Gelatinous-alginate sponge as the drug delivery for implantation

J.Pluta¹, D.Haznar¹, A.Owczarek¹, B.Żywicka², M.Szymonowicz², S.Pielka², L.Solski²

¹ Department of Applied Pharmacy, Wrocław Medical University, Szewska 38, 50-139 Wrocław
² Department of Experimental Surgery and Biomaterials Research, Poniatowskiego 2, 50-326 Wrocław

The application of polymer drugs carriers enables significant modifications in the pharmacokinetics (solubility, time and profile of liberation) of the active substance release from the drug form. Especially interesting seems to be polymer drug carriers use as an implants to parenteral route, such as delivery composition of bioresorbable polymers, which do not require to be removed from the human body after a drug liberation [1,2]. The study was undertaken in order to obtain a porous carrier from bioresorbable polymers – gelatine and alinate sodium salt - suitable for an implantation.

Sponges were prepared from sterilized aqueous solutions of gelatin (20% w/w) and sodium alginate (2% or 4% w/w) with the addition of two concentrations of glycerol (GL) as a the plasticizer substance. The mixture of the adequate components was frothed and next lyophilized. The obtained cylindrical mould was sliced in order to evaluate pharmaceutical properties of the sponges. The obtained sponges were assessed in vitro taking into consideration their elasticity, the degree of maintenance of the porous structure, density, sorption capacity as well as resistance to the action of proteolytic enzymes.

All the obtained preparations were cream-white in colour and had a distinct porous structure. The research revealed that the average theoretical matrix density was decreasing with the growing content of glycerol. The sorption capacity of gelatinous-alginate sponge was decreasing too with the growing glycerol content (in spite of hygroscopic properties of glycerol). The alginic acid sodium salt content only to a small extent affected the sorption capacity, but its content at the significant means grew the resistance to an action of proteolytic enzymes. We affirmed in our research of gelatinous-alginate matrix pharmaceutical properties that matrix which larger additive of alginic acid sodium salt have got more favourable properties as drug delivery with increased resistance of proteolytic enzymes action and prolongate drugs liberation.

Provisionally matrix implantation was carried out after pharmaceutical properties examination. Sponges were implanted in rats dorsum muscle and macroscopy and histological evaluation were done after 24 hours. In the macroscopy evaluation an existence of implanted matrix was not confirmed. But histological evaluation affirmed existance of matrix fragments, what was the confirmation of its resorption and degradation. Inflammatory process in the penetration zone was connected with multinuclear granulocytes, monocytes and extravasationaly erythrocyte infiltration andrevealed resorption intensity of the matrix.

Keywords: drug delivery, sponge, bioresorbable polymers