Georgian Scientists
ქართველი მეცნიერები
Vol. 7 Issue 4, 2025
https://doi.org/10.52340/gs.2025.07.04.22

Analysis of local and international patents for the microfiltration process of various types of red wine materials.

[1]Elene Kakabadze, [2]George BibileiSvili, [3]Zaza JavaSvili, [4]Leila Tananashvili, [5]Manana Mamulashvili, [6]Tinatin Butkhuzi, [7]Ia Gogiberidze

Engineering Institute of Membrane technologies of Georgian Technical University

[1]Doctor, Chief Scientist - e-mail:Kaelene@yandex.ru

[2]Doctor of Chemical and Biological Engineering, Chief Scientist, e-mail: 75bibileishvili@gmail.com
ORCID ID: https://orcid.org/0009-0003-7712-2436

[4]Learned Secretary of Engineering Institute of Membrane Technologies - dodo_chanturia@mail.ru

Summery

Analysis of some issues of local and international patents related to methods of obtaining and purifying various types of red wine materials through the microfiltration process determines the consideration of technologies, techniques, basic technical levels and prototypes created by local and international researchers for the scientific research work of the Institute.

Keywords: Microfiltration Process, Treatment, different Types, red grape must, research

The main prerequisite for increasing the export performance and competitiveness of Georgian wine is a high quality standard, for which it is necessary to process them using membrane technologies.

The influence of both low and high molecular weight compounds present in red grape must on the decrease in permeate flux (Jv) during its nanofiltration was studied. The most important low molecular weight compounds are glucose and fructose, while other compounds, such as polyphenols, polysaccharides, proteins, etc., are of high molecular weight. A synthetic solution containing low molecular weight compounds characteristic of natural must was subjected to nanofiltration, and the results obtained were compared with the results of nanofiltration of commercial red must.

During nanofiltration of red yeast rice, a gel layer formed on the membrane surface and gradually thickened, leading to a rapid decrease in Jv and a slow increase in the concentration of sugars in the retentate due to the recovery of a small volume of permeate. A method was developed that allows the resistance and fouling mechanisms caused by sugars and high molecular weight compounds to be studied separately under these extreme conditions.

The results showed that high molecular weight compounds have a greater impact on the reduction of permeate flux, as they are mainly responsible for the cake filtration mechanism, while low molecular weight compounds cause the flux reduction more by increasing the osmotic pressure [1].

Mannoprotein solutions and their use

The invention describes a mannoprotein solution having a turbidity, measured by nephelometry at a mannoprotein concentration of 200 g/l and a pH range of 4 to 8, of less than 70 NTU, preferably less than 60 NTU, more preferably less than 50 NTU and most preferably less than 40 NTU. This solution can be effectively used to stabilize wine against tartrate precipitation, as it is very clear and can be added directly to wine without causing turbidity [2].

Today, the majority of red wines exported to both the domestic and international markets are classic and traditional qvevri wines made from Saperavi. However, Saperavi, due to its strong varietal aroma and other taste qualities, has much greater potential for producing other types of wines. For example, pink wines are becoming increasingly popular. Making rosé from grapes with such intense color, such as Saperavi, is associated with certain challenges, requiring the use of delicate grape processing and maceration regimes. The aim of the study was to determine the possibilities of using dry ice in the process of making classic wines from Saperavi in terms of increasing the intensity of the aroma and obtaining the desired color condition in the process of making pink wines. A classic rosé wine was made from Saperavi grapes obtained from Mukuzani and Vachnadziani vineyards under industrial conditions using dry ice, and the variability of their physicochemical and organoleptic indicators was studied in comparison with control samples. The use of an innovative technological regime confirms the improvement of the quality of both wines. [3]

The phytoalexin properties of grapevine stilbenoids are a characteristic of significant biological activity against bacterial and fungal diseases. We have investigated the correlation of immunity of some Georgian white and red grape wine grape varieties with phytoalexin stilbenoids under conditions of bacterial and fungal diseases. The present materials present the results of the study of the variability of phytoalexin stilbenoids of Saperavi and Rkatsiteli grapevine strains when infected with bacterial canker

(Agrobacterium tumefaciens) in viticulture microzones with different soil and climatic conditions. Specifically, for Saperavi - in the Mukuzani and Napareuli microzones, for Rkatsiteli - in the Tsarafi and Tibaani microzones.

The above-mentioned grape varieties were artificially infected with an aqueous suspension of a pure culture of Agrobacterium tumefaciens in April 2023 and the development/proliferation of bacterial canker was observed during the period from April to September. Healthy grapevine strains from Saperavi and Rkatsiteli, as well as those previously treated with an aqueous suspension of stilbenoids, were artificially infected. In the vineyards of the experimental microzones, trans-resveratrol was found to be dominant in healthy grapevine strains from Saperavi and Rkatsiteli compared to trans-ε-viniferin. Trans-resveratrol was detected in large quantities in the Rkatsiteli grapevine strain from the Tibaani microzone.

The main stress metabolites stilbenoids: trans-resveratrol and trans-ε-viniferin were detected in Saperavi and Rkatsiteli grapevine strains infected with bacterial canker. The dependence of their variability on grapevine variety, age, and soil-climatic factors was determined. The results of the experiment are important data for further studies to determine the stilbenoid biomarker of Saperavi and Rkatsiteli as a resistance to bacterial canker of grapevines [4].

The invention provides a method for preparing a summer black dry red wine, where the grape variety is summer black grapes, and the preparation method includes the following steps:

(1) saturation with CO_2,

(2) flour dissolution and sterilization,

(3) fermentation,

(4) stirring,

(5) testing,

(6) secondary fermentation,

(7) sterilization,

(8) freezing,

(9) multiple filtration,

(10) bottling and packaging.

The invention effectively extracts the aroma of the summer black grape fruit and significantly enhances its aromatic properties. It also effectively extracts the pigment of the summer black grape, as a result of which the color of the wine becomes red like precious stones. As a result of freezing and multiple filtration, the sediment content in the wine is significantly reduced [5].

Systems and methods for assessing wine characteristics, the method comprising:

• Receiving wine ratings from wine experts, each rating containing intensity values that describe different wine characteristics for each wine;

• Generating a global intensity value from the intensity values obtained for a specific wine characteristic;

• Comparing the intensity value given by the selected wine expert to the global intensity value to determine the accuracy deviation;

• Comparing the accuracy deviation to specified limits to determine whether the given value is inaccurate;

• Updating the global intensity value for the specific characteristic of the specific wine based on the accuracy assessment;

• Storing the updated global intensity value in a wine database[6].

The paper deals with the use of an integrated, environmentally friendly membrane separation process for the extraction of polyphenols and organic acids. A two-stage membrane process involving ultra- and nanofiltration is described. The physicochemical and antioxidant properties of all process streams were determined. High-performance liquid chromatography (HPLC) was used to identify certain individual organic acids and polyphenols, and the antioxidant potential was determined by 2,2'-diphenyl-1-picrylhydrazyl (DPPH) free radical scavenging capacity and color reduction.
The resulting liquid concentrate containing 1351 ppm polyphenols was then spray-dried to a powder. The resulting powder retained most of the polyphenols and antioxidant properties. It has been successfully used to inhibit lipid oxidation in a real food system, as confirmed by the determination of thiobarbituric acid-reactive substances (TBARS) and oxymyoglobin content.
The results show that membrane separation technology is an attractive alternative process for the recovery of valuable substances from wine lees.[7]
Whey is a by-product of cheese production, so research into new uses for whey proteins will help increase its value and reduce waste. This study provides the first detailed comparison of the effectiveness of gelatin and β-lactoglobulin (β-LG) as filtering agents.

Experiments showed that gelatin was more reactive towards tannins than whey proteins. This was confirmed by both the bitterness assessment method (where ovalbumin was used to form a precipitate) and the tannin determination method (where methylcellulose was used to form a precipitate). Although both proteins showed similar selectivity towards polyphenols, β-LG was less effective at removing catechins.

Centrifugation and subsequent filtration resulted in complete or minimal removal of the filtering agent, reducing the risk of its allergenic potential. Furthermore, a better understanding of the interaction between proteins and tannins has been achieved using fluorescence, size determination, and isothermal titration calorimetry (ITC) methods. In summary, this study demonstrates that whey proteins can reduce bitterness in red wine and may have promising applications in oenology [8].

Method of making syrup

The syrup production process involves removing the lees from the wine, squeezing, crushing, sterilizing, adding water, heating the resulting mass to a temperature of 90-96°C and maintaining the same temperature for 10-12 minutes, straining and filtering the juice, adding sugar to the resulting liquid, and fermenting [9].

Method of making fortified wine

The process of making fortified wine involves crushing 100-350 different varieties of ripe, high-sugar grapes, destemming, separating the sweet, pressing the sweet, removing it from the lees, placing it in a qvevri and starting fermentation, then distilling it with a pre-prepared alcoholic mixture of wine brandy and chacha vodka, placing the distilled wine material in the qvevri, and then in a barrel [10].

Georgian local strain of yeast GWL-01R for the production of red wines

The invention relates to the field of winemaking and relates to a new strain of wine yeast Saccharomyces cerevisiae (vini) GWL-01R, which is used for the production of high-quality red grape wines [11].

Thus, this review provides a summary of some international and local patents related to methods of obtaining - producing and storing various types of red wine materials.

Literature:

1.Influence of low and high molecular weight compounds on the permeate flux decline in nanofiltration of red grape must ; C. Salgado a, L. Palacio a, F.J. Carmona b, A. Hernández a, P. Prádanos a ; Desalination Volume 315, 15 April 2013, Pages 124-134;

2. Solutions of mannoproteins and their use; Peter Philip Lankhorst, Hendrik Louis Bijl,Ibrahim Oezkan;US20130309721A1;

3.Improving the quality of Saperavi rosé and classic type wines using dry ice; Giorgi Mchedlishvili Caucasus International University; Olani Gotsiridze Academic Doctor of Technical Sciences, Associate Professor; Caucasus International University - Theses; Section - Viticulture-Enology; pp.361-362; 10.06.2023;

4.Variation of phytoalexin stilbenoids of grapevine (Vitis vinifera L.) under conditions of bacterial canker (Agrobacterium tumefaciens) infection;

M. Bezhuashvili, L. Bavaresco, M. Surguladze, Sh. Kharadze, G. Shoshiashvili, N. Darchiashvili, P. Vashakidze; Bulletin of the Georgian National Academy of Sciences. – 2024. – Vol. 18. – #2. – pp. 133-139.

5. Preparation method of summer black dry red wine CN113373011A2021-09-10;

6. Systems and Methods for Evaluation of Wine Characteristics; Michael J. Tompkins ; US US10488383B2;

7. Sequential Membrane Filtration to Recover Polyphenols and Organic Acids from Red Wine Lees: The Antioxidant Properties of the Spray-Dried Concentrate; P Filippou, ST Mitrouli, P Vareltzis - Membranes, 2022,12(4), 353;

8. Astringency reduction in red wine by whey proteins; Paula Jauregi a, Jumoke B. Olatujoye a, Ignacio Cabezudo b, Richard A. Frazier a, Michael H. Gordon a , Food Chemistry Volume 199, 15 May 2016, Pages 547-555;

9. Method of making syrup, Tamar Jaaparidze, U 2023 2146 Y, 2023-03-27.

10. Method of making fortified wine, Teimuraz Lomsadze, U 2022 2129 Y, 2022-09-12;

11. Georgian local yeast strain GWL-01R for making red wines, Davit Bochorishvili, Giorgi Kvesitadze, Tinatin Sadunishvili, Khatuna Varsimashvili, Nino Gagelidze, Lia Amiranashvili, P 2021 7292 B, 2021-09-27

სხვადასხვა ტიპის წითელი ღვინომასალის მიკროფილტრაციული პროცესით დამუშავების ადგილობრივი და საერთაშორისო პატენტების ანალიზი

[1]ელენე კაკაბაძე, [2]გიორგი ბიბილეიშვილი, [3]ზაზა ჯავაშვილი, [4]ლეილა თანანაშვილი, [5]მანანა მამულაშვილი, [6]თინათინ ბუთხუზი, [7]ია გოგიბერიძე

საქართველოს ტექნიკური უნივერსიტეტის მემბრანული ტექნოლოგიების საინჟინრო ინსტიტუტი

რეზიუმე

ადგილობრივი და საერთაშორისო პატენტების ზოგიერთი საკითხის ანალიზი, რომლებიც დაკავშირებულია სხვადასხვა ტიპის წითელი ღვინომასალის მიკროფილტრაციული პროცესით მიღება - გასუფთავების მეთოდებთან განსაზღვრავს ინსტიტუტის სამეცნიერო-კვლევითი სამუშაოებისთვის ადგილობრივი და საერთაშორისო მკვლევართა მიერ შექმნილი ტექნოლოგიების, ტექნიკის, საბაზისო ტექნიკური დონისა და პროტოტიპების გათვალისწინებას.

საკვანძო სიტყვები: მიკროფილტრაციის პროცესი, დამუშავება, სხვადასხვა სახეობები, წითელი ყურძნის ტკბილი, კვლევა