AMINO ACID BASED BIODEGRADABLE POLYMERS - PROMISING MATERIALS FOR NUMEROUS BIOMEDICAL APPLICATIONS

V.Beridze, R. Katsarava

Center for Medical Polymers and Biomaterials, Georgian Technical University, Tbilisi, Georgia. E-mail: kats@caucasus.net

Tbilisi

May 06, 2010

Biodegradable Amino Acid Based Polymers (AABPs)

Three classes of biodegradable AABPs were obtained:

PEAs, PEURs, and PEUs

Among them PEAs are the most promising for numerous practical applications like

resorbable surgical materials and controlled drug eluting devices

due to wide range of material properties and low price

Molecular Mass, Thermal & Mechanical Characteristics of

PEAs

Mw = 24,000 – 167,000 Mw / Mn = 1.20 – 1.81

Tg = 5 – 102 ^{o}C Tm = 103 –124 ^{o}C

Mechanical properties: from hard films to hydrophilic elastomers with elongation at break up to 800 %

The PEAs showed higher biocompatibility as compared with poly(lactide/glycolide) polymers

Solubility :

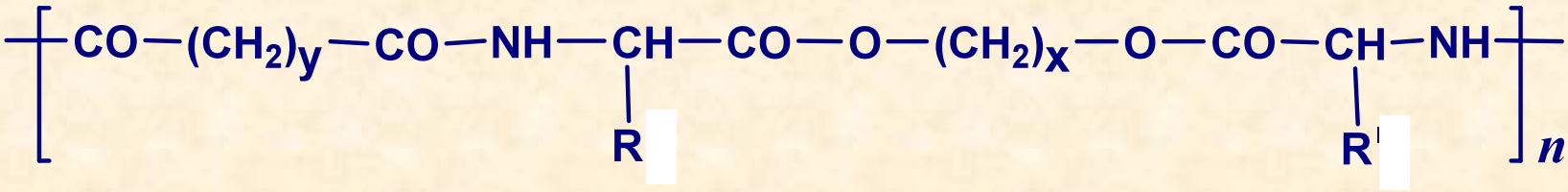
The PEAs are soluble in common organic solvents like:

- DMF
- THF
- Dioxane
- Ethanol (approved by FDA)
- Chloroform
- Methylene chloride
- Acetone

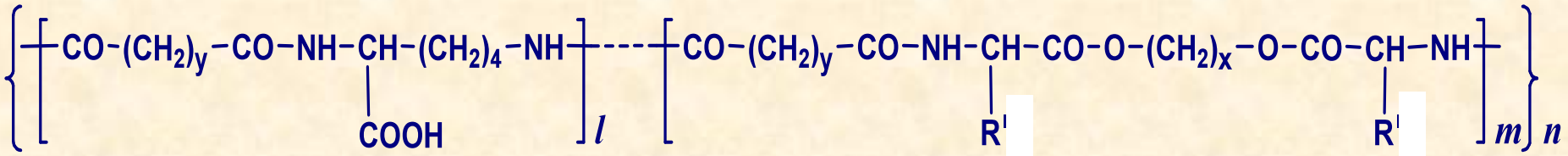
The PEAs are easily processable into different shapes.

SOME CASE STUDIES

Regular PEAs



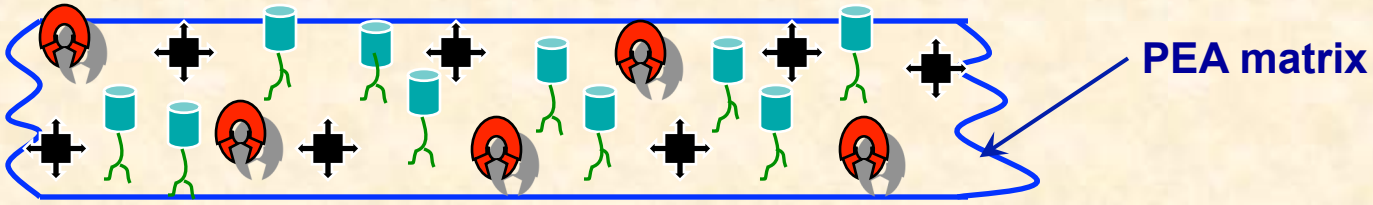
Functional PEAs



R – hydrophobic substituent

One of the most successful applications of *regular PEA is* the use as a matrix for constructing a drug sustained/controlled release biocomposite material PhagoBioDerm.

PhagoBioDerm® in cross-section



Bacteriophages *against* ***Ps.aeruginosa, Staphilococcus, Streptococcus, Proteus, E.coli***

Enzyme (Trypsin or α-Chymotrypsin)

Other bioactive substances

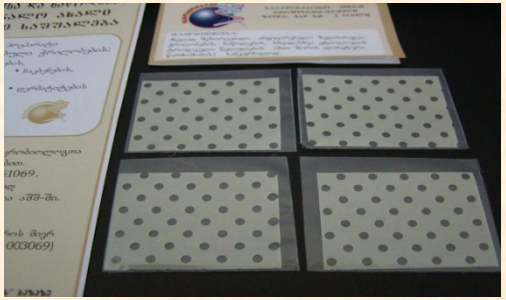
R. Katsarava, Z. Alavidze, US Patent 6,703,040 (2004).

PhagoBioDerm is produced as:

Stripes (for dental applications)

Wound dressing (Artificial skin)

Powder (to treat deep wounds and cavities)

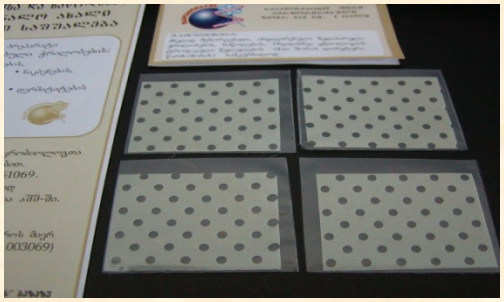


Artificial skin "PhagoBioDerm" showed high wound healing potential in cases of infected superficial wounds with retarded healing rate such as bedsores (pressure ulcers), trophic and diabetic ulcers, thermal and radiation burns, infected stings, etc.

trophic ulcer

Figure 1 The use of PhagoBioDerm for wound healing in an 80-year-old female patient (case no. 22). The pictures show (from left to right) the initial lesion, application of PhagoBioDerm (day zero), and wound healing on days 10, 30, and 90, respectively.

K Markoishvili., G.Tsitlanadze, R.Katsarava, J.G.Morris,. et al., *Intern. J. Dermatology*, 41, 453 (2002).



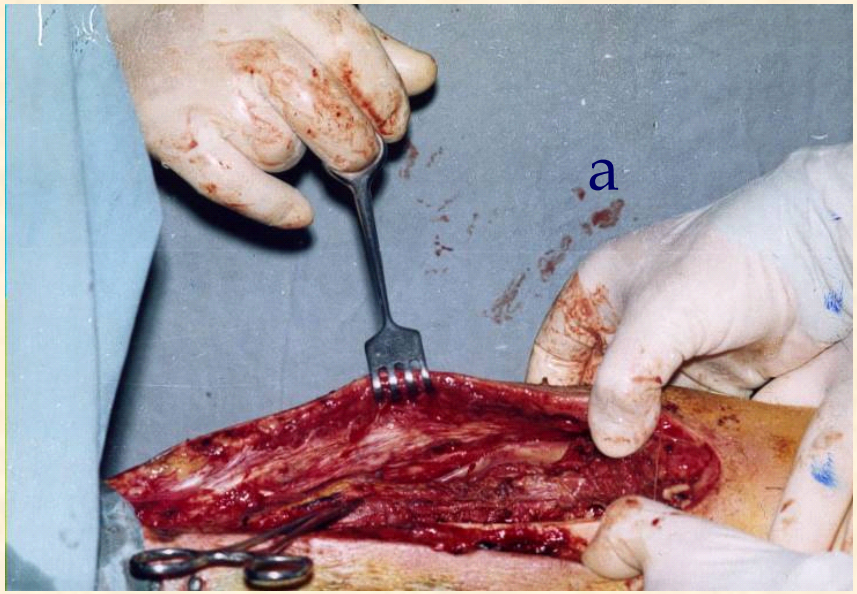
In December 2001, three Georgian lumberjacks from the village of Lia were exposed to a strontium-90 source from two Soviet-era radiothermal generators they found near their village.

Radiation injure

The use of PhagoBioDerm for wound healing in patient 1-DN. The pictures show (from left to right) the purulent lesion on day 23 of hospitalization, application of PhagoBioDerm on day 29 of hospitalization, and wound healing after 23 days.

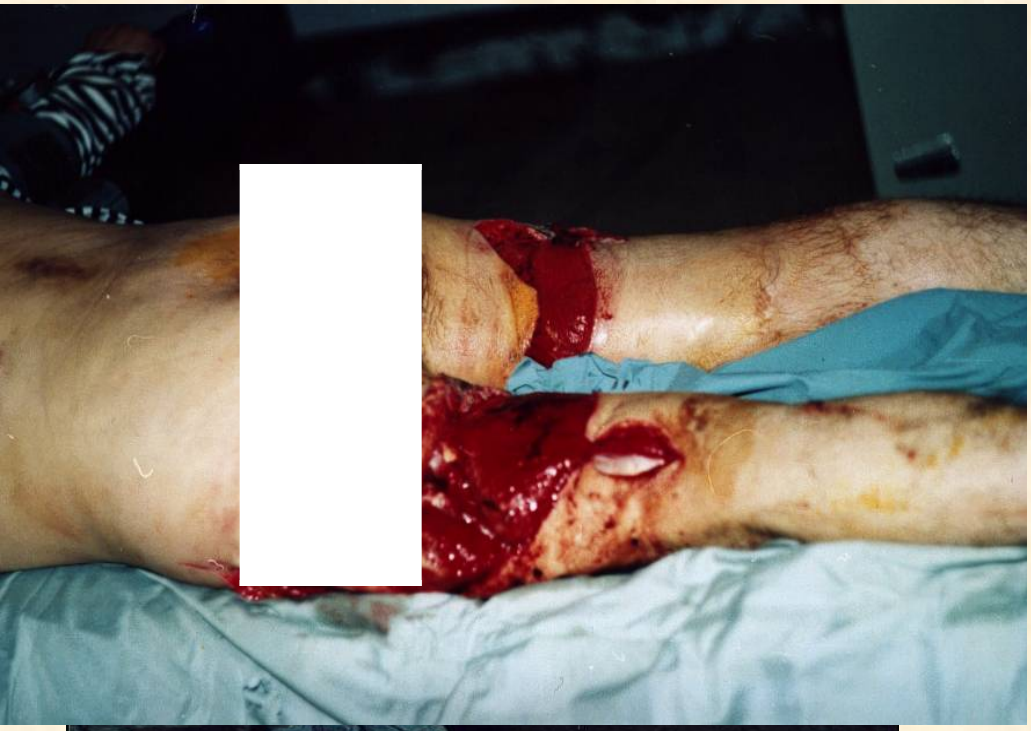
D. Jikia, N. Chkhaidze, E. Imedashvili, I. Mgaloblishvili, G.Tsitlanadze, R. Katsarava, J. Glenn Morris, Jr., A. Sulakvelidze, *Clinical and Experimental Dermatology*, 30, 23 (2005).

Wound treatment by powdery form of "PhagoBioDerm"



D.N., 40, female: a) when entered the clinic, b) the wound treatment with powdery PhagoBioDerm

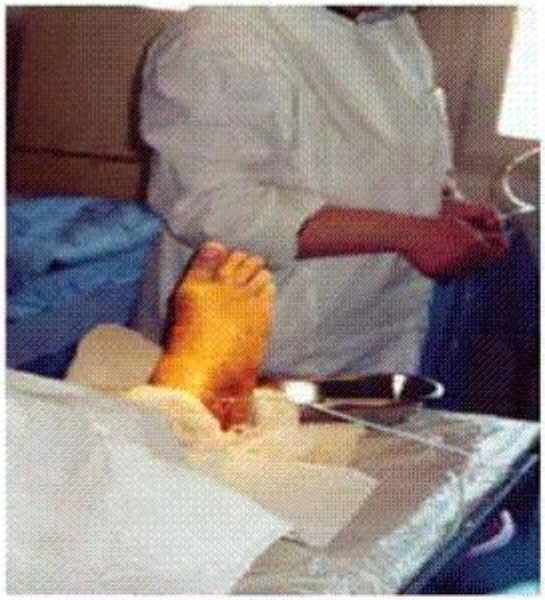
G. Gvasalia, Z. Alavidze, Z. Dzneladze, et al.,"Local Phage Therapy in the Complex Treatment of Severe Wound Infections" – 1, 6-th Evergreen International Gathering of the Phage Family, Olympia, WA, USA, 2005



Wound treatment by powdery form of "PhagoBioDerm"

T.K., 38, male: a) when entered the clinic, b) the wound after suppressing suppurative inflammation with subsequent wound closure (ca. two weeks later after entering the clinic).

Ostemyelitis



Alfred G. , 39, Canada.

Alfred looks happy

Ostemyelitis

**Naum Ch.,56 (USA)
when entered the clinic.**

Naum Ch., 56, the wound is healed completely.

Coladerm® - spray wound dressing

On offer now

Platform biodegradable polymer

Coladerm

Post-operation wound dressing

Rhinophyma.

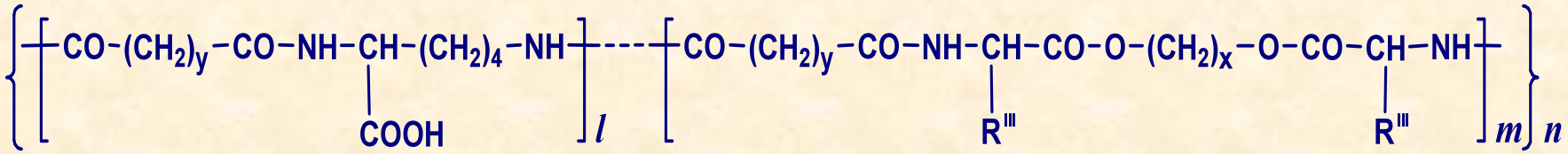
Before operation

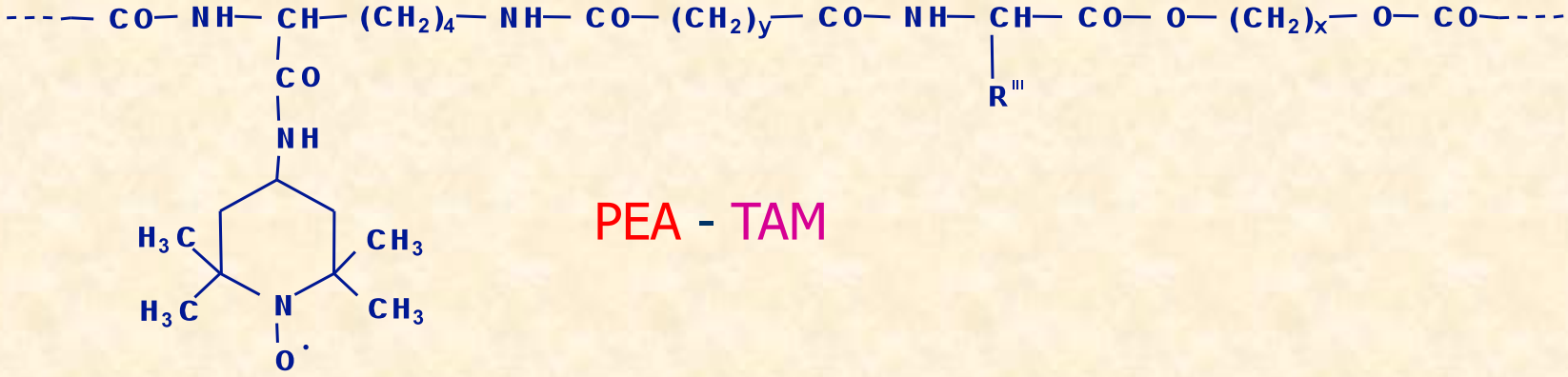
The first day: right after operation

Full healing after 6 days

Burn

15

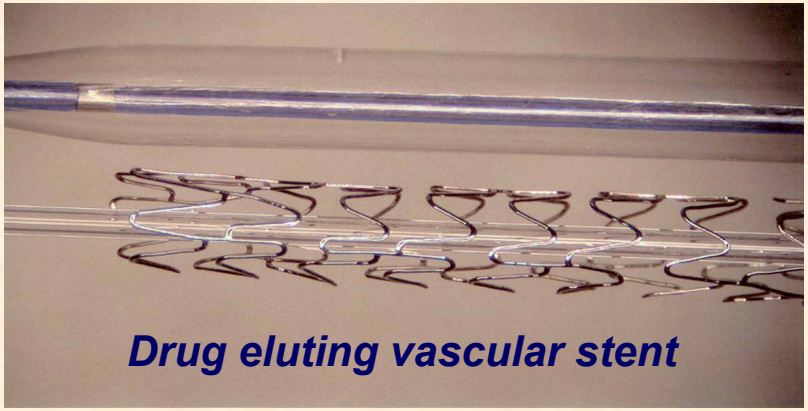




PEA - TAM

4-amino-TEMPO (TAM) – suppresses cell proliferation

PEA - TAM was used as a coating of stainless vascular stent (MediVas,LLC, San Diego, CA)



NOBLESSE clinical trial (Nitric Oxide through Bioabsorbable Layer Elective Study for Safety and Efficacy), 45 patient study for drug eluting stent with 24 month follow up was completed; Taxuslike results achieved with MediVas polymer alone.

TAXUS = Paclitaxel (Taxol) eluting Coronary Stent system from Boston Scientific Co

Z.Gomurashvili, H.Zhang, T.D.Jankins, J.Huges, M.Wu, L.Lambert, L.Eltepu, C.Pabba, N.Chowdari, V.Vasilev, R.Katsarava, B.Turnell, From drug-eluting stents to bio-pharmaceuticals: Poly(ester amide) a versatile new bioabsorbable polymer. ACS 232nd National Meeting, 10-14 September, 2006, San Francisco, CA. (C&EN, August 21, 2006, P. 138-TECH).

Thank you!