ABSTRACT

Medical textile is one of the rapid focused sectors of the global textile industry. Human prefers to be most comfortable in all the aspects which are highly expected in medicinal treatments. In this advanced technology developed world, the end users are very much aware of the health and hygiene lifestyle. With this advanced exposure, consumers expects for a wide range of textile goods finished with antibacterial properties. Even though there are lots of medicinal products with these antibacterial properties, at some points these products may give way to various side effects on the human body as most of them are petroleum based products.

Conventional wound dressings made on textile products are highly absorbents and afford most positive wound healing conditions. In recent times, highly developed wound dressing materials were developed to give most favorable wound healing conditions and better functionalities that helps to maintain a suitable healing environment around wounds through different finishes on the surface of the dressing material. These types of wound care system gives way to a sustained drug release, moisture management, barrier properties and bioactivity. The development of drug delivery system in this traditional method is increasing in clinical applications.

In this research work, an attempt has been made in the area of developing a wound dressing material coated with natural extracts and enhanced with growth factors which is used for wound healing applications. In this present study different natural products with antibacterial in its nature are being selected and the extracts from the products are coated on the bamboo fiber based wound dressing material and enhanced with epidermal growth factor. Three different sets of natural products are selected for the
research work and the extracts from the natural products are used in the
development of wound dressing material.

Natural products namely leaves of aloe vera, curcumin, chitosan,
leaves of calotropis gigantean, eucalyptus globules and buds of Syzygium
aromaticum, leaves of piper betel and neem leaf have been selected for the
study which are having antibacterial property in its nature. The extracts of the
products are coated on the bamboo based wound dressing material and
enhanced with the combination of various components, and to characterize its
physical and chemical properties. The functional properties and in vivo
evaluation were also studied in order to forecast the performance of these
materials for wound care applications.

Development of natural fibres based wound dressing material
coated with different compositions of aloe vera, curcumin and Chitosan
enhanced with recombinant epidermal growth factor (rhEGF) (REGEN-D™)
for wound healing applications was explicate in the first part of the research
work. The results of Fourier Transform Infrared Spectroscopy (FTIR)
determined the fraction of secondary structures from the amide region of
coated wound dressing material. Scanning Electron Microscopy (SEM) image
showed permeable morphologies of the developed dressing material. The
coated fabrics were evaluated for mechanical properties, anti bacterial test and
Scanning Electron Microscopy. Justifying more on these findings, the coated
fabric samples were tested for its wound healing efficacy through in vivo
method of wound healing using Wister Albino rats. The dorsal surface of the
rat’s skin was removed and created a full-thickness wound. Then the
developed fabric samples loaded with rhEGF were applied over the wound
surface and the wound closure was studied in equal interval of days. The
formation of zone of inhibition in antibacterial test and wound closure rate in
In Vivo evaluation reveals that a specified composition of natural extracts of
aloe vera, curcumin and solution of Chitosan enhanced with rhEGF reveals that coated fabric samples exhibits good antibacterial property and higher rate of wound healing nature.

In the second part of the work, the leave extracts of Calotropis gigantean, Eucalyptus globules and buds of Syzygium aromaticum were prepared and coated on natural fibres based bamboo gauze fabric for wound dressing applications. The fabrics coated with different compositions of the natural extract were enhanced with rhEGF (REGEN-D™ 60). The antibacterial activity of the developed samples was studied after testing of its mechanical properties and Scanning Electron Microscopy. The results of Fourier Transform Infrared Spectroscopy (FTIR) determined the fraction of secondary structures from the amide region and OH groups of alcoholic extract of the coated wound dressing material. The wound healing efficacy of the coated fabric samples were studied through In vivo method using Wister Albino rats. The type of wound selected for the study was second degree burn wound. The dorsal surface of the rat’s skin was removed and second degree burn wound was created. Then the developed fabric samples were dressed over the wound surface and the wound healing was studied by wound closure rate in equal interval of days. A specified composition of natural extracts coated on bamboo gauze fabric enhanced with rhEGF (REGEN-D™ 60) exhibiting good antibacterial property was confirmed from the formation of zone of inhibition in antibacterial test against Gram-negative (Escherichia coli) and a Gram-positive bacteria (Staphylococcus aureus) and appropriate wound closure rate on second degree burn wound through In vivo evaluation.

In the last part of work, the leave extracts of aloe vera, piper betel and neem leaf were prepared and coated on bamboo fibre based material for wound dressing applications. The fabrics coated with different compositions of the natural extract were enhanced with rhEGF (REGEN-D™ 150). The
FTIR confirmed the presence of alcoholic and phenolic groups which were responsible for antibacterial activity. The SEM morphology of the developed dressing material was porous in nature and more suitable for the process of curing wound. In antimicrobial tests, the zone of incubation of *E. coli* and *S. aureus* ranges from 18 mm and 22. *In vivo* study using albino rats induced with diabetes reveals that the wound healing rate is increased in the range of 25% to 54% compared to a negative control group.

Overall, the natural extracts coated dressing material have considerable potential and well suited for clinical application that was evidenced through antimicrobial and *in vivo* study results. Therefore natural extracts coated on bamboo based dressing materials are claimed to have helpful nature for wound healing and current study will be one of the platforms for natural extracts coated material based medical textile applications. This research may be extended to the clinical setting and act as a successful promoter for wound healing applications in human beings.