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## **MECHANICAL PROPERTIES OF HYDROGELS AND AUTOMATED SYSTEM “KERN-DP”**

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### **ABSTRACT**

The static elastic module  $E$  at compression, at extension; elastic limit  $\sigma_E$ , effective fluidity limit  $\sigma_{fl}$ ; strength limit at compression  $\sigma_{st}$  for the radiation cross-linked hydrogel + 5, 6, 8, 10% polyvinyl alcohol were measured. The values of static module  $E$ , elastic limit  $\sigma_E$ , effective fluidity limit  $\sigma_{fl}$ , strength limit at compression  $\sigma_{st}$  of the radiation cross-linked hydrogels are determined by the formation of the polyvinyl alcohol molecules nanoclusters. The optimum compositions of initial hydrogels and electronic irradiation regimes, which allow making the radiation cross-linked hydro polymeric composites with the necessary characteristics at the radiation doses, were found. The software “KERN-DP” is developed for the automated system of anisotropy parameters analysis.

**Keywords:** mechanical characteristics, hydrogel, deformation, strength limit, elastic module.

### **INTRODUCTION**

Bandages from the radiation cross-linked hydrogels (CLHG) show by itself elastic films with thickness  $h = 2\div 4 \times 10^{-3}$  m - transparent jelly sterile material, that with  $C = 85\div 90\%$  consists of distillate water. Such bandages for wounds for the grant of the urgent help at bleeding, burns must be biologically compatible and not stick to the wounds. They can contain antiseptic, anaesthetic, haemostatic. The optimum compositions of initial hydrogels and electronic irradiation regimes, which allow making the radiation cross-linked hydro polymeric composites with the necessary characteristics at the radiation doses, were found. The software “KERN-DP” is developed for the automated system of anisotropy parameters analysis [1,2].

### **RESULTS AND DISCUSSION**

The CLHG hydrophilicity and gas-penetrability were investigated as the function of their chemical composition and terms of electrons irradiation. The optimum compositions of initial hydrogels and electronic irradiation regimes, which allow to make the radiation cross-linked hydro polymeric composites with the necessary characteristics at the radiation doses  $D = 2,5\div 10$  Mrad were found. It allows attaining the surgical sterility level ( $10^{-6}$ ) of the made material without substantial influence on pharmaceutical facilities properties at RSHG composition.

It is 3D polymeric net - is the sponge with the pores size  $d \leq 10^3$  nm, because it contains distillate water, assumes the diffusion of solutions, but does not skip the bacteriums. The

static elastic module  $E \approx 147,3$  KPa at compression,  $E \approx 105,3$  KPa at extension; elastic limit  $\sigma_E \approx 38$  KPa, effective fluidity limit  $\sigma_{fl} \approx 82$  KPa; strength limit at compression  $\sigma_{st} \approx 145$  KPa for the radiation cross-linked hydrogel + 10% polyvinyl alcohol  $(C_2H_4O)_n$ , Figure 1.

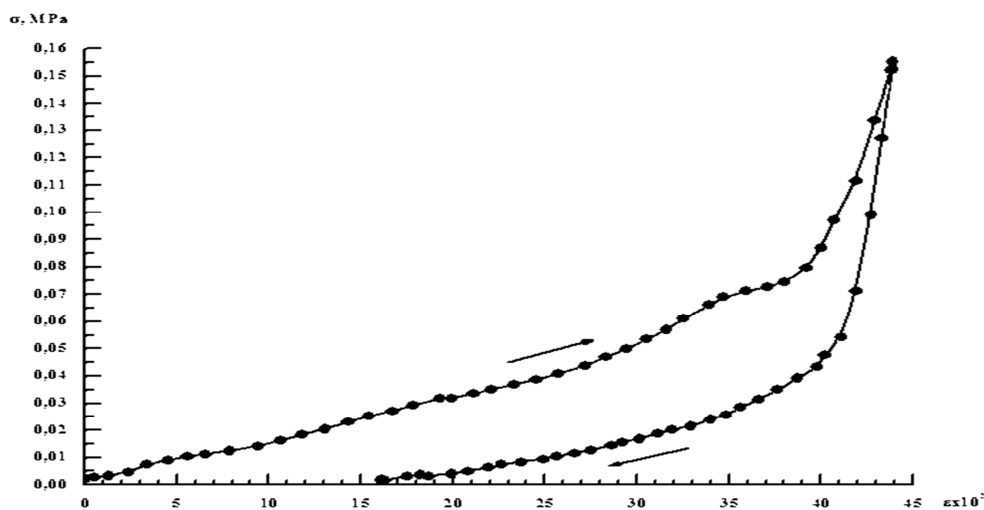


Fig. 1 - Diagram of strain - deformation  $\sigma - \epsilon$  of radiation cross-linked hydrogel + 10%  $(C_2H_4O)_n$ .

Concentration dependence of static elastic module  $E$ , strength limit at compression  $\sigma_{st}$ , elastic limit  $\sigma_E$  radiation cross-linked hydrogel + %  $(C_2H_4O)_n$  are represented in Figure 2, in consequence of the formation of the polyvinyl alcohol molecules nanoclusters.

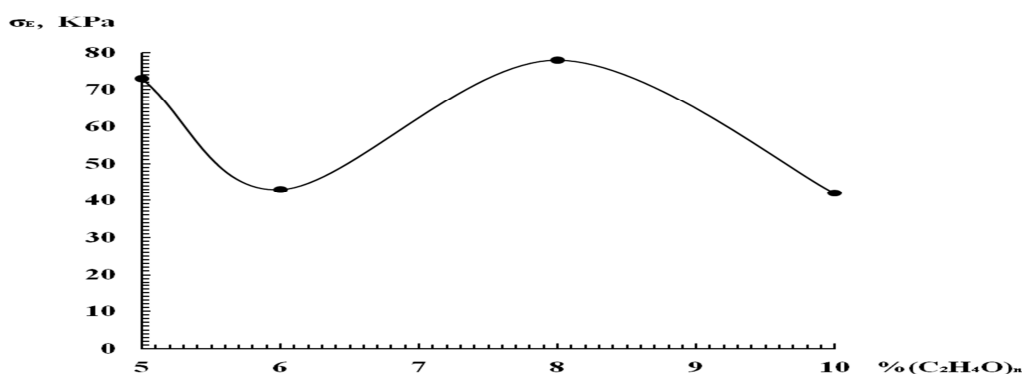


Fig. 2 - Concentration dependence of elastic limit  $\sigma_E$  radiation cross-linked hydrogel + %  $(C_2H_4O)_n$ .

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