ISSN 2228-9860 eISSN 1906-9642 CODEN: ITJEA8

International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies

http://TuEngr.com

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

Valeria Maksimovna Grezina[1], Aslanbek Borisovich Buraev[2], Victoria Olegovna Medicari[2], Nikolai Olegovich Remizov[3], Fatima Ruslanovna Bichekueva[1], Muminat Abduragimovna Nugaeva[4], Diana Abubakarovna Tatarkhanova[5], Madina Tamerlanovna Urtaeva[2], Anna Ruslanovna Kubatieva[1], Labazanova Shuainat Gadzhimuradovna[4]

[1]Rostov State Medical University, Rostov-on-Don, RUSSIA.
[2]North Ossetian State Medical Academy, Vladikavkaz, Republic of North Ossetia-Alania, RUSSIA.
[3]Moscow State University of Medicine and Dentistry Named After A. I. Evdokimov, Moscow, RUSSIA.
[4]Dagestan State Medical University, Makhachkala, Republic of Dagestan, RUSSIA.
[5]Tyumen State Medical University, Tyumen, RUSSIA.
**Corresponding Author (Tel: +79183500889, Email: ruslankalmykov777 @yandex.ru).*

Paper ID: 13A11U

Volume 13 Issue 11

Received 15 April 2022
Received in revised form 15 July 2022
Accepted 22 July 2022
Available online 29 July 2022

Keywords:
Periodontal disease; Ointment; Extraction; Semipermeable membrane; Release of flavonoids

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

Cite This Article:

Grezina, V.M., Buraev, A.B., Medicari, V.O., Remizov, N.O., Bichekueva, F.R., … , Gadzhimuradovna, L.Sh. (2022) Development of the composition and technology of soft dosage forms for periodontal treatment. *International Transaction Journal of Engineering, Management, & Applied Sciences & Technologies, 13*(11), 13A11U, 1-6. http://TUENGR.COM/V13/13A11U.pdf DOI: 10.14456/ITJEMAST.2022.231

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.

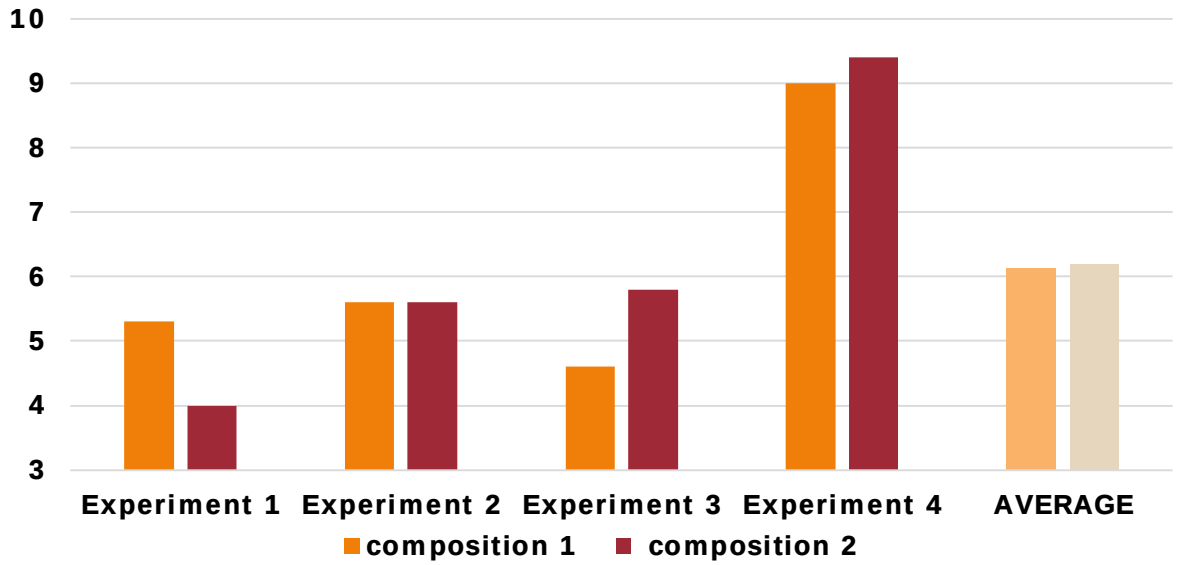

Figure 1: Release of flavonoids in 3% gelatin gel (iron III chloride reagent): composition 1 (gelling agents methylcellulose 6%); composition 2 (polyethylene oxide base 7:3)

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 Kruvchinsky 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.

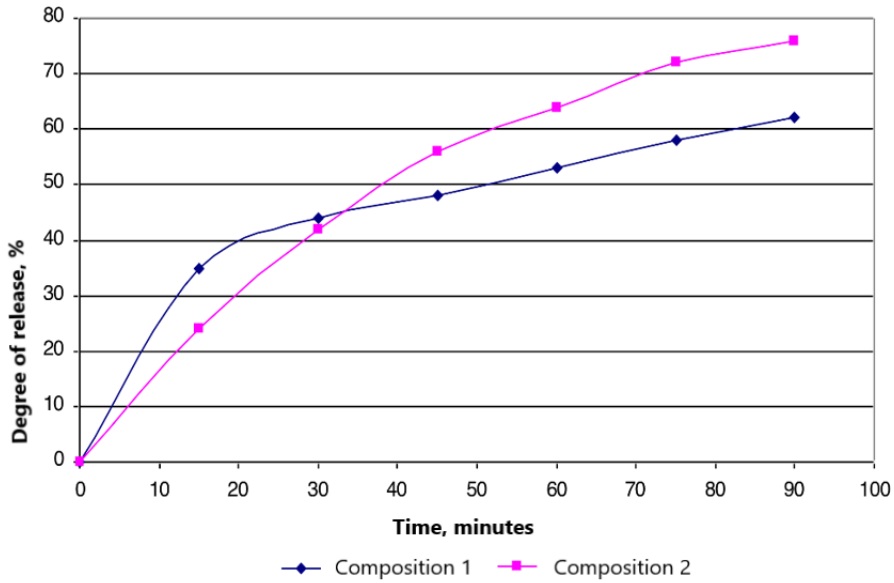

Figure 2: Results of biopharmaceutical research by dialysis through a semipermeable membrane

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.

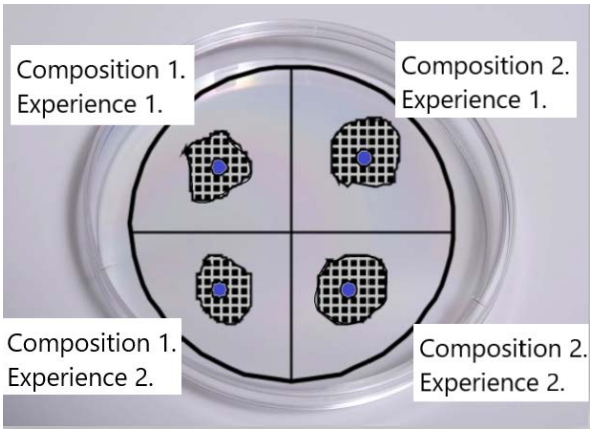

Figure 3: Microbial retention zones
Note: Composition 1. Experience 1 – the diameter of the inhibition zone – 2.6;
experience 2 - the diameter of the inhibition zone - 2.8;

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.

6 References

[1] Slots J. Primer on etiology and treatment of progressive/severe periodontitis: A systemic health perspective. Periodontology 2000. 2020 Jun;83(1):272-6.

[2] Heyman L, Houri-Haddad Y, Heyman SN, Ginsburg I, Gleitman Y, Feuerstein O. Combined antioxidant effects of Neem extract, bacteria, red blood cells and Lysozyme: possible relation to periodontal disease. BMC complementary and alternative medicine. 2017 Dec;17(1):1-8.

[3] Blinov AV, Nagdalian AA, Povetkin SN, Gvozdenko AA, Verevkina MN, Rzhepakovsky IV, Lopteva MS, Maglakelidze DG, Kataeva TS, Blinova AA, Golik AB. Surface-Oxidized Polymer-Stabilized Silver Nanoparticles as a Covering Component of Suture Materials. Micromachines. 2022 Jul;13(7):1105.

[4] Siddiqui SA, Bahmid NA, Taha A, Khalifa I, Khan S, Rostamabadi H, Jafari SM. Recent advances in food applications of phenolic-loaded micro/nanodelivery systems. Critical Reviews in Food Science and Nutrition. 2022 Mar 22:1-21.

[5] Yoshinuma NA, Nozawa TA, Okutsu SE, Arai SH, Satoh S, Fujikawa KE, Ito KO, Murai SE. Clinical effects of chewing gum containing egg-white lysozyme and mace extract. Nihon Shishubyo Gakkai Kaishi. 1989 Sep 1;31(3):941-7.

[6] Sela MN. Effect of human leukocyte extracts and gingival exudate on periodontopathic bacteria. Inflammation. 1983 Jun;7(2):205-12.

[7] TN A, ZD S. A pharmacodynamic study of a new gel containing an extract of Aloe vera and an extract of oak bark for potential treatment of periodontal diseases. Ceska a Slovenska Farmacie: Casopis Ceske Farmaceuticke Spolecnosti a Slovenske Farmaceuticke Spolecnosti. 2020 Jan 1;69(3):143-8.

[8] Rauf A, Abu-Izneid T, Olatunde A, Ahmed Khalil A, Alhumaydhi FA, Tufail T, Shariati MA, Rebezov M, Almarhoon ZM, Mabkhot YN, Alsayari A. COVID-19 pandemic: epidemiology, etiology, conventional and non-conventional therapies. International Journal of Environmental Research and Public Health. 2020 Nov;17(21):8155.

[9] Orsaeva AT, Tamrieva LA, Mischvelov AE, Osadchiy SS, Osipchuk GV, Povetkin SN, Simonov AN. Digital clinic “smart ward. Pharmacophore. 2020;11(1):142-146

[10] Dotsenko EV, Dmitrieva LA, Chekmareva MS, Fedoriuk LF. Ispol'zovanie ortofensoderzhashcheĭ pasty v kompleksnom lechenii zabolevaniĭ parodonta [The use of an ortofen-containing paste in the combined treatment of periodontal diseases]. Stomatologiia (Mosk). 1990 Sep-Oct;(5):24-6. Russian.

[11] Sadyrin E, Swain M, Mitrin B, Rzhepakovsky I, Nikolaev A, Irkha V, Yogina D, Lyanguzov N, Maksyukov S, Aizikovich S. Characterization of enamel and dentine about a white spot lesion: mechanical properties, mineral density, microstructure and molecular composition. Nanomaterials. 2020 Sep 21;10(9):1889.

[12] Graziani F, Karapetsa D, Alonso B, Herrera D. Nonsurgical and surgical treatment of periodontitis: how many options for one disease?. Periodontology 2000. 2017 Oct;75(1):152-88.

[13] Galabueva AI, Biragova AK, Kotsoyeva GA, Borukayeva ZK, Yesiev RK, Dzgoeva ZG, Okolelova AI, Simonov AN, Povetkin SN, Mishvelov AE. Optimization of modern methods of treating chronic generalized periodontitis of mild severity. Pharmacophore. 2020 Jan 1;11(1):47-51.

[14] Remizova AA, Dzgoeva MG, Tingaeva YI, Hubulov SA, Gutnov VM, Bitarov PA. Tissue dental status and features of periodontal microcirculation in patients with new covid-19 coronavirus infection. Pharmacophore. 2021 Mar 1;12(2):6.

[15] Kotsoeva GA, Esiev RK, Toboev GV, Zakaeva RS, Kulova AA, Tsokova LV. Phytoadaptogenic cocktail use" Biorithm-E" in the complex treatment of odontogenic inflammatory diseases of the maxillofacial region. Ann. Dent. Spec. 2021 Apr;9(2):52-7.

[16] Walker CB, Gordon JM, Magnussen I, Clark WB. A role for antibiotics in the treatment of refractory periodontitis. Journal of periodontology. 1993 Aug;64:772-81.

Valeria Maksimovna Grezina is a student of Rostov State Medical University, Rostov-on-Don, Russia

Aslanbek Borisovich Buraev is a student of North Ossetian State Medical Academy, Vladikavkaz, Republic of North Ossetia-Alania, Russia

Victoria Olegovna Medicari is a student of North Ossetian State Medical Academy, Vladikavkaz, Republic of North Ossetia-Alania, Russia

Nikolai Olegovich Remizov is a student at Moscow State University of Medicine and Dentistry Named After A. I. Evdokimov, Moscow, Russia.

Fatima Ruslanovna Bichekueva is a student of Rostov State Medical University, Rostov-on-Don, Russia

Muminat Abduragimovna Nugaeva is a student of Dagestan State Medical University, Makhachkala, Republic of Dagestan, Russia

Diana Abubakarovna Tatarkhanova is a student of Tyumen State Medical University, Tyumen, Russia

Madina Tamerlanovna Urtaeva is a student of North Ossetian State Medical Academy, Vladikavkaz, Republic of North Ossetia-Alania, Russia

Anna Ruslanovna Kubatieva is a student of Rostov State Medical University, Rostov-on-Don, Russia

Labazanova Shuainat Gadzhimuradovna is a student of Dagestan State Medical University, Makhachkala, Republic of Dagestan, Russia