Development of Bio-Active Wound Care Dressing Material by Using Spirulina Extract

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Abstract- Medical textile is one of the highly developing field in technical textile. There are wide range of textile materials used in medical field in which bandages made of textile material plays a vital role in wound dressing. Our purpose of the study is to increase the efficiency of wound healing activity without using any toxic chemicals, which causes various side effects later on. Wound dressing material is made of various natural substances like spirulina(microalgae), AloeVera and Ocimum Basilicum (basil seed). Each component has its own function in wound healing due to various functions like anti-oxidant, anti-inflammatory, anti-fungal, anti-viral and digestive enzymes. Antioxidants are compounds, which inhibit oxidation. Oxidation is the process of chemical reaction that can produce free radicals, there by leading to chain reactions that may damage cells of living organisms. Anti-inflammatory is the property of a substance or treatment that reduces inflammation or swelling. Resist in growth of fungus and virus, which enters the body parts, is known as anti-fungal and anti-viral respectively. The digestive enzyme of the ocimumbasilicum (basil seed) is applied over the fabric above the spirulina extract. When it gets contact with water molecules in the blood it converts into gelatinous and enters into the wound, which heals the wound quicker than the other medicines available.

I. INTRODUCTION

A wound is a type of injury which happens relatively quickly and damages the skin tissue such as torn, cut, or punctured (an open wound), or where blunt force trauma causes a contusion (a closed wound). In pathology, it specifically refers to a sharp injury which damages the Epidermis of the skin. The healing of a wound is a complex, dynamic and continuous process aiming at there pairing of damaged tissue. The efficient treatment system of a wound is very important to improve the healing process, in terms of both quality and time, as well to reduce the costs associated with the treatment.

Currently, there is a great variety of wound-care products, available in the market, including creams, solutions, dressings or skin tissue engineering substitutes. Among these products, bioactive wound dressings represent an effective method for wound treatment, presenting a good relationship between clinical efficacies and manufacturing cost.

However, for some types of wounds, such as infected wounds, use of bioactive wound dressings cannot be sufficient to promote the healing process, as many of these materials do not present therapeutic activity (e.g. antibacterial and anti-septic characteristics). In order to solve this limitation, some dressings, based on natural bioactive compounds, were developed incorporating different protein and compounds to reduce the growth of microorganisms in wounds. The continuous administration of protein contents in infected wounds though associated with the development and spread of antibiotic resistant strains of bacteria presents at is factory clinical results To address this challenge, the potential of bioactive wound dressing material is being developed, consisting of Spirulina plantensis, Aloevera and Ocimumbasilicum seed for bio medical applications. Seaweeds are present in a large scale as unused protein rich content. Spirulina contains large percent of beta carotenoids and associated proteins. This kind of material can be used to produce the hygienic material. So the aim of the project is to produce the medical textile product with the help of spirulina.

SPIRULINA

Spirulina plantensis is a filamentous blue green algae, it grows naturally in fresh, brackish, sewage water and even in saline environment. It grows through photosynthesis, hence, can be termed as vegetative

food. It has been already affectively promoted as anatural food. It holds valuable compounds like poly unsaturated fatty acids (PUFA), phycocyanin and phenolic, which act as antioxidants. It is also used as nutraceutical agent due to the presence of macro and micronutrients like carbohydrates, proteins, essential fatty acids, vitamins (B-complex, vitamin E and carotenoids), magnesium, selenium, copper, manganese, zinc and iron. Several strains of blue green algae are well known for diverse biological activities such as anti bacterial, antifungal, cytotoxic, algaecide ,immune suppressive 9 and antiviral activities. Aloe Vera is a green colour plant with thick, fleshy, tapered, spiny, marginated and dagger shaped leaves growing from a short stalk near ground level. Aloe Vera is the most widely used species, both commercially and for its therapeutic properties. This plant contains two materials with a juicy consistency: the first, a yellow exudate containing a high concentration of anthraquinone-type compounds, which have been used for decades as cathartics and purgatives, and the second, a clear mucilaginous gel that has been used since ancient times for the treatment of burns and other wounds.

II. MATERIALS AND METHODS

MATERIALS

The raw materials used in this work are non-woven fabric, spirulina plantens is, aloe vera and ocimumbasilicumseed.

Non-woven Fabric

The material selected for this study is spun bonded non-woven fabric consist of Viscose/cotton in the blend ratio of 80:20. The spun bonded non-woven fabric is selected because it has excellent water absorbency, breathability and hygiene property. The fabricis sourced from Rade MYRA non-woven industry pvt ltd, Ahmedabad.

Spirulina

Spirulina platensis is a potential source of high value compounds with functional propertiese. g., phycocyanins, carotenoids, phenolicacidsandomega-3andomega-6polyunsaturated fatty acids. Spirulina is a great source of beta-carotene (pro vitamin A) and vitamin B-12. Vit B-12 is very useful in treatment of pernicious anemia. Carbohydrates -Glucose, rhamnose, mannose, xylose and galactose etc are found in microalgae biomass. Spirulina plantensis is directly purchased from Vetraspirulina private limited, Coimbatore.

Aloevera

Aloe vera is consists of 98-99% water and the remaining 1-2% contains the active compounds, such as aloesin, aloin, aloeemodin, aloemannan, acemannan, aloeride, naftoquinones, methyl chromones, flavonoids, saponin, sterols, amino acids, and vitamins. The levels of these compounds vary according to species, strain, and growth conditions.ThepharmacologicalactionsofAloeveraincludeanti-inflammatory, antibacterial, antifungal, antioxidant, immune-boosting and hypoglycemic properties. Aloe vera leaves are collected from nearby village.

Ocimum Basilicumseed

Sweet basil seeds are also known as sabja seeds, falooda seeds, tukamaria seeds. Ocimumbasilicum is the technical name, which represents the basil seed. Ocimumbasilicumseedis purchased from Jayasuryastores, Tiruchengode.

Chemicals

The chemicals such as ethanol are purchased from Microtroniks Quali-Tech chemicals, Agra. The other chemicals Such as diclofenac, chloro form and other auxiliaries are purchased from Tiruchengode.

METHODS

PREPARATION OF SPIRULINA WOUND DRESSING MATERIAL.

Chemicals Required

- Ethanol
- Distilled water

Glassware & equipment required

- Beakers
- Polymeric tray
- Centrifuge tubes

- Pipettes
- Funnels
- Filter papers (Whatmanno1)

Equipment required

- Weighing balance
- Centrifuge machine
- Ortex machine
- Vaccum filter

PROCEDURE

Spirulina powders were extracted with ethanol (20 mg/100mL). 20mg of spirulina powder is dissolved in 100ml of solvent. The spiritual powder is mixed thoroughly by stirring for 30 min and remains untouched for about 24 hours. Extracts were then filtered through What man no. 1 filter paper in a Buchner funnel under vacuum. The filtered Spirulina extract is stored untiluse.

Aloe vera the spines of the leaf were chopped and the upper layer of the skin called rind was opened longitudinally to collect the gel. The collected gel is mixed with electrical blender to get a low viscosity of aloe vera gel. Then the gel was homogenized to make a crude paste and used for further process.

Basil seed mucilage was obtained by Vacuum filtration process. The whole nutlets were soaked in aloe vera gel, in a seed: gel ratio of 1:50. The mucilage of basil seeds was extracted by continuous centrifuge on a electrical centrifuge at 10000 rpm for 40 min at40°C.Vacuum filtration was carried out to remove all likely seed residuals from the separated mucilage.

COATING OF SPIRULINA/ ALOE VERA/ OCIMUM BASILICUM SEEDONNON-WOVENFABRIC

The spun bonded non-woven is washed in distilled water and dried in oven to get better absorbing efficiency. The dried non-woven fabric is weighed in weighing balance, based on the weight of the fabric amount of extract required is calculated.

The non-woven fabric is placed in a polymeric tray and the ethanol extract of Spirulina is poured inside the polymeric tray. The trey is left undisturbed for about 15minutes, effective absorption of spirulina extract will takes place. Finally the fabric is dried in the room temperature for about 18 hours. The ethanol content evaporates in air and spirulina coated non-woven material is covered with aluminium foil sheet, then stored for further use.

After24hours, the fabricis placed on a smooth surface. Then the extracted mucilage of basil seed is poured on the top of the coated non-woven fabric. Mechanical holder is used to clamp the fabric firm and tightly, squeegee is used to spread the mucilage evenly over the surface of the fabric. Ocimumbasilicum (basil seed) is applied over the spirulina coated fabric. The fabric is dried at room temperature for 12 hours, then the same procedure is carried out for the other side of the fabric. Finally the fabric is dried for 14hours and stored in a aluminium foil sheet.

CHARACTERISTICS OF SWELLING

A weighed 20 x 20 mm^2 dried sample was soaked in distilled water (~25^0c). After 48h soaking, swelling was measured. The swollen sample was taken from the water; excess surface water was wiped off with a filter paper, and weighed immediately. Swelling was calculated as:

$$\text{Swelling} = \frac{M_W - M_0}{M_0}$$

Where M_0 was the sample mass before immersion and M_W was the mass after immersion.

FTIR

Fourier Transform Infrared Spectros copy, also known as FTIR Analysis or

FTIR Spectros copy, is an analytical technique used to identify organic, polymeric, and, in some cases, inorganic materials. The FTIR analysis method uses infrared light to scan test samples and observe chemical properties.

CONCLUSION

Spirulina is a protein rich seaweed which has an anti-oxidant compound (β-carotene) in it this helps in healing the wound faster. As like anti-oxidant anti-microbial activity is also an important factor in quick healing so that Aloe vera extract is coated along with spirulina, extract in a spun bond non-woven fabric. This shows a faster wound healing in Wister albino rats. Thus the fabric coated with spirulina aloe vera and ocimum basilicummucilaginous layer acts as a wound healing product

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