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SCIENCE AND INNOVATION OF MODERN WORLD

PROCEEDINGS OF VI INTERNATIONAL SCIENTIFIC AND PRACTICAL CONFERENCE FEBRUARY 23-25, 2023

LONDON
2023

SCIENCE AND INNOVATION OF MODERN WORLD

Proceedings of VI International Scientific and Practical Conference

London, United Kingdom

23-25 February 2023

London, United Kingdom

2023

UDC 001.1

The 6th International scientific and practical conference "Science and innovation of modern world" (February 23-25, 2023) Cognum Publishing House, London, United Kingdom. 2023. 827 p.

ISBN 978-92-9472-194-5

The recommended citation for this publication is:

Ivanov I. Analysis of the phaunistic composition of Ukraine // Science and innovation of modern world. Proceedings of the 6th International scientific and practical conference. Cognum Publishing House. London, United Kingdom. 2023. Pp. 21-27. URL: https://sci-conf.com.ua/vi-mizhnarodna-naukovo-praktichna-konferentsiya-science-and-innovation-of-modern-world-23-25-02-2023-london-velikobritaniya-arhiv/.

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PHARMACEUTICAL SCIENCES

UDC 615.454.2:615.225,.011-047.37

STUDY OF STRUCTURAL AND MECHANICAL PROPERTIES OF SUPPOSITORY COMPOSITIONS WITH PENTOXIFYLLINE

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Abstract: Presence of suppository mass on polyethylene oxide base of considerable quantity of polyethylene oxide base of considerable quantity of coagulative tics in structure, and also biggen quantity of effective toughness, than in suppository mass on adipose base, characterizes this system, as more steady system under considerable mechanical coercions arising usually during forming, packing and transportation of suppository. It has been established, that toughness of both systems diminishes with increasing of the speed of displacement, and the quantity of tangent strain of displacement increases. All this testifies about presence of structure in studing suppositoriac masses.

Key words: pentoxifylline, suppository, dispersion analysis, structural and mechanical parameters, mechanical stability.

Structural and mechanical characteristics significantly affect the processes of release and absorption of drugs from suppositories, as well as their quality indicators.

In the manufacture of suppositories, as well as in their use by the patient there are efforts similar to those that occur during the shift of the viscous-plastic material in a rotary viscometer at a certain rate of shift and can be recorded instrumentally [1, 2].

Suppositories show a non-Newtonian nature of fluidity, so the shear stress is not a value directly proportional to the shear rate. To set the range of shear stresses that provide optimal quality characteristics, it is necessary to set the shear rate that determines this process.

Pentoxifylline is a xanthine derivative with vasodilatory activity, which improves the microcirculation by increasing of erythrocyte flexibility and reducing blood viscosity and decreases the ability for platelet adhesion and aggregation and thrombus formation [3].

Experimental part

Comparative determination of structural and mechanical parameters of suppositories with pentoxifylline on polyethylene oxide and fat bases was performed using a viscometer «Reotest-2» with conical plate equipment. The results of the definitions are given in table 1.

Table 1

The value of the ultimate shear stress and the effective viscosity of the suppository mass with pentoxifylline on polyethylene oxide and fat bases

Gradient Shift, $Дс^{-1}$	Shear limit voltage, N/m^2	Effective viscosity, Pa·s	Shift gradient, $Дс^{-1}$	Shear limit voltage, N/m^2	Effective viscosity, Pa·s
Polyethylene oxide base					
11.2	43.80	394.55	180.1	85.14	47.25
20.1	64.48	322.34	100.1	72.99	72.99
33.4	94.89	284.64	60.1	63.24	105.43
60.1	149.62	249.41	33.4	49.86	149.61
100.1	187.33	187.33	20.1	38.93	194.63
180.1	231.12	128.27	11.2	27.99	252.07
Fat base					
11.2	6.57	59.07	4860.1	2.42	0.04
20.1	9.38	46.88	2700.1	2.42	0.08
33.4	10.45	31.34	1620.1	2.42	0.13
60.1	11.79	19.65	900.1	2.42	0.28
100.1	13.13	13.13	540.1	1.89	0.34
180.1	15.1	8.33	300.1	1.15	0.47
300.1	16.61	5.54	180.1	1.13	0.63
540.1	19.29	3.58	100.1	0.81	0.81
900.1	23.04	2.57	60.1	0.58	0.97
1620.1	25.45	1.58	33.4	0.41	1.22
2700.1	26.25	0.98	20.1	0.25	1.22
4860.1	26.23	0.55	11.2	0.07	0.73

It has been found that as the shear rate increases, the viscosity of the systems decreases and the contact shear stress increases. This indicates the presence of structure in the suppository masses.

Based on the results of the dependence of the tangential shear stress on the strain rate, rheograms of the fluidity of suppository masses were constructed (Figs. 1, 2).

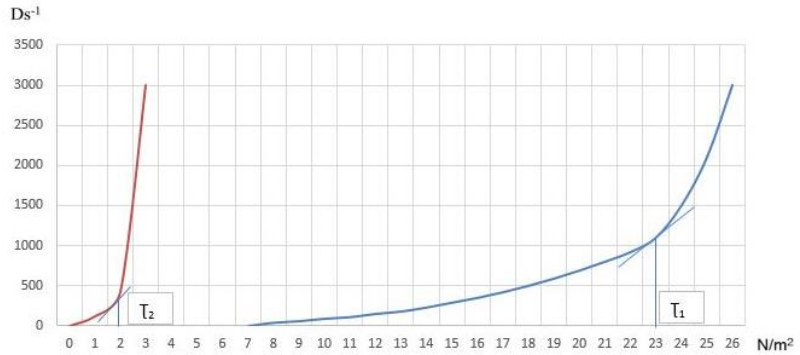

Fig. 1. Fat flow diagram of suppository mass with pentoxifylline on a fat basis

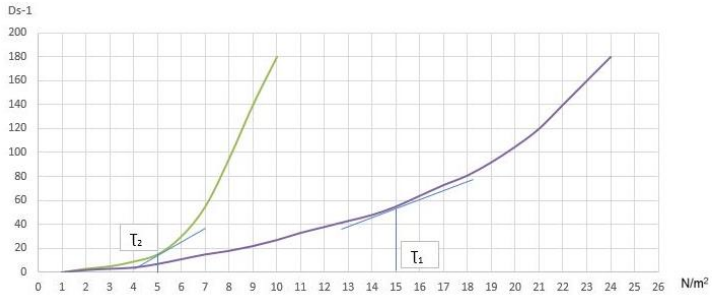

Fig. 2. Rheogram of fluidity of suppository mass with pentoxifylline on a polyethylene oxide basis

Fluidity in the studied systems does not appear suddenly, but only after certain efforts required to break the structural elements. The value of this force for the suppository mass on a polyethylene oxide basis exceeds that for the suppository mass on a fat basis in 6.67 times, which confirms the significant mechanical strength of the mass of pentoxifylline on a polyethylene oxide basis.

The tangential shear stress for the fat-based system increases to 26.24 N / m2, followed by a section of line that indicates the destruction of the structure. During the period of decreasing shear stress, the viscosity of the investigated system is

practically not restored, which, together with the largest difference between the ascending and descending curves, indicates the dominance of non-reducing condensation bonds in the system.

The set value of «mechanical stability» is 18.67, which indicates the irreversible nature of deformations in the fat-based system and its possible instability during long-term storage.

Analysis of the rheogram for a suppository based on polyethylene oxide showed that although the ascending and descending parts do not form «hysteresis loops», but the gentle, without a straight line, the nature of the descending curve indicates the dominance of viscoplastic properties. The value of «mechanical stability» for the studied system (3,0) indicates the presence in the structure of reversible thixotropic bonds, which are restored after the application of significant deformation forces and, accordingly, predicts the stability of such a system during long-term storage.

The presence in the structure of the suppository mass on a polyethylene oxide basis of a significant number of coagulation bonds, as well as greater effective viscosity than the suppository mass on a fat basis, characterizes this system as the most stable under significant mechanical impact, which usually occurs when formation, packaging and transportation of suppositories.

Conclusions

1. It is established that the fluidity in the studied systems does not start suddenly, but only after certain efforts required to break the structural elements. The value of this force for the suppository mass on a polyethylene oxide basis exceeds that for the suppository mass on a fat basis in 6.67 times, which confirms the significant mechanical strength of the mass of pentoxifylline on a polyethylene oxide basis.

2. The value of "mechanical stability" for the studied system (3,0) indicates the presence in the structure of reversible thixotropic bonds, which are restored after the application of significant deformation forces and, accordingly, predicts the stability of such a system during long-term storage.

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