



# Development of the Composition and Technology of Soft Dosage Forms for Periodontal Treatment

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## Abstract

This paper presents the results of the development of optimal parameters for obtaining a phytocomposition – a complex alcoholic extraction of Japanese sophora fruits, marigolds of flowers and nettle leaves from medicinal plant raw materials. On the basis of the obtained complex phytoproduct, lysozyme, as well as the aqueous extraction of oak bark and sea buckthorn oil, the optimal composition and rational technology for obtaining ointment for the treatment of periodontal disease have been developed.

**Disciplinary:** Medicine, Dentistry

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## 1 Introduction

To date, periodontal diseases occupy one of the leading places in the structure of dental diseases. This is due to the unfavorable socio-economic and environmental situation, irrational

antibiotics, hormones and chemotherapy, and inadequate and irrational nutrition. As a result of these factors, the treatment of periodontal diseases becomes an urgent problem in dentistry [1-3].

Periodontal lesions include inflammatory degenerative and neoplastic processes of various forms and clinical manifestations. Thus, according to WHO, severe periodontal diseases occur in 5-25% of the adult population, moderate - in 30-45% of the adult population, and only 2-8% of people have intact periodontal disease at the age of 35-45 years. The prevalence of periodontal diseases at the age of 40, in general, is 94.3%. Periodontal diseases cause serious complications in the body as a whole and are one of the most complex pathologies in terms of therapy, during which complex treatment is often necessary [4-7].

Most medications used in the treatment of periodontal diseases contain broad-spectrum antibiotics, which contribute to the appearance of dysbiosis in the oral cavity. In this regard, it becomes necessary to create a drug with minimal risk of side effects [8-11].

Therefore, the main goal of our work was to develop a rational composition of a soft dosage form - an ointment with bactericidal, anti-inflammatory and regenerating effects [12-15].

## 2 Method

The work used such research methods as biopharmaceutical (diffusion into gelatin gel), pharmaceutical and technological (study of thermal and colloidal stability of ointment), Physico-chemical (quantitative determination of flavonoids in terms of rutoside) and microbiological (study of specific activity – bactericidal action) [16].

## 3 Results and Discussion

At the first stage of our research, a complex alcohol extraction was obtained from medicinal plant raw materials: Japanese sophora fruits, flower marigolds and nettle leave. On the basis of experimental studies, optimal extraction parameters were determined:

extractant – ethyl alcohol 50%;

the degree of grinding of raw materials – 2 mm;

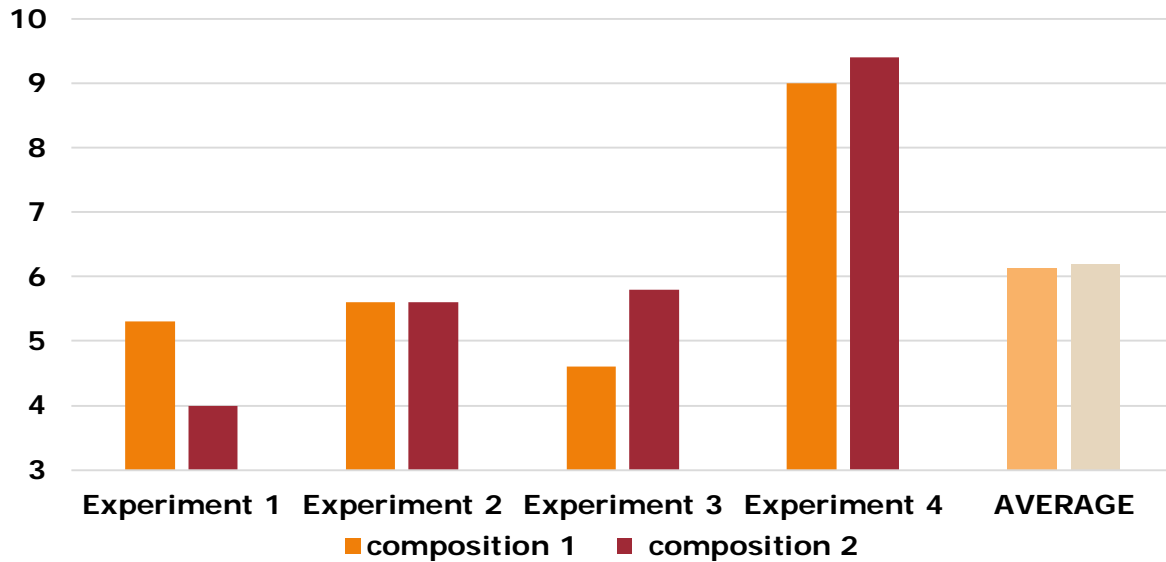
raw material ratio: extractant – 1:10;

the extraction method is fractional maceration followed by evaporation of extraction to half the volume.

Water extraction from oak bark was obtained using the traditional technology of making decoctions, which was also subsequently evaporated to half the volume.

Model samples of ointments, including, in addition to the obtained phytocompositions, lysozyme and sea buckthorn oil, were prepared according to generally accepted technology. Samples obtained using carbopol gel 1% and sodium alginate 6% did not withstand the quality assessment: the gels were stratified, represented heterogeneous systems.

The results of a biopharmaceutical study on the selection of the optimal composition (gelling agents methylcellulose 6% (composition 1) and polyethylene oxide base 7:3 (composition 2)) are shown in Figure 1. The studies were conducted in 4 repetitions.

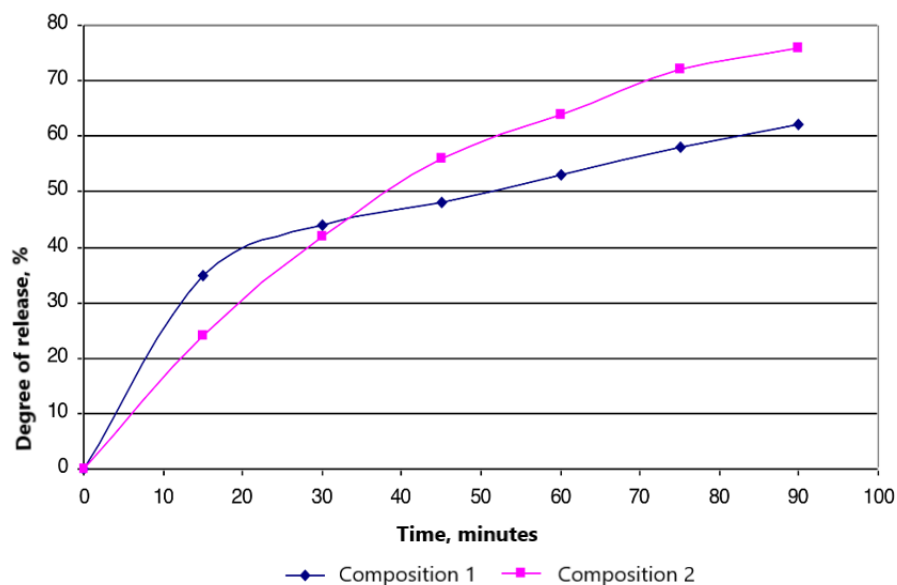


**Figure 1:** Release of flavonoids in 3% gelatin gel (iron III chloride reagent): composition 1 (gelling agents methylcellulose 6%); composition 2 (polyethylene oxide base 7:3)

It follows from Figure 1 data that the staining zones of the model ointment samples of composition 1 (based on methylcellulose) and composition 2 (polyethylene oxide base) are approximately the same, so both of the considered compositions are taken by us for further research.

The release of flavonoids from the studied compositions 1 and 2 was carried out by the Kravchinsky equilibrium dialysis method, while cellophane of the kuprofan brand was used as a semipermeable membrane, ethyl alcohol 50% served as the dialysis medium. The system was additionally sealed, and thermostatically controlled and samples were taken at specified intervals. The quantitative content of flavonoids in the sample was determined spectrophotometrically in terms of rutoside.

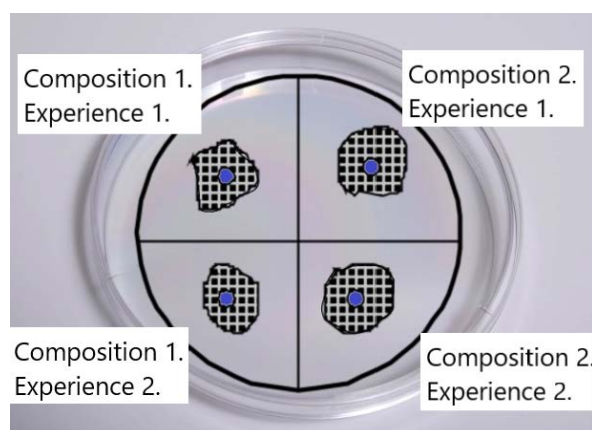
The results of the experiment are shown in Figure 2.



**Figure 2:** Results of biopharmaceutical research by dialysis through a semipermeable membrane

From the data in Figure 2, it can be seen that the highest degree of flavonoid release has a composition of 2 – 76%, which is 14% more than that of composition 1.

The optimal composition was also selected according to the delay zone – the manifestation of bactericidal activity. The study was carried out by the "well" method on a nutrient medium impregnated with culture obtained from the oral cavity of patients with periodontal diseases. The evaluation criterion was the growth inhibition zone around the "well", due to the ability of the ointment to suppress the growth of colonies of microorganisms by diffusion into the nutrient medium. The results of the experiment are shown in Figure 3.



**Figure 3: Microbial retention zones**

Note: Composition 1. Experience 1 – the diameter of the inhibition zone – 2.6; experience 2 - the diameter of the inhibition zone - 2.8;

Composition 2. Experience 1 - the diameter of the inhibition zone - 3.0; experience 2 - the diameter of the inhibition zone - 3.2.

It follows from the data in the figure that the greatest delay in the growth of microorganisms on the nutrient medium meat-peptone broth corresponds to composition 2.

When conducting research on colloidal (centrifugation) and thermal (heating and freezing) stability, model composition 1 was stratified and became unusable. Therefore, the composition of ointment 2 is recognized by us as the optimal composition.

## 4 Conclusion

Thus, on the basis of comprehensive experimental studies, we have proposed the optimal composition of ointment based on phytocomponents (Japanese sophora fruits, flower marigolds, nettle leaves, oak bark, sea buckthorn fruits) and lysozyme. This composition of the ointment can be used for subsequent research on the development of a domestic medicinal product for the treatment of periodontal disease.

## 5 Availability of Data and Material

Data can be made available by contacting the corresponding author.

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