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## Search and analysis of local and international patent works for the nanofiltration process of grape-based alcoholic beverage - Georgian Chacha - under conditions of variable temperature and viscosity

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### Abstract:

Analysis of local and international patents related to the nanofiltration process of grape-based alcoholic beverage - Georgian Chacha - under conditions of variable temperature and viscosity determines the consideration of technologies, technical means, basic technical level and prototypes created by local and international researchers for the ongoing scientific research work at the institute.

**Keywords:** nanofiltration process, alcoholic beverage, variable temperature, viscosity, Georgian Chacha.

Chacha is a traditional alcoholic beverage of grape origin, obtained by fermentation and distillation of the grape processing residue - chacha (skin, seeds and sometimes pulp). It is especially widespread in Georgia and is considered an important element of the country's agro-food and cultural heritage. The technology of chacha production is based on a combination of biochemical and physico-chemical processes, among which special importance is attached to the stages of alcoholic fermentation, formation of aromatic compounds and distillation separation.

Modern scientific research in the production of chacha is focused on optimizing the chemical composition of raw materials, controlling microbiological processes, and improving the quality indicators of the final product. In this context, membrane technologies (microfiltration, nanofiltration) play a special role, ensuring the effective removal of unwanted impurities, maintaining the aromatic profile, and increasing the stability of the product.

In addition, during the process of making chacha, significant attention is paid to controlling such parameters as temperature, viscosity, mass transfer rate, and molecular mass of components, which determine both the separation efficiency and the sensory and physicochemical properties of the resulting alcoholic beverage. A complex analysis of these factors creates the basis for the development of innovative methods of chacha production and the improvement of relevant technological processes.

"Chacha" is a traditional Georgian alcoholic beverage, obtained by distilling the liquid obtained after pressing grapes.

This drink carries a history spanning many generations, from simple recipes to complex and sophisticated variations.

Chacha was traditionally prepared at home, and each family might have its own unique recipe. The drink was used not only for pleasure, but also as a medicine, believed to have healing properties. In modern Georgia, chacha remains a symbol of hospitality.

The history of chacha dates back thousands of years and is closely linked to ancient Georgian winemaking methods. Georgia, often called the homeland of wine, has been using and developing distillation techniques to create chacha for many centuries. The basis of chacha is the grape pomace that remains after winemaking.

The main stages of the technology for producing chacha are given:

**Harvesting the skins.** The preparation of chacha begins with harvesting the skins - these are the grape skins, seeds, and sometimes stems that remain after the juice is pressed for wine.

**Fermentation.** The wort is placed in large containers where it undergoes primary fermentation. This process can last from a few days to a few weeks and helps convert the sugars into alcohol.

**Distillation.** After boiling, the mixture is distilled. In Georgia, a traditional still, called a "chacha kiln" or "chacha cauldron," is often used for this. Distillation is usually done twice to increase the strength of the drink and to purify it.

**Purification and maturation.** The spirit obtained after distillation can be further filtered and matured. Some producers leave the chacha to mature in oak barrels, which gives the drink additional aroma and smoothness.

**Pouring the finished chacha.** It can be colorless or slightly colored, depending on the production method and maturity.

Depending on the region and the producer, there may be variations in these basic steps, as well as the addition of herbs and fruits for flavor. This subtlety makes each chacha unique.

### **Tasting characteristics of chacha:**

The tasting characteristics of chacha can vary significantly depending on the region of production, the grape varieties used, and the specifics of the distillation process. Chacha is generally known for its bright and strong aroma and flavor, which can include notes of fresh and dried fruits, herbs, and flowers. Nutty and vanilla nuances are also often found, especially if the drink is aged in oak barrels.

Chacha can be very smooth and smooth, or sharper and hotter, depending on the degree of purification and the strength of the alcohol. The typical alcohol strength of chacha ranges from 40 to 50 percent, making it a strong and intense drink. The taste of chacha is often described as deep and complex, with excellent tannic structure.[1]

The patent - All-Natural Accelerated Aging of Distilled Spirits - discusses a process for producing an aged beverage, preferably a wood-aged distilled spirit, in which the raw or partially aged beverage is processed in a closed system, under controlled temperature and oxygen concentration conditions, and is simultaneously in contact with the wood material intended for aging the beverage. In certain embodiments, ethyl acetate is added to the raw beverage before the aging process begins. {2}

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Invention - membrane process for dealcoholization of naturally fermented beverages includes the following steps:

A) optionally, contacting the beverage with a microfiltration membrane, resulting in a permeate and a retentate containing, respectively, low and high concentrations of high molecular weight turbidity-causing compounds;

B) optionally, contacting the beverage or microfiltration permeate with a nanofiltration membrane, resulting in a permeate and a retentate containing, respectively, low and high concentrations of flavor and taste-determining compounds;

C) contacting the microfiltration or nanofiltration permeate with a reverse osmosis membrane that selectively passes ethanol and selectively retains aroma and flavor-determining compounds, In which, respectively, the concentration of ethanol is high and low, and the concentration of aromatic and flavor compounds is low and high. [3]

Artificial aging of alcoholic beverages is possible using carbon dioxide under high pressure. Under these conditions, carbon dioxide produces carbonic acid, which promotes the formation of various esters both in the presence and absence of wood, and at the same time provides a mellow taste.

The wood material can be pre-treated with ozone, which results in the extraction of lignin; then, when exposed to high-pressure CO<sub>2</sub>, the lignin is converted to vanillin, which gives the beverage a vanilla flavor.

After CO<sub>2</sub> treatment, further treatment with ozone is possible, which results in mild oxidation and additional flavor harmonization.[4]

The invention, which concerns the method of producing Georgian "Chacha" vodka, is based on two-stage distillation: in the first stage, fermented grape chacha is distilled, and in the second stage, the resulting primary distillate (alcohol content 15–20%) is re-distilled.

According to the invention, in order to improve the quality of the product, the aqueous-alcoholic vapors generated during the distillation process are brought into contact with copper oxide, which is preheated to a temperature of 95–100°C and maintained at this temperature throughout the distillation process.

This approach ensures a reduction in methanol content and an improvement in the quality of the final product.[5]

The invention relates to a method for obtaining a final, aged distilled spirit, as well as a method for bottling distilled spirit, which uses an in-bottle finishing process. In one embodiment, the method comprises the following steps:

- (1) placing aged distilled spirit in a bottle;
- (2) placing a piece of wood in the bottle, said piece of wood being used in the bottling process and previously stored in a non-alcoholic liquid prior to being placed in the bottle;
- (3) hermetically sealing the bottle so that both the aged distilled spirit and the piece of wood are simultaneously placed inside the bottle [6]

The patent describes - the following steps for removing a complex of impurities from an alcoholic beverage:

First, an aqueous solution is prepared, which contains about 96% pure water and at least 4% honey by volume;

Then, a mixture is obtained, which consists of about 50% by volume of said aqueous solution and about 50% by volume of an alcoholic base containing impurities and at least 80% by volume of alcohol;

Then, about 1% by volume of a mixture of extracts is added to the resulting product to obtain the desired flavor;

About 4% or more by volume of sugar is also added;

About 0.5% by volume of a precipitate is added to obtain a two-phase colloidal system that catalyzes precipitation;

The impurities are adsorbed on the precipitate;

And finally, the precipitate is separated from the resulting product.[7]

Nanofiltration processes, which are carried out using one or more traditional nanofiltration membrane modules under positive pressure, are used to selectively change the concentration of one solute in a solution relative to another solute.

For example, it is possible to change the concentration of compounds containing monovalent ions (such as sodium chloride or sodium chlorate) relative to compounds containing polyvalent ions (e.g., sodium sulfate or sodium dichromate).

This process is particularly effective in reducing the concentration of undesirable ions (especially silicon and dichromate ions) in highly saline aqueous solutions in chlor-alkali and chlorate salt systems, as well as in increasing the concentration of sodium sulfate relative to sodium chloride in chlor-alkali solutions.[8]

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**ადგილობრივი და საერთაშორისო საპატენტო ნამუშევრების მოძიება და ანალიზი  
ყურძნისეული წარმოშობის სპირტიანი სასმელის - ქართული ჭაჭას -  
ნანოფილტრაციული პროცესისათვის, ცვალებადი ტემპერატურისა და სიბლანტის  
პირობებში.**

**გიორგი ბიბილეიშვილი, ზაზა ჯავაშვილი, ელენე კაკაბაძე, ლეილა თანანაშვილი, მანანა  
მამულაშვილი, ლიანა ებანოიძე.  
საქართველოს ტექნიკური უნივერსიტეტის მემბრანული ტექნოლოგიების საინჟინრო  
ინსტიტუტი**

**რეზიუმე:**

ადგილობრივი და საერთაშორისო პატენტების ანალიზი, რომლებიც დაკავშირებულია ყურძნისეული წარმოშობის სპირტიანი სასმელის -ქართული ჭაჭას - ნანოფილტრაციულ პროცესთან ცვალებადი ტემპერატურისა და სიბლანტის პირობებში, განსაზღვრავს ინსტიტუტში მიმდინარე სამეცნიერო-კვლევითი სამუშაოებისათვის ადგილობრივი და საერთაშორისო მკვლევრების მიერ შექმნილი ტექნოლოგიების, ტექნიკური საშუალებების, საბაზისო ტექნიკური დონისა და პროტოტიპების გათვალისწინებას.

**საკვანძო სიტყვები:** ნანოფილტრაციული პროცესი, სპირტიანი სასმელი, ცვალებადი ტემპერატურა, სიბლანტე, ქართული ჭაჭა.