

ADVANCED COMPOSITES - ORGANIC NANOSCAFFOLDS FOR WOUND HEALING**S. KANIMOZHI^{a1}, R. SUGANTHY^b, M. MONIKA^c, S. HARINI^d AND K. GEETHA^e**^{abcde}Nanotechnology Division, Department of Electronics and Communication Engineering, Periyar Maniammai, University, Vallam, Thanjavur, India**ABSTRACT**

This research article highlights about the advanced composites to heal the wounds by using nanoscaffolds. Electrospinning exhibits appropriate resemblance with Extra Cellular Matrix (ECM) by its nanofibrous and microporous for biomedical applications. Likewise the electrospun Scaffold could possess best bio mimicking ability, high surface to volume ratio, surface roughness, and efficient releasing material for wound healing. Naturally obtained organic material such as curcumin (active component of turmeric) and aloe Vera which has effective anti-inflammatory, antimicrobial and antibacterial properties. The catalytic enzyme Nitric oxide synthetase (NOS) levels are very high in open wound and inflamed region. Curcumin have the ability to inhibit the NOS level and nitric oxide (NO) production and the presence of flavones could provide the antibacterial property for curcumin and aloe Vera. In the present work an antibacterial and anti-inflammatory Electrospun scaffold was fabricated by electrospinning of a Polymeric solution composed of PVA/curcumin/aloe Vera. The SEM images revealed that the mat have good morphology. The bactericidal property and the releasing kinetics of the scaffold to be studied in future. Overall this article gives the ideal solutions for wound healing compared to conventional one.

KEYWORDS: Woundhealing, Electrospinning, Scaffold, Bio Mimicking.

Scaffolds are the three dimensional structure consisting of biodegradable material. Scaffold could possess best bio mimicking ability, high surface to volume ratio, surface roughness, and efficient releasing of drug material loaded in it. This scaffolds have their important role in healing process. This will enable the inflammatory cells to migrate and starts the process of healing. This scaffolds are prepared by using an electrospinning techniques. The electrospinning technique is one of the spinning techniques which is wellknown since 1930. It can be able to produce a continuous polymeric fibre. This technique is also able to produce fibre in the sub micron range. The fibre can be produced by applying high voltage to the polymeric solution. The polymeric solution is loaded in the needle. After applying voltage, the polymeric solution become charged and it is sprayed as a jet. The sprayed solution is collected by using collector. Scaffolds are prepared from the fibre material which could offer high surface to volume ratio and supporting the growth of the cells.

THE HEALING PROCESS OF THE WOUND

The process of wound healing involve haemostasis, inflammation, Proliferation, epithelisation, maturation and remodelling of scar tissue. The inflammation phase start at imeddiately after injure occuring and it might be continued for 6 days. The growth facor which is released from platelets are surrounding the wound area by diffusing through the tissue and it brought the inflammatory cells to that wound area. The maturation phase will starts from 3 weeks. Meanwhile there is a need for antibacterial and anti-inflammatory agent to restrict the inflammation of the cells and to destroy the bacteria that present in the

wounding area. One of the most impotant part in wound healing is nitric oxide (NO) and its prodction is maintained but the catalytic enzyme nitric oxide synthetase (NOS). Normally the NOS level is high in the wounding area. The anti-bacterial and anti inflammatory agent should have the ability to decrease the level of NO in the wound area.

THE ANTI-BACTERIAL AND ANTI - INFLAMMATORY AGENT

The role of antibacterial and anti-inflammatory agent in the wound healing process is to reduce the level of nitric oxide in the affected area. The agent which reduces the NO level should be considered as the good anti-bacterial and anti inflammating agent. In our present work we are selecting the naturally available organic material curcumin-active agent of turmeric and taloe Vera as a anti bacterial and anti inflammatory agent.

CURCUMIN- THE ACTIVE AGENT OF TURMERIC

Curcumin is the active component of Indian spice turmeric- curcumin longa. curcumin is one of the three curcuminoids of turmeric. It is a bright yellow compound obtainning from plants. And it is belongs to the ginger family. This curcumin is reason or the yellow colour of the turmeric and it is used as a food colorant and additives. This curcumin is obtained from the rhizhome of the turmeric. The chemical formula for curcumin is $C_{21}H_{20}O_6$. The curcumin is the organic material from the nature which is founded to have a anti-bacterial and anti-inflammatory property againgst any wounds or infection. The curcumin have the ability

to decrease the nitric oxide level in the wound area. Curcumin at 0.1 to 10µg/ml was founded to have the ability to decrease the NO level. The antibacterial property of curcumin is due to the presence of flavone. Flavones are belong to the class of flavonoids whose chemical formula is C₁₅H₁₀O₂. Flavonoids are also obtained from plant source. They believed that flavonoids were necessary to protect the health of capillaries, the smallest blood vessels.

ALOE VERA

Aloe Vera is the plant species belong to the genus Aloe. It is cultivated for agriculture and medicinal application. Aloe Vera is the another naturally obtained organic material. Aloe vera is also playing an important role in wound healing process. It plays a beneficial role in Educing the inflammation in the wounding area. The antibacterial property of aloe Vera is due to the presence of phenolic compound such as flavones. This is as similar to the curcumin by containing flavone compound.

NANOSCAFFOLDS PREPARATION

The polymeric nanoscaffolds is prepared by using polyvinyl alcohol incorporating with curcumin and aloe Vera. PVA is a water soluble polymer. Making polymeric solution by using polyvinyl alcohol incorporating curcumin and aloe vera by using distilled water. The solution comprising of PVA/curcumin/aloe vera. The SEM of the scaffolds shows good morphology by providing high surface to volume ratio, surface roughness. The bactericidal property and drug releasing capacities to be studied in future works.

REFERENCES

Drug Delivery Systems in Bone Regeneration and Implant Dentistry By Sukumaran Anil, Asala F. Al-Sulaimani, Ansar E. Beeran, Elna P. Chalisserry, Harikrishna P.R. Varma and Mohammad D. Al Amri DOI: 10.5772/60003

Electrospinnig of nanofibers- Thandavamoorthu subhah, G.S. Bhat, R.W. Tock, S. Parameswaran, S.S. Ramkumar.

Electrospun biomaterial for biomedical application-Pooja Agarwal, Dr.Pradeep Srivastava* School of Biochemical Engineering, Institute of Technology, Banaras Hindu University, Varanasi-221005, India

Nanotechnology-Based Therapies for Skin Wound Regeneration Ilaria Tocco,1 Barbara

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Turmeric and curcumin: Biological actions and medicinal applications Ishita Chattopadhyay1 , Kaushik Biswas1 , Uday Bandyopadhyay2 and Ranajit K. Banerjee1,* 1Department of Physiology, Indian Institute of Chemical Biology, 4, Raja S.C. Mullick Road, Kolkata 700 032, India 2Department of Biochemistry, Central Drug Research Institute, Chhattar Manzil Palace, Lucknow 226 001, India

Curcumin: A natural antiinflammatory agent K Kohli, J Ali, MJ Ansari, Z Raheman Department of Pharmaceutics, Faculty of Pharmacy, Jamia Hamdard University, Hamdard Nagar, New Delhi, India

Medicinal Plants and their Role in Wound Healing Rajinder Raina, Shahid Parwez, P. K. Verma* and N. K. Pankaj

Division of Pharmacology and Toxicology, Faculty of Veterinary Sciences and Animal Husbandry, Sher-e-Kashmir University of Agricultural Sciences and Technology - Jammu

Therapeutic and Medicinal Uses of Aloe vera: A Review Pankaj K. Sahu1 , Deen Dayal Giri2 , Ritu Singh2 , Priyanka Pandey1 , Sharmistha Gupta3 , Atul Kumar Shrivastava4 , Ajay Kumar5 , Kapil Dev Pandey5

Effect of topical aloe vera on the process of healing of full-thickness skin burn: a histological and immunohistochemical study Ahmed A.M. Abdel Hamid* and Mona FM Soliman

The Review on Properties of Aloe Vera in Healing of Cutaneous Wounds Seyyed Abbas Hashemi, 1 Seyyed Abdollah Madani, 2 and Saied Abediankenari 3, 1 Department of Otolaryngology, Head and Neck Surgery, Traditional and Complementary Medicine Research Center, Mazandaran University of Medical Sciences, Sari, Iran

Turmeric: The genus curcuma-google search book.