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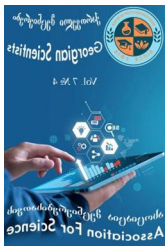

Microbiological analysis of wastewater, fruit juices, determination of microbial sizes, diagnostics and filtration of microorganisms

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Abstract

The paper studies the microbiology of water and apple juice from the Mtkvari River. Various types of bacteria (Escherichia coli, Enterococcus Faecalis, Pseudomonas aeruginosa) were found in the water, which indicates the pollution of the Mtkvari River, while the study of apple juice revealed bacterial (Bacillus subtilis, Lactobacillus spp,) microflora, and the sizes of the microbes were determined. The reliability of ultrafiltration, which completely removes contaminants, improves the quality of water and fruit juice, has been established.

Keywords: water, fruit juices, microbiology, diagnostics, ultrafiltration

Introduction

The Mtkvari River basin creates an important living environment for domestic and industrial facilities in and outside Tbilisi. The main source of river pollution is municipal wastewater. Wastewater leads to deterioration of chemical and biological indicators of river water quality, disrupts the biodiversity of aquatic ecosystems and causes microbiological pollution. Microbiological analysis has determined the types and quantities of microorganisms, which determine the water quality and ecological status of the Mtkvari River and indicates possible epidemiological risks [1,2].

In fruit juices, the natural sugars, acidity and high water activity contribute to the development of both beneficial and pathogenic microbes. Membrane processing of fruit juices is carried out on an industrial scale to replace the stages of depth filtration,

decantation and partial evaporation. Membrane filtration is an effective method for purifying juices, resulting in a crystal-clear permeate [3].

Purpose and analysis of the work

The purpose of the study is to study the contaminating microbes present in the water of the Mtkvari River and apple juice, for which cultivation was carried out on various nutrient media and their characteristics were studied. Technological conditions of baromembrane processes were developed for the disinfection and sterilization of solutions.

To detect microbes, incubation was carried out at 22-37°C for 24-72 hours. The Mtkvari River sample was taken in Tbilisi according to the international ISO 5667-10 standard for water sampling. For microbiological research, the standard ISO 9308-1:2014 direct seeding and membrane filtration method was used [4,5,6].

We cultivated microbes in Petri dishes on dense nutrient media. We used chromogenic coliform (CCA), endo and nutrient agar as culture media for microorganisms. Microbe sizes were determined with an accuracy of 1 μm using a polarizing interference optical microscope (Biolar) with an objective micrometer division of 10 μm [7,8].

The water samples of the Mtkvari River were filtered through a membrane with a pore size of 0.1 μm, and apple juice through a membrane with a pore size of 0.45 μm.

Conclusions and judgment

As a result of the inoculation of water samples on a nutrient medium, E-coli was detected as a typical blue color, and coliform as a pinkish-reddish oxidase-negative colony. The results of the study are expressed by measuring the number of colony-forming units in a volume considered standard for microorganisms. The results of the analysis of water from the Mtkvari River are given in Table 1;

Table 1. Number of microbes in the water of the Mtkvari River

Indicator to be investigated	Unit of measurement	Allowed quantity	Result before filtering	Result after filtering
Mesophilic aerobes and facultative anaerobes 37°C 22°C	In 1 ml	 20 100	 15 40	 Not found Not found
Common coliform bacteria	Goat/300 ml	It doesn't work.	2400	Not found
Escherichia coli	Goat/300 ml	Will not be allowed	2200	Not found
Streptococcus faecalis	Goat/250 ml	Will not be allowed	300	Not found
Pseudomonas aeruginosa	Goat/250 ml	Will not be allowed	1700	Not found
Sulfite-reducing clostridia (Cl perfringens)	Goat/50 ml	Will not be allowed	40	Not found

The indicators of microorganisms found in the Mtkvari River indicate fecal pollution. Their characteristics are presented in Table 2.

Table 2. Characteristics of microorganisms present in the Mtkvari River sample

Characteristic	*Escherichia coli*	Streptococcus faecalis	Pseudomonas aeruginosa
Form	Round	Round	Irregular
Color	Pink	Black-dark	Green-cyan
Surface	Glossy	Smooth	Shiny
Consistency	Soft	Soft	Adhesive
Size in μm	2,0 -3,0	1,5	3,0 – 4,0

The results of the microbiological study of apple juice are given in Table 3.

Table 3. Characteristics of microorganisms present in apple juice sample

Juice	Colony type	Total number of cells/ml		Form	Color	Surface	Microscopic characteristics
		Before filtration	After filtration				
Apple	Bacteria	2600	Not found	Round	White	Smooth	Bacillus subtilis (size 3,0 -5,0 μm)

As the results show, fecal contamination was detected in the water of the Mtkvari River, which in itself negatively affects the quality of the river's water, while as a result of ultrafiltration, no contaminants were detected in either the Mtkvari River water or the apple juice filtrate.

Conclusion

The study showed that the number of microbes found in the water of the Mtkvari River indicates potential sanitary hazards, while bacterial microflora was detected in apple juice. It was determined that ultrafiltration improves the transparency and quality of water and fruit juices, resulting in microbiologically clean water and juice.

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ჩამდინარე წყლების, ხილის წვენების მიკრობიოლოგიური ანალიზი, მიკრობთა ზომების განსაზღვრა, მიკროორგანიზმთა დიაგნოსტიკა და ფილტრაცია

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საქართველოს ტექნიკური უნივერსიტეტის მემბრანული ტექნოლოგიების საინჟინრო ინსტიტუტი

რეზიუმე

ნაშრომში შესწავლილია მდინარე მტკვრის წყლის და ვაშლის წვენების მიკრობიოლოგია. წყალში აღმოჩენილია სხვადასხვა ტიპის ბაქტერიები (Escherichia coli, Enterococcus Faecalis, Pseudomonas aeruginosa), რაც მიუთითებს მდინარე მტკვრის დაბინძურებაზე, ხოლო ვაშლის წვენის კვლევისას გამოვლენილია, როგორც ბაქტერიული ისე სოკოვანი (Bacillus subtilis, Lactobacillus spp,) მიკროფლორა, განსაზღვრულია მიკრობთა ზომები. დადგენილია ულტრაფილტრაციის საიმედოვება, რომელიც მთლიანად აშორებს დამაბინძურებლებს, აუმჯობესებს წყლის და ხილის წვენის ხარისხს.

საკვანძო სიტყვები : წყალი, ხილის წვენები, მიკრობიოლოგია, მიკრობთა ზომები, დიაგნოსტიკა, ულტრაფილტრაცია