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**DEVELOPING TECHNOLOGY OF ANTI-INFLAMMATORY  
ACTING GEL BASED ON THE EXTRACTS OF FOLIA URTICAE,  
HERBA BIDENTIS AND HERBA EQUISETI**

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# Work actuality

Inflammation is a widely distributed pathological process, which arises in damaging tissues and it has alteration, exudation and proliferation stages during its flow. In this preferably local process all person body is involved and first of all, such systems as immune, endocrine and nerve systems. Inflammatory reaction is developed in different diseases and necessity in anti-inflammatory preparations is high sufficiently. Present time there is a great number of preparations with anti-inflammatory action, either steroid group or non-steroid group preparations. Safety problems of medicines became one of the most important problems of the healthcare system in the world. Perspective direction of creating safety anti-inflammatory preparations is obtaining preparations from vegetable origin.

# Aim

The aim of this research is developing of anti-inflammatory acting gel based on extracts of *Herba Bidentis*, *Folia Urticae* and *Herba Equiseti* an experimental valuation of local anti-inflammatory activity gel

# Research aim

- To make researches on selecting optimal composition and efficient technology of gel with anti-inflammatory action;
- To make quality assessment of developed gel, according to requirements, shown in regulatory documents (RD);
- To study rheological properties of ternary gel;
- To research ability of medicinal substances for releasing from gels in experiments in vitro;

- To define quantitative content of acting substances in offered medicinal form;
- To study pharmacological safety and specific activity of gel with anti-inflammatory action;
- To research stability of developed gel in the storing process and to determine preliminary expiry dates;

# Research object and subject

The objects of the research are obtained liquid extracts of medicinal plant raw material: *Herba Bidentis*, *Folia Urticae* and *Herba Equiseti* .

The subject of the research is dermatological gel, valuation of qualitative and quantitative characteristics.

# Technology of obtaining the ternary liquid extract

There has been developed ternary composition, consisting of vegetable raw material: *Herba Bidens*, *Folia Urticae*, *Herba Equiseti* in a ratio of 1: 1:1, recommended as an anti-inflammatory agent. For obtaining a liquid extract there have been used comminuted plant material from 3 to 5 mm, and 70% ethyl alcohol extragent of various concentrations. The liquid extract was obtained by a two-day maceration with followed percolation method .

# Technological scheme of obtaining ternary liquid extract

Figure 1

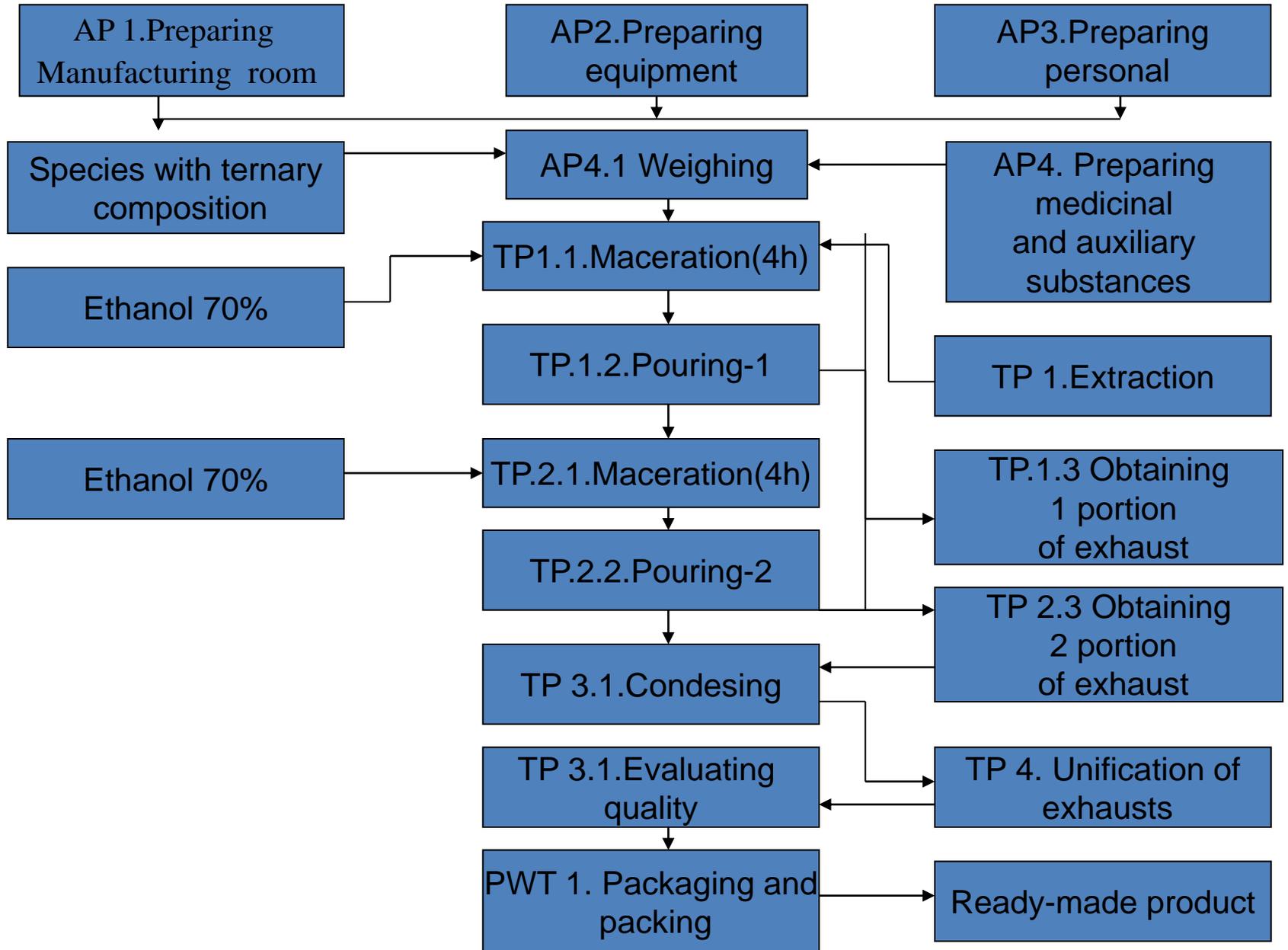


Table 1

**Results of studying technological properties of the liquid extract obtained from ternary vegetable raw material.**

Experiment №	Alcohol concentration ,%	Density, g/ml	Dry residual, %	Heavy metals
1	67,5	0,9044	2,9	Correspond
2	68,8	0,9046	2,8	Correspond
3	68,0	0,9060	3,0	Correspond
4	68,0	0,9055	2,9	Correspond
5	68,5	0,9060	3,0	Correspond
Se	68,16	0,9053	2,9	Correspond

The table shows that the liquid extract obtained from the ternary plant raw material meets the requirements of RD .

**Authentication is performed by qualitative and quantitative reactions to the main active ingredients flavonoids and carotenoids by Spectrophotometer analysis method**

**Metrological characteristics of results of the quantitative determining flavonoids and carotenoids (n=5; P=95%; t(p,f)=2,78)**

**Table 2**

<b>Analysis method</b>	$X$	$\bar{X}$	$S^2$	$S$	$S_x$	$\Delta X$	$\overline{\Delta X}$	$\varepsilon \%$	$\bar{\varepsilon} \%$
Spectrophotometer	0.495	0.49	0.000007	0.0027	0.0012	0.007	0.003	1.53	0.68
	0.490								
	0.490								
	0.489								
	0.488								
<b>Analysis method</b>	$X$	$\bar{X}$	$S^2$	$S$	$S_x$	$\Delta X$	$\overline{\Delta X}$	$\varepsilon \%$	$\bar{\varepsilon} \%$
Spectrophotometer	0.365	0.363	0.0000017	0.0013	0.00058	0.0036	0.0016	0.99	0.44
	0.362								
	0.362								
	0.362								
	0.363								

Based on a series of conducted experiments it was found that the content of flavonoid amount in terms for rutin should be at least 0.5%. Carotenoids content amount in terms of potassium dichromate should be at least 0,36%



# Composition

Liquid extract -10.0

S-CMC -6.0

Glycerin -10.0

Nipagin -0.1

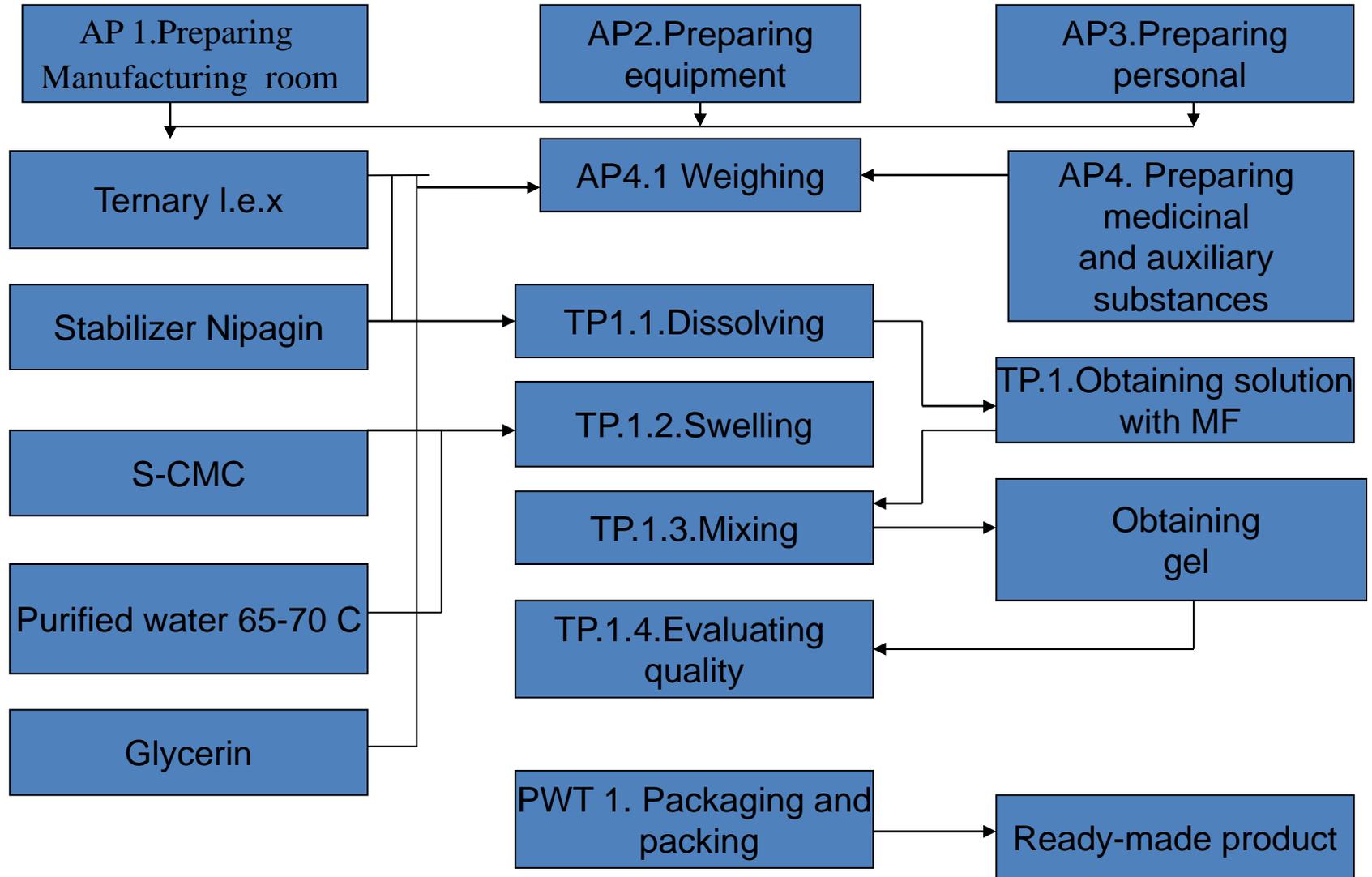
Purified water to 100.0

Developing gel technology with ternary liquid extract of (vegetable) raw materials.

**Gel technology:** Weighed S-CMC in a porcelain cup, filled with purified water and left for swelling for 30-40 min. There has been added Glycerin and carefully triturated. In the liquid extract of ternary raw material with Nipagin was dissolved and added to the resultant gel of S-CMC, mixed thoroughly until obtaining homogenous gel and placed in a dark glass jar.

# Technological scheme of obtaining ternary liquid gel

Figure 2

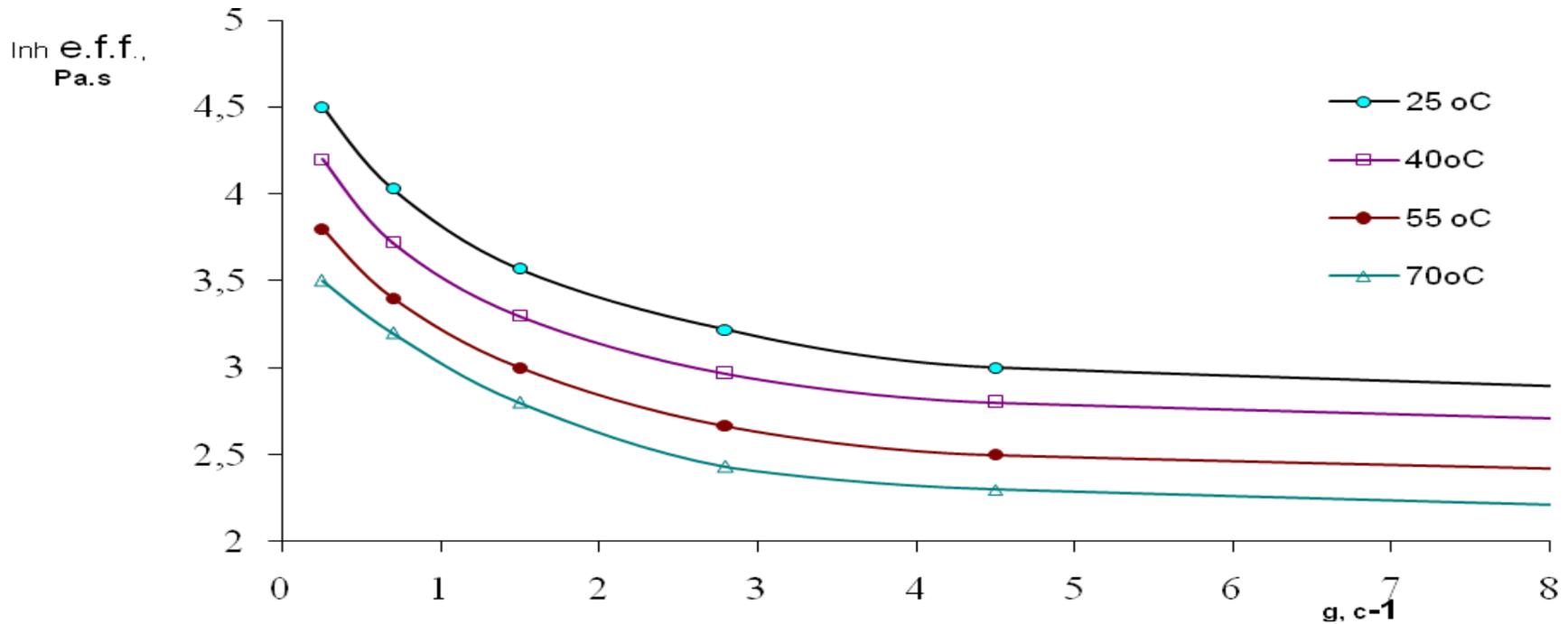


## Studying results of the physical-chemical and technological properties of the ternary gel

Researching properties	Indices				
	1	2	3	4	5
Appearance	Transparent sticky consistency gel with specific odour and dark-green colour	Transparent sticky consistency gel with specific odour and dark-green colour	Transparent sticky consistency gel with specific odour and dark-green colour	Transparent sticky consistency gel with specific odour and dark-green colour	Transparent sticky consistency gel with specific odour and dark-green colour
Qualitative	Correspond	Correspond	Correspond	Correspond	Correspond
pH value of water exhaust 1:10	7,10	6,95	7,05	7,0	7,05
Homogeneity	Correspond	Correspond	Correspond	Correspond	Correspond
Weight loss,%	50,8	51,2	49,7	51,1	50,8
Colloidal resistance of centrifuging at 1500 turns/minute, 5 minutes	Not stratified				
Resistance of thermostating at 40±2°C	Resistant	Resistant	Resistant	Resistant	Resistant

As it can be seen in Table 5, a gel with the liquid extract of ternary vegetable raw material, prepared according to the developed technology, meets the modern requirements of the gels, and it is not separated by centrifugation and temperature control, and it is a colloidal stable system.

Rheological properties of the gel. The logarithm dependence of the effective viscosity ( $\ln \eta_{\text{eff}}$ ) from gradient velocity ( $\dot{\gamma}$ ) of the shear flow of the gel based on the ternary liquid extract at different temperatures: 25 °C; 40 °C; 55 °C; 70 °C. Figure 4

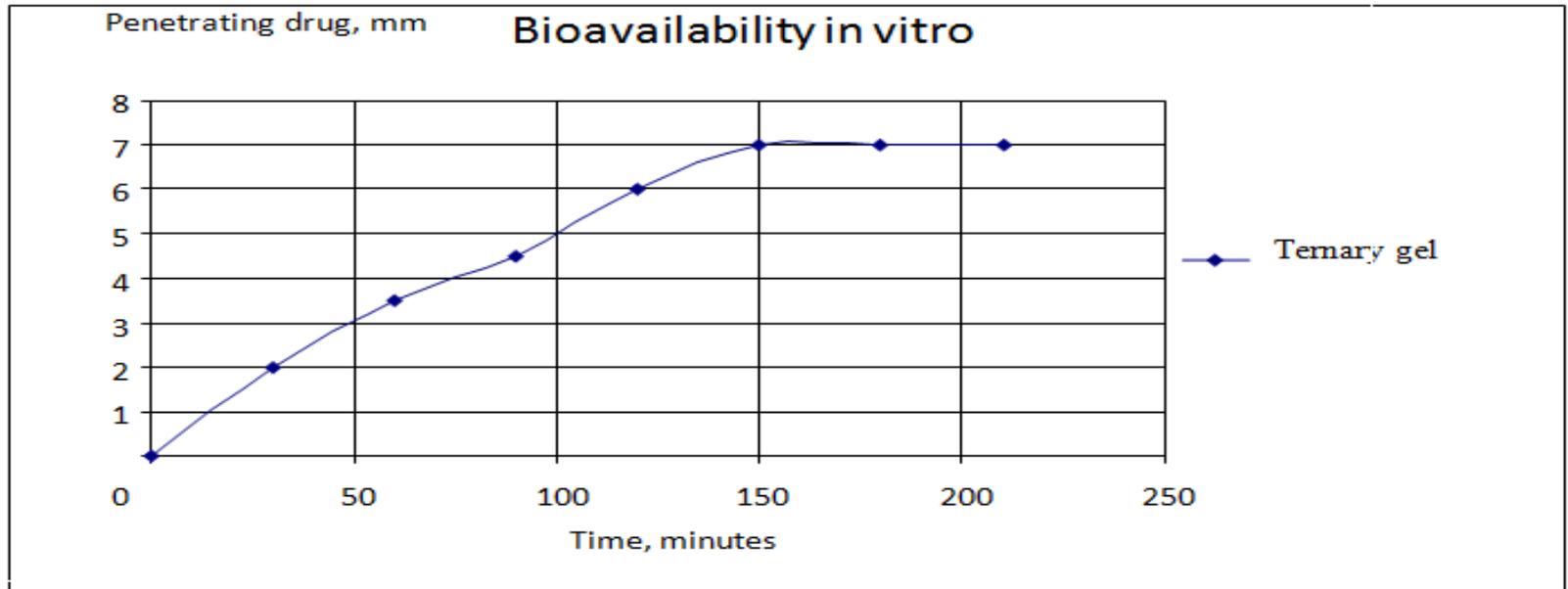


So, after research in the used samples, there were no changes in color, smell, texture, they are the same, there was not separating there.

# The results of studying bioavailability of the transverse distribution

## Table 5

Time (min)	0	30	60	90	120	150	180	210
Penetrating drug of ternary gel (mm)	0	2	3,5	4,5	6	7	7	7



Investigation of drug bioavailability in vitro experiments was carried out by the method of diffusion in 5% gelatin gel, using as an indicator 1 m NaOH. The diffusion of registering every 30 minutes.

Results of studying bioavailability of the preparation show, that active substances of ternary gel over the cross-level distribution and penetration time is gradual released active substances from suggested gel.

**The results of metrological characteristics of the quantitative and qualitative analysis in determining flavonoids and carotenoids  
(n=5; P=95%; t(p,f)=2,78)**

<b>Analysis method</b>	$X$	$\bar{X}$	$S^2$	$S$	$S_x$	$\Delta X$	$\overline{\Delta X}$	$\varepsilon \%$	$\bar{\varepsilon} \%$
Spectrophotometer	0.271	0.27	0.000006	0.0025	0.001	0.007	0.0027	2.56	1.14
	0.272								
	0.272								
	0.271								
	0.266								

<b>Analysis method</b>	$X$	$\bar{X}$	$S^2$	$S$	$S_x$	$\Delta X$	$\overline{\Delta X}$	$\varepsilon \%$	$\bar{\varepsilon} \%$
Spectrophotometer	0.058	0.057	0.0000017	0.0013	0.00058	0.0036	0.0016	6,33	2,83
	0.058								
	0.055								
	0.058								
	0.057								

Based on the series of conducted experiments it was established, that the flavonoid content amount in terms of rutin should be not less than 0.27%, and carotenoid should be not less than 0,05%

# **Useful life and stability of the gel were studied by the natural storage method**

The results of these researches indicate the stability of the gel for 1.5 years of natural storage (time of observation).

# Conclusions

1. As a result of the complex technological, rheological and biopharmaceutical researches there have been scientifically substantiated the composition and the technology of the gel with the anti-inflammatory action.
2. For the first time there have been studied the physical-chemical and technological characteristics of the new ternary gel and there have been developed methods of quality control.
3. There have been made investigations of structural and mechanical properties of the gel by determining the effective and dynamic viscosity and depending on the temperature. It is shown that the suggested gel is a viscous-plastic system.
4. There have been made biopharmaceutical researches and it was found that the selected base provides bioavailability.
5. There have been studied an acute toxicity, local irritant effect and the specific activity of the ternary gel.
56. There have been studied the gel stability by the natural method of storage and there has been installed preliminary shelf life - 1.5 years.

Thank for your attention