TEXTURE AND VISCOELASTICITY OF VARIOUS PHARMACEUTICAL GELS BASED ON PROPOLIS

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Abstract

Hydrogels can be soft or have a certain resistance to compression or traction. The hydrogel is constructed in such a manner that it allows the regeneration of the tissues and the formation of blood vessels, at a very accelerated pace. The faster the healing process occurs, the lower the chances of any visible scaring are. The importance of a dermatological product's tensile strength on teguments is widely acknowledged, because only one with an appropriate consistency can be applied under optimal conditions. The gel is defined as a soft, or semisolid or solid like material, which has both solid and liquid components, where the solid component present as a mesh/network of aggregates,which immobilizes the liquid component. This solid network prevents the liquid from flowing by increasing the surface tension. They have wide range of properties ranging from soft and weak to hard and tough. Gels by weight are mostly liquid, but they behave as solids due to their three dimensional cross-linked network within the liquid. In other words, gels are dispersion of liquid molecules in solid in which the solid is the continuous phase and liquid is the stationary phase.

Keywords: propolis, buffer solutions, carbopol gel, tincture

INTRODUCTION

Formulation characteristics, including viscosity and elasticity are the most important factors in the development and final behavior of semisolid preparations (Jones et al, 1997, Popovici, 1980).

An organogel, a viscoelastic system, can be regarded as a semi-solid preparation which has an immobilized external apolar phase. The apolar phase is immobilized within spaces of the three-dimensional network structure formed due to the physical interactions amongst the self-assembling structures of compounds regarded as gelators. In general, organogels are thermodynamically stable in nature and have been explored as matrices for the delivery of bioactive agents (Sahoo S. et al, 2011).

Hydrogel is a transparent, viscoelastic and thermo dynamically stable system consisting of a polar solvent and a polymer, where polar solvent is the external phase. The polymer which are of synthetic or natural origin assemble to form a three dimensional network which can absorb and retain significant amount of water (Ur-Rehman et al, 2011). The hydrogel is constructed in such a manner that it allows the regeneration of the tissues and the formation of blood vessels, at a very accelerated pace.

The faster the healing process occurs, the lower the chances of any visible scaring are (Predescu et al, 2001, Simionovici, 1983, Dumitru, 1982,

Idson et al, 1978). Hydrogels are one of the upcoming classes of polymer based controlled release drug delivery systems.

Polymeric drug delivery systems have been extensively studied in order to solve the potential problems associated with drugs or bioactive molecules including toxicity, site dependence, low effectiveness, poor solubility, short half-life, rapid degeneration and rapid clearance from the body (Ur-Rehman et al, 2011, Salerno et al, 2010, Baboota et al, 2007,)

Propolis is a sticky dark-colored material that honeybees collect from living plants, mix it with wax and use it in the construction and adaptation of their nests, mainly to fill out cracks in the bee hive.

It has been used in folk medicine since ancient times and is now known to be a natural medicine with antibacterial, antifungal, antitumoral, antioxidative, imunomodulatory and other beneficial activities (Burdock G.A., 1998, Pallag A.,2013).

The propolis, in alcoholic solution, serves as a natural antibiotic and an excellent anti-inflammatory. We can find even 5% of propolis mixed with honey being sold (Bogdanov, 2006, Haro et al, 2000, Markham et al, 1996, Marcucci, 1995, Pallag A et al., 2011).

The propolis tincture, from the firm Hofigal Bucharest, was incorporated in the base. As specified on the label, the product has a minimum alcoholic concentration of 50%.

MATERIALS AND METHODS

The viscosity and rheograms of the gels were determined with the help of the 2.5 Rheotest rotating viscometer. The following rheological parameters were calculated. The dynamic viscosity:

$$\eta = \frac{\tau_r}{\Delta_r} \cdot 100 \quad [cP]$$

where $\Delta_r[s^{-1}]$ is the velocity gradient, depends on the geometrical characteristics of the cylinders and is directly proportional to the number of revolutions of the interior cylinder (Neacșu, 2002, Rawhi et al, 2002, Joean, 1997). The propolis tincture, from the firm Hofigal Bucharest, was incorporated in the base.

As specified on the label, the product has a minimum alcoholic concentration of 50%. It's state is that of a clear, yellowish – brown liquid, with a characteristic smell and a pH of 5.4.

Externally, it is indicated in eczemas, burns, frostbites, wounds, ulcerations having an antimicrobial, healing and anti-inflammatory effect (Romanian Pharmacopeia, 2008, U.S. Pharmacopeia, 2006).

Hydrogel quality control: The quality of the hydrogels that were made (after 24 hours since their preparation) was tracked in order to select the best

formulas. The products were kept in appropriate containers, tightly sealed, at room temperature (a maximum of 25º C) (Garcia-Viguera et al, 1993).

The following control tests were performed:

- the determination of the organoleptic characteristics (Romanian Pharmacopeia, 2008);
- the determination of the pH;
- the determination of the tensile strength;
- the rheological study

RESULTS AND DISSCUTIONS

The pH was determined as follows: 2 g of the sample was dispersed in 10 g of distilled water, then the mixture was filtered and the potentiometric pH was determined during the aqueous phase (Cvek et al, 2007, Nyiredi, 2001, Bankova et al, 1982, Bungău et al, 2015).

The importance of a dermatological product's tensile strength on teguments is widely acknowledged, because only one with an appropriate consistency can be applied under optimal conditions. The test was carried out with the Ojeda-Arbussa method (Codruta et al, 2010, Garcia-Viguera et al, 1993).

One gram of sample is placed on the lower glass plate, after which it is covered on top with the second plate. The diameter of the circle, which constitutes the sample after being subjected to pressure, is determined. After equal intervals of time (1 minute), weights are brought on the superior plate, in an ascending order (40 g, 100 g, 250 g) and the diameters of the newly formed circles are read. Afterwards the surfaces of the circles are calculated.

In figure 1 can observe the rheological profiles of the analyzed propolis tincture.

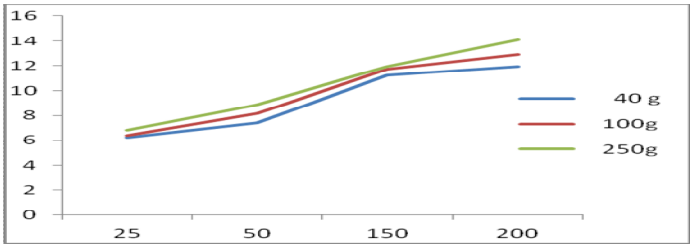

Fig 1 Tension variation calculated with formula 1

CONCLUSSIONS

By looking at the rheograms presented in the experimental part of the paper, one can notice that, as the rotating time increases so does the shear stress.

For low shear stresses, the viscosity is high and, with the increase of the shear stress, the viscosity of the gels decreases.

The rheological properties of the gels vary depending on their composition. The best tension surface values were recorded for gels 1 and and 3.

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