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Short report Peer-reviewed

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ABSTRACT

This is a brief experimental description and theoretical approach to preparation of "chuflay", a Bolivian drink socially widely diffused under a spherification process. The physical presentation of the beverage is under the form of spherical capsule obtained through the gelification of alginate molecules (alginic acid salt) and calcium ions, by the spherification process of the alcoholic chuflay.

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RESUMEN

Encapsular en forma de esfera la bebida tradicional boliviana denominada "Chuflay", mediante un proceso de esferificación que consiste en una gelificación entre moléculas de alginato y iones calcio.

INTRODUCTION

Since not long ago, chemistry tools can be applied in a novel field: kitchen and gastronomy. This gives naissance to a new scientific discipline known as molecular kitchen chemistry or molecular gastronomy, being considered as a subdiscipline of food science; its aim is to study transformations, physical or chemical of food ingredients after or during cooking [1,2]. The term "molecular and physical gastronomy" was given to the new discipline by Nicholas Kurti and Hervé This [3-15].

Due to the use of plenty of synthetic substances as flavoring or conservative agents in foods, there seem to be some kind of divorce between chemistry and alimentation, being nowadays the green food much more sought over those products currently offered in the market, submitted to previous physicochemical or chemical processes, it is worth to say: processed foods [16]. However, the relationship between science and food goes further and more recently a bridge between chemistry physics and gastronomy has been established through the development of molecular gastronomy [17-25].

During the last years an important evolution in kitchen and gastronomy took place around the world but more precisely in western European countries namely, France and Spain, with a well reputed culinary development through the centuries until nowadays. These changes are now supported by science, and many recipes have been modified with regard to their methodology by using chemistry laboratory techniques implying the use of highly precise measured masses and volumes, temperatures, times and the using of new products and innovation with new techniques with the aim of assuring reproducibility in the culinary preparations [26].

This is the commencement of the discipline called Molecular Gastronomy, whose final goal is the application of scientific knowledge to gastronomic preparations to afford new forms and textures in foods and demonstrate their scientific basis. Molecular gastronomy's aim is not oriented toward the molecular structure or its transformations due to industrial processes but instead the scientific study of culinary processes already known in order to understand them from a molecular stand point; on the other hand, molecular kitchen as well proposes new techniques taking advantage of scientific knowledge that has not previously applied in kitchen [27-44].

Traditional Bolivian gastronomy: The Chuflay [45]

The Bolivian traditional gastronomy's social beverage widely diffused named as "chuflay " was born between the end and the beginning of the XIX and XX centuries respectively in Bolivia. It was the preferred drink by British workers of the installation of the occidental railroad net in Bolivia. Its composition was a mixture of Gin and Gingerale (named also as "Gin & Gin"). Due to its mediterranean country condition, furnishing in drinks and foods, which were all imported from England for the British workers of the Bolivian Railway Company, used to be scarce eventually. Thus gin started to be replaced by a Bolivian alcoholic drink "agua ardiente" (burning water) produced by distillation of muscatel grapes in the valleys of southern Bolivia [45].

The new combination, "singani" (burning water) and ginger ale was named "short fly", this was the term given to any temporary rail, usually extended over water soak areas of the rail or any other shortcut due to any other inconvenient in the terrain [45,46]. The term short fly obeys in its meaning to the rapid effect on the brain to become drunk experimented by the consumers. Native Spanish speakers soon transformed the sound of the English expression "short fly" into: "chuflay" as a phonetical adaptation of the term [45,47]. See Figure 1.

Figure 1. *Chuflay, traditional Bolivian gastronomy alcoholic drink*

The present short report explains the process of spherification of the alcoholic traditional drink from Bolivia named chuflay in order to present it as Chuflay Capsules. The process is a gelification between alginate molecules and calcium ions.

RESULTS AND DISCUSSION

Spherification and gelification are produced by the link between solubilized alginate molecules and calcium ions. This is called ionic gelification, external or internal, depending on the corresponding position of the calcium ions (alginate gummies).

Our molecular chuflay was obtained by external gelification. The process implies the migration of calcium ions from the inner part of the sphere toward the wall where they link to the alginate present in the solution. The formation of the membrane or gel starts at the interphase of both liquids, advancing toward the inner part while the surface becomes saturated in calcium ions pushing out other ions from the molecular structure of alginate. The whole process depends strongly on the appropriate concentration of calcium ions and the composition of the alginate.

The gelification process is possible when alginate interacts with a calcium solution at low temperatures. Firstly, alginate (in its alginic acid sodium salt form, $[NaC_6H_7O]_n$, or additive E-401), which is a purified substance present in cell walls of algae, interacts with calcium ions forming unions where the latter act as bridges between carboxyl groups of alginate as shown in Figure 2.

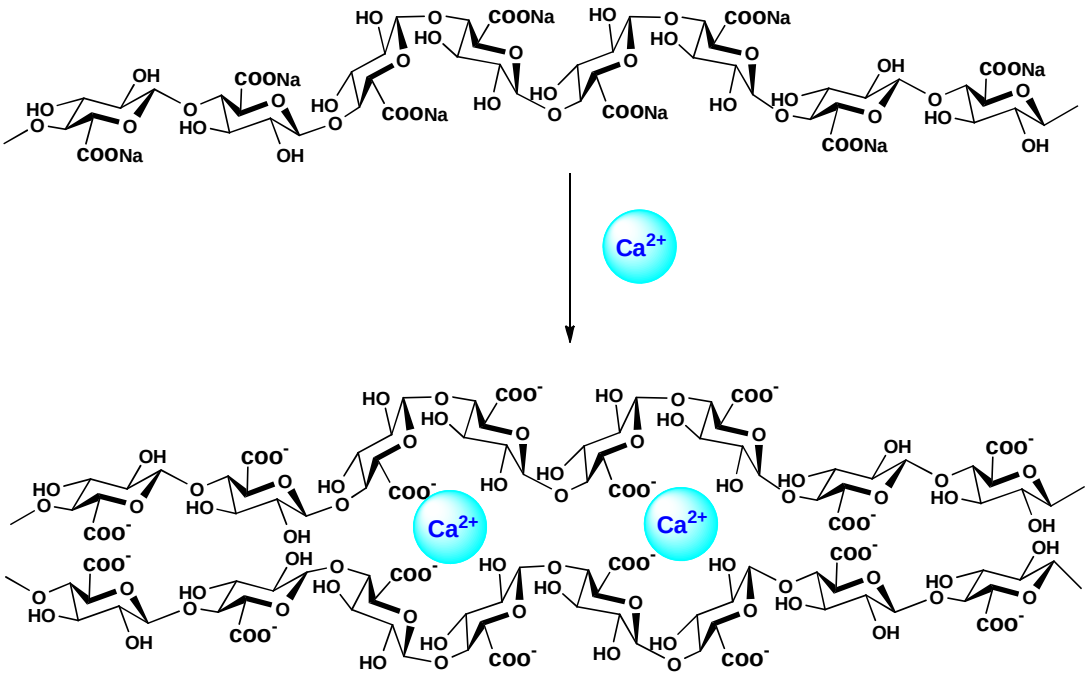

Figure 2. *Alginate molecules in interaction with Ca^{2+} ions in forming a membrane or gel in molecular chuflay preparation*

Usually, alginate forms gels are mostly temperature-independent and stable in time. However, exposing for longer periods to heat treatments or extreme pH variations provoke degradation of the membrane (gel). Another aspect to be taken into account concerns its full dependence on pH of the solution. Thus, alginate is only effective at pH values in the range 4-7.

EXPERIMENTAL

The preparation of chuflay in laboratory included the distillate singani Casa Real (2oz) and Gingerale (500mL) added with lemon extract (0.5g). The solution was added of calcium gluconolactate (5g), the all was mixed in a rotatory magnetic mixer until the obtaining of a homogeneous mixture (solution A). A sodium alginate (2.5g) aqueous solution (deionized water 500mL) was prepared by mixing in a rotatory magnetic mixer until the obtaining of the

corresponding homogenous mixture (solution B). The transfer of solution A (chuflay) by means of Pasteur pipette was done over the beaker with solution B. After 10 minutes, spheres containing molecular chuflay appeared in the very interior of the liquid (Figure 3). Spheres were transferred by means of a tea spoon and poured into a beaker containing distilled water.

Figure 3. *Molecular chuflay*

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