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Characterization and biological evaluation of new polymeric systems with potential applications in chronic wound treatment

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Statement of the Problem: Recent data indicate that chronic wounds account for almost 4% of total health system costs, and that this proportion is increasing. The common chronic skin and soft tissue wounds include the diabetic food ulcer, the pressure ulcer and the venous and arterial leg ulcers. Prevention of bacterial infection is important in severe cases because it is associated with septic shock, the major cause of death.

Materials & Methods: New hybrid hydrogels based on chitosan-hyaluronic acid-bentonite which have incorporated arginine (2%) as active substance, have been developed. The proportion of chitosan-bentonite hydrogel and hyaluronic acid solution ranged between 95%-5% and 40%-60%. Arginine is a basic alpha-amino acid which is known that enhances wound collagen synthesis and wound breaking strength during normal and impaired healing. The hybrid hydrogels have been studied in terms of swelling degrees and porosity. The antimicrobial study using Gram positive and Gram negative bacterial strains and *in vitro* antioxidant assays were performed. In order to correlate the intensity of the biological effect with arginine concentration, *in vitro* kinetic release of active agent was also performed.

Findings: The swelling degree is depending on concentration of chitosan and hyaluronic acid as well as on concentration of arginine and is ranged between 200% and 300% after 60 min. The presence of arginine in the polymeric matrix has as result increasing of the porosity degree. The porosity degree is an important characteristic of polymeric membranes used in the treatment of wounds, since it influences the exudate absorption, the rate of colonization and the angiogenesis process. Arginine improved also the biological effects of the polymeric matrix based on chitosan-hyaluronic acid-bentonite.

Conclusion & Significance: The features and biological effects of the developed hybrid hydrogels recommended them as new therapeutic alternatives in the treatment of chronic wounds.

Recent Publications

- 1. Cervini-Silva J, Ramírez-Apan MT, Kaufhold S, Ufer K, Palacios E and Montoya A (2016) Role of bentonite clays on cell growth, Chemosphere, 149: 57-61.
- 2. Giri TK, Thakur A, Ajazuddin AA, Badwaik H and Tripathi DK (2012). Modified chitosan hydrogels as drug delivery and tissue engineering systems: present status and applications, Acta Pharmaceutica Sinica B, 2 (5): 439-449.
- 3. Mogoşanu GD and Grumezescu AM (2014) Natural and synthetic polymers for wounds and burns dressing, International Journal of Pharmaceutics, 463 (2): 127-136.
- 4. Morton LM and Phillips TJ (2016) Wound healing and treating wounds: Differential diagnosis and evaluation of chronic wounds, Journal of the American Academy of Dermatology, 74 (4): 589-605.
- 5. Smith R G (2008) Enzymatic debriding agents: an evaluation of the medical literature. Ostomy/wound management, 54.8: 16-34.

Biography

Mihaela-lustina Avram has completed her PhD at Grigore T Popa University of Medicine and Pharmacy, Romania. She is involved in the activities and she wants to discover new models with potential therapeutic applications. She conducted this study of the biological characterization and evaluation of hybrid hydrogels after intense and long-term research in the field. Developed hybrid hydrogels are recommended as new therapeutic alternatives for the treatment of chronic wounds.

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