Bacteria and Yeast) from previous fermentations. This inoculum has a double function: on the one hand, to initiate the process of transformation of sugar into other organic compounds; on the other hand, to serve as a barrier in more advanced phases to initiate a moderate alcoholic fermentation.

The preparation starts with tea infusions with a sugar content varying between 5 and 15%. Once infused, the tea is cooled to room temperature and a quantity of fermented tea containing the SCOBY (or a gelatinous film of it, called 'tea fungus' from previous fermentations) is added and left to ferment at room temperature for 7-10 days, long enough for it to acquire a slightly sour taste and some effervescence. Specific flavors of all kinds can be added to the tea, often vegetable juices or liquefiers, to diversify the range of flavors and mouthfeel and help to reinforce the image of a healthy product with dietary properties.

The yeasts initiate the process by hydrolyzing sucrose to glucose and fructose (a critical step since acetic acid bacteria cannot carry out this hydrolysis) and continue towards the production of ethanol (alcoholic fermentation); the acetic acid bacteria consume part of the glucose to produce organic acids (mainly acetic, gluconic and glucuronic) through aerobic metabolism that progressively reduce the pH of the liquid. At the same time, a gelatinous film (a cellulose matrix) forms on the surface of the culture, generated by the acetic acid bacteria themselves, which reduces the entry of oxygen and causes a second fermentation of the residual sugars into ethanol and carbon dioxide. At the end of the process, the alcohol concentration in the final product is very low, around 0.5%, although it can reach 3% in very prolonged fermentations or with high initial sugar concentrations, and a pH between 3 and 5 is reached. At this point it can be decided to stop the process by pasteurization or cold storage.

The industrial production of kombucha is very recent in time and still has to solve several relevant technical challenges, as the final result is affected by numerous variables derived from both the raw materials used (tea, water, sugar, composition of the SCOBY starter) and the conditions under which

the process takes place (infusion time, temperature, fermentation time, aeration). In order to guarantee the consistency over time necessary in industrial production, different physicochemical variables that would affect the different stages of the process must also be carefully monitored.

For example, the extraction of tea components is directly affected by the presence of ions in the water: in particular, hard waters with high calcium content reduce the efficiency of the infusion, while soft waters increase the extraction of organic molecules, including tannins that contribute to bitterness. Also, the content of initial sugars and their nature (sucrose, or glucose syrups) are relevant, since a higher glucose content favors the production of lactic and gluconic acid, while fructose could favor ethanol and acetic acid.

Some of the critical components that would be relevant would be the content of residual sugars, the concentration of acetic acid, the content of polyphenols extracted from the tea, the levels of ethanol or carbon dioxide, in addition to others relevant to the development of the process such as the levels of nitrogen, gluconic acid or ions present in the water used for the infusion, without forgetting that, contrary to what happens with fruits, the level of acidity of the infusion is generally low, which means that its capacity to block the development of other species of non-acetic bacteria is limited. All these components are critical in the final organoleptic sensation and directly affect the palatability of the final product so, in industrial productions, they constitute relevant control elements.

Sinatech has reagents for the determination of quality parameters in kombucha by enzymatic and colorimetric methods, which allow standardizing all the stages of the production process and adjusting them to the desired product. The Dionysos system is an optimal tool for the control of the production process, capable of guaranteeing the quality and food safety requirements demanded by existing regulations.

- Total Sugar, Glucose+Fructose, Glycerol
- Acetic, Lactic, Malic, Gluconic, Total Acidity
- Primary Amine Nitrogen, Amonium
- Polyphenols, Catechins, Antocyanins