

Antimicrobial hydrogels for treatment of infected wounds

**Nadtoka S., Virych P., Doroshchuk V., Lelyushok S.,
Nadtoka O., Bezugla T., Pavlenko V., Kutsevol N.**

¹Taras Shevchenko National University of Kyiv, Volodymyrska Street, 64/13, Kyiv-01601, Ukraine.

E-mail: n.serhiy.oleks@gmail.com



Hybrid cross-linked hydrogels Dextran-grafted-Polyacrylamide with different cross-linking density were **synthesized** as promising materials of a new generation for **biomedical application**. Hybrid hydrogels have been synthesized by graft copolymerization reaction of Dextran/Dextran Sodium Sulfate and Acrylamide using N,N-methylene-bis-acrylamide as a cross-linker and cerium ammonium nitrate as an initiator (Fig.1.). To obtain antimicrobial hydrogel coverings all hydrogels were swelling in cefuroxime solution. The saturation of hydrogels with the antibiotic, as well as antibiotic desorption into the aqueous medium, was defined using the HPLC-UV method.

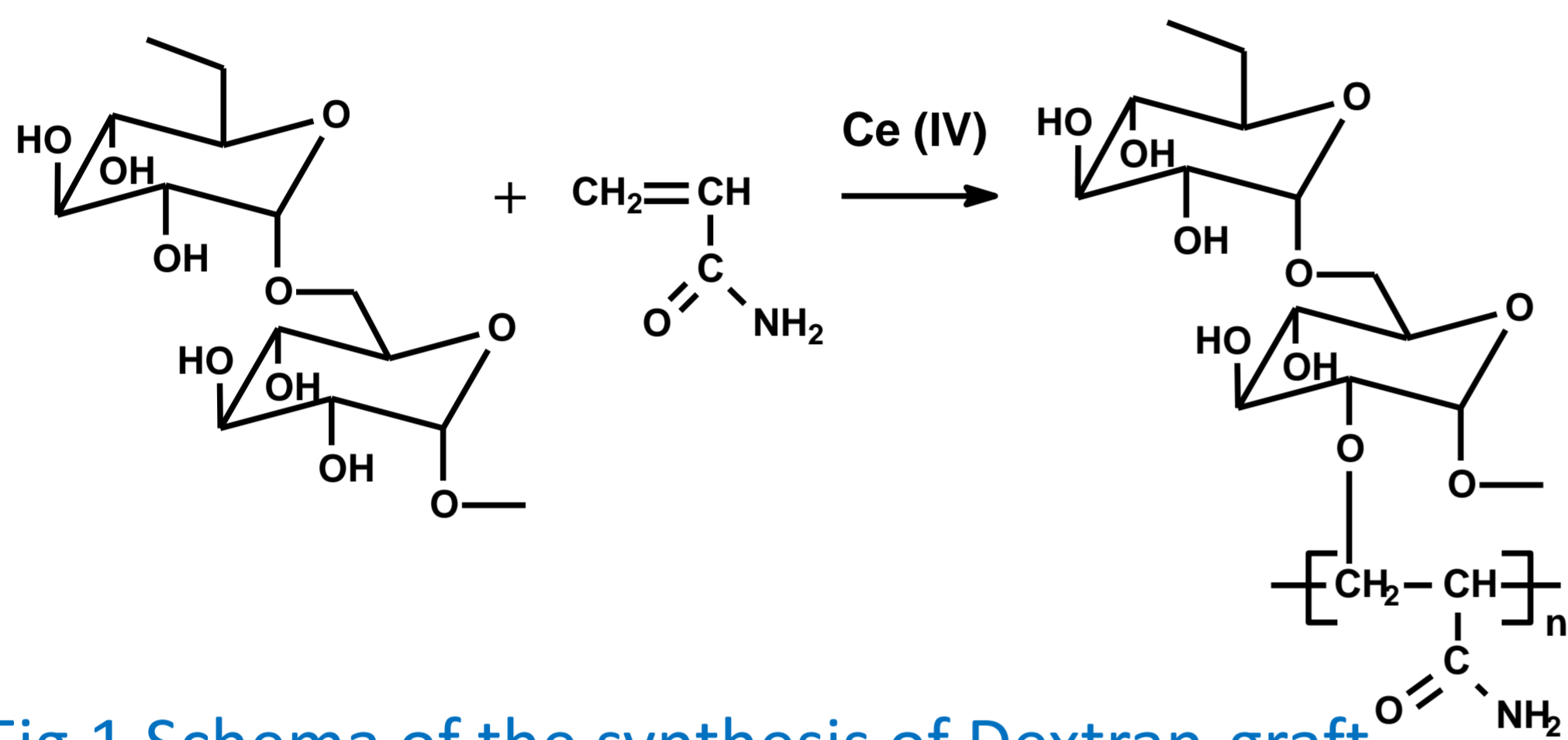


Fig.1. Schema of the synthesis of Dextran-graft-Poly (Acrylamide) (D-g-PAA)

Sorption/desorption process of antibiotic into/out off hydrogels as an important factor for regulation of therapeutic concentrations of the active substances in bacteria medium were studied.

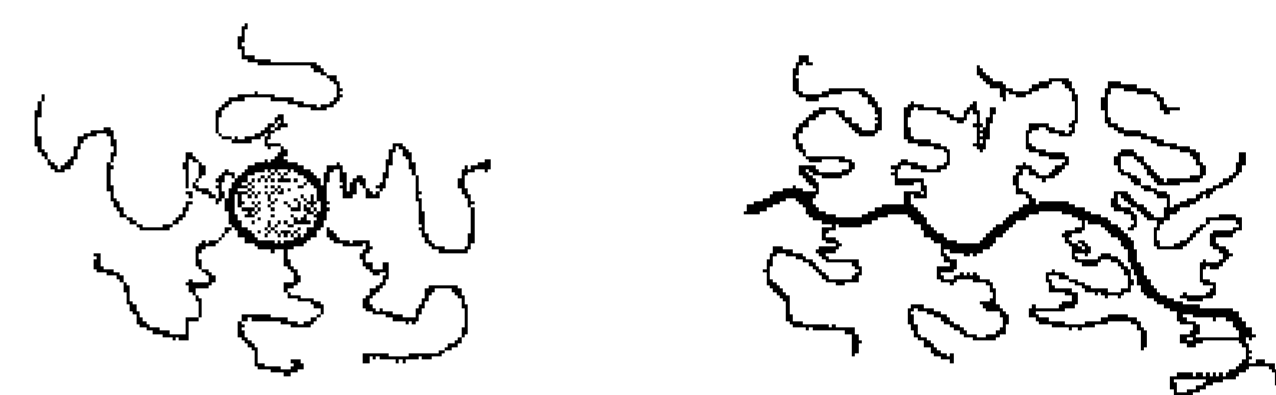


Fig.2. The sketches of the macromolecule of star-like D500-g-PAA (a) and brush-like DS500-g-PAA (b) copolymers

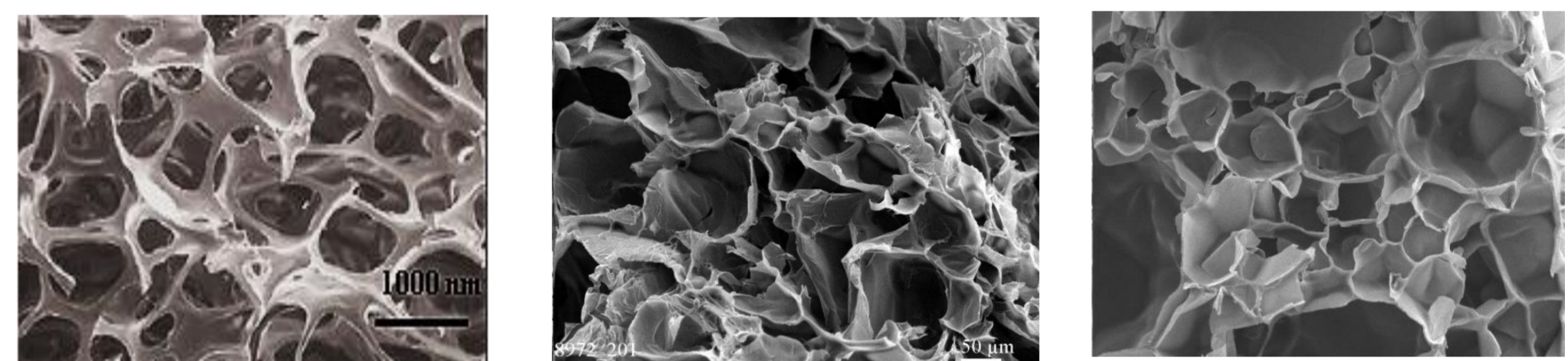


Fig.3. SEM images of cross-linked PAA (a); D500-g-PAA (b) and DS500-g-PAA (c) hydrogels

Table 1. Content of Cefuroxime in the synthesized hydrogels (g of antibiotic per g of dried hydrogel)

Sample	Content, g/g
1 D20-g-PAA-0.4-Cef	3.52
2 D100-g-PAA-0.4-Cef	3.40
3 D500-g-PAA-0.4-Cef	3.34
4 DS500-g-PAA-0.4-Cef	3.31
5 PAA-0.4-Cef	1.64

Table 2. Release of Cefuroxime (in %) from the antibiotic-loaded hydrogels into water

Sample	Time of contact		
	0.5 h	1 h	6 h
PAA-0.4-Cef	28	42	55
D20-g-PAA-0.4-Cef	24	30	42
D100-g-PAA-0.4-Cef	22	27	38
D500-g-PAA-0.4-Cef	19	34	40
DS500-g-PAA-0.4-Cef	27	37	51

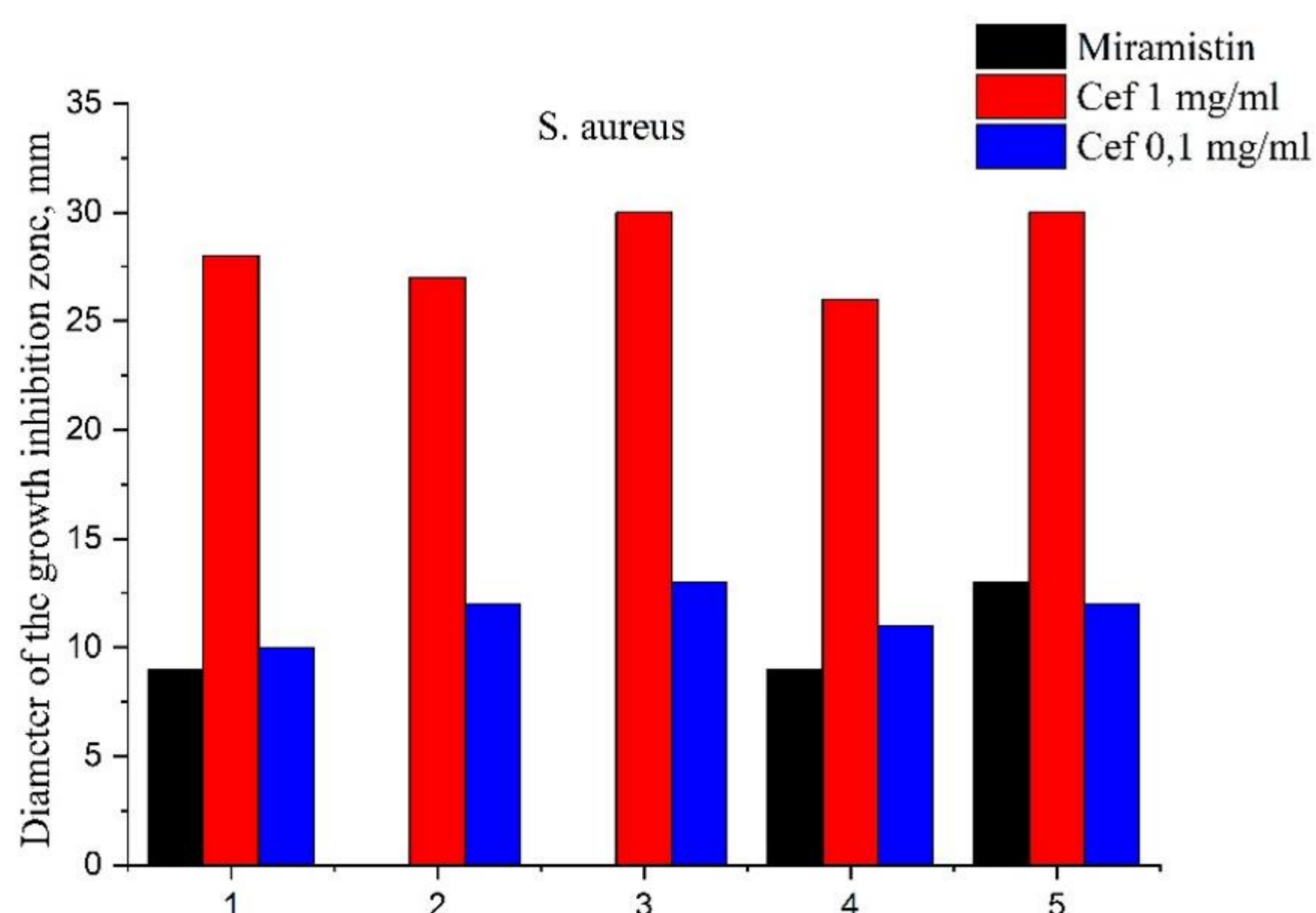


Figure 4. Activity of the antimicrobial hydrogels against *S.aureus*

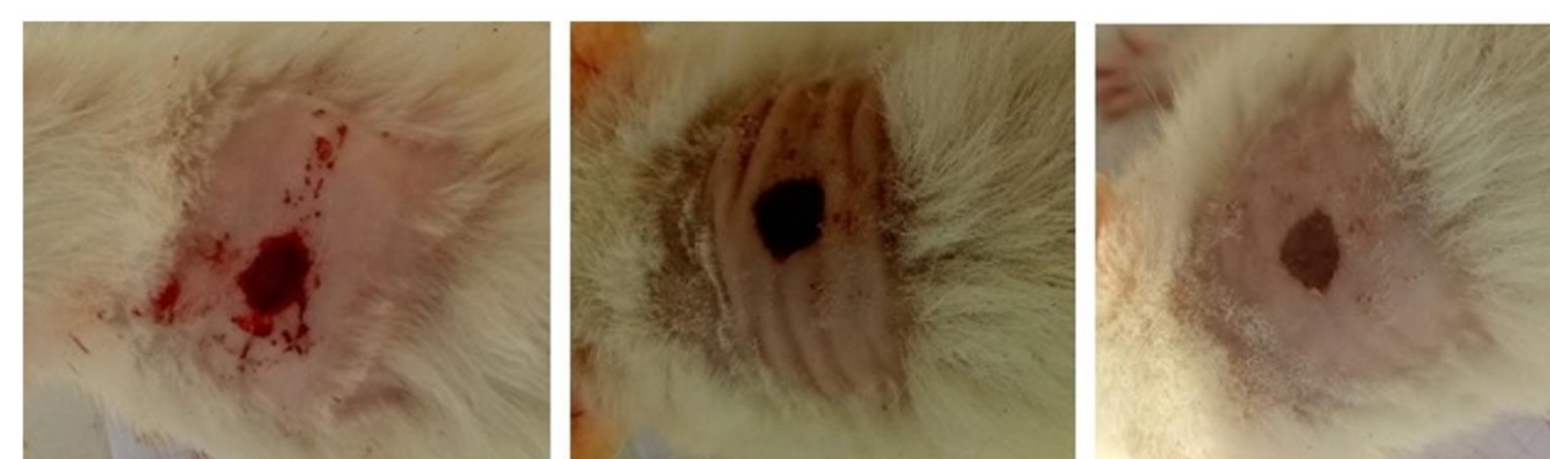


Figure 5. Rat wounds after removal of bandages (24 h): (a) classic gauze dressing (the wound was opened after the animal's motor activity); (b) Miramistin-loaded D500-g-PAA-0.4 hydrogel; (c) Cefuroxime-loaded D500-g-PAA-0.4 hydrogel.

Conclusion: D/SD-g-PAA-based hydrogels are promising materials for the development of antimicrobial dressings for the protection and treatment of superficial wounds.