



Research Article

DETAILED STUDY ON THE SYNERGISTIC EFFECT OF NEEM EXTRACT LOADED WITH CURCUMIN IN WOUND HEALING USING TEXTILE SUBSTRATE

Dhinakaran M ^{1*}, Sundarasan S ², Arunraj A ³

¹Sr.Associate Professor, Department of Textile Technology, Kumaraguru College of Technology, Coimbatore, India

²Assistant Professor[SRG], Department of Textile Technology, Kumaraguru College of Technology, Coimbatore, India

³Assistant Professor, Department of Textile Technology, Kumaraguru College of Technology, Coimbatore, India

*Corresponding Author Email: dhinakaran.m.txt@kct.ac.in

Article Received on: 06/07/17 Approved for publication: 29/07/17

DOI: 10.7897/2230-8407.087126

ABSTRACT

The world is moving towards hygienic and there is a need for hygienic products in modern lifestyle. It is an opportunity to grow the textile market by meeting the expectation through textile products finished with antimicrobial properties. Multidrug-resistant organisms are increasingly implicated in acute and chronic wound infections, thus compromising the chance of therapeutic options. This paper focuses on a wound dressing with extract from natural sources of neem leaves and turmeric. The efficacy of the product was evaluated by various physical and biochemical tests.

Keywords: hygienic, antimicrobial properties, Multidrug-resistant organisms, chronic wound infections, wound dressing

INTRODUCTION

Wound healing is a multi-stage process. It contains a two stages namely formation of glycosaminoglycan followed by formation of granulation tissue. Neem oil can be used as a wound healing agent because it contains active ingredient that directly deal with the wound healing process Fatty acids present in the Neem plays an important role in adding moisture and a soft texture to the

skin during the healing process. It also helps in the re-structuring of the skin during the wound healing process. Extract from Neem leaf and seed have proven antimicrobial effect and keeps the wound free from infection by bacteria, viruses, parasites and fungi. Clinical studies show that neem plays another important role in wound healing by inhibiting inflammation and it can be used in place of cortisone acetate.

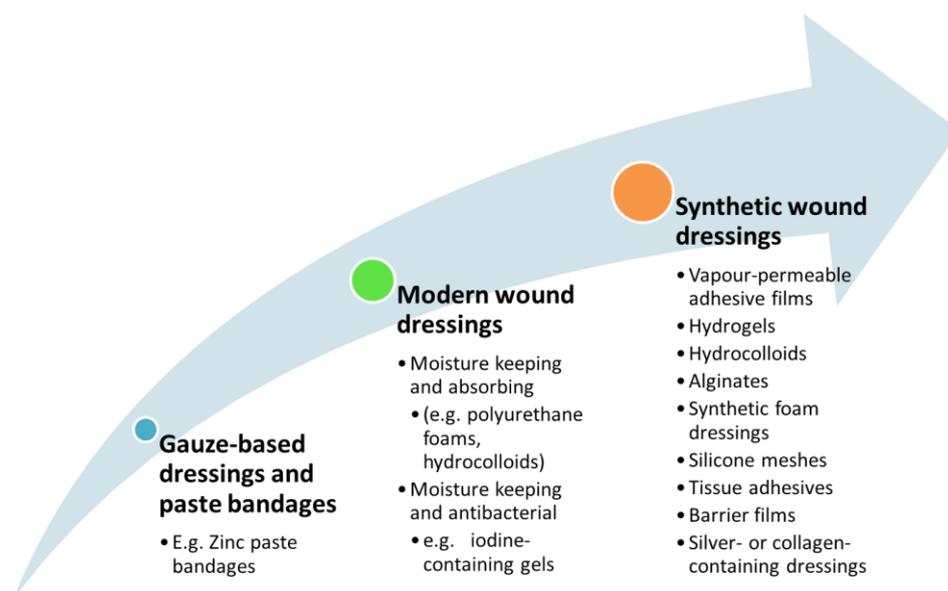


Figure 1: Evaluation of Wound Dressings

Another commonly used herb readily available in all Indian household is turmeric. Turmeric contains a powerful active chemical compound called curcumin. This compound is not only responsible for its vibrant yellow-orange color and its distinctive zing, but is also the spice's most powerful medical constituent bestowing it with powerful health benefits. Both laboratory and animal studies have provided evidence of spice's powerful anti-inflammatory activity. Potency of turmeric's anti-inflammatory and anti-arthritis effects have been equated with that of the popular pharmaceutical anti-inflammatory drugs such as Motrin and hydrocortisone-without the potential side effects and toxicity of this manufacture drugs. Previous researchers found that a daily dosage of curcumin was even more effective in easing post-surgical inflammation as the regular anti-inflammatory prescriptions. Recent research attributes

turmeric's anti-inflammatory mechanism to this powerful capacity to inhibit the activity of enzymes COX-2 and lipoxygenase. It has also eases the inflammation caused by the body's allergic reaction to histamines, as well as trauma, injury and the stiffness of over-or under-inactivity. Turmeric is naturally anti-septic and anti-biotic that has historically been used as an herbal to treat everything from minor cuts and scrapes to scabies, skin and even leprosy. Turmeric essential oil is a powerful topical antibiotic that helps prevent infections and sepsis in wound. Two types of wound dressing namely gauze-based dressings and paste bandages are normally used for wound dressing. The development in wound dressing taken place on account of moisture management and antibacterial finishing.

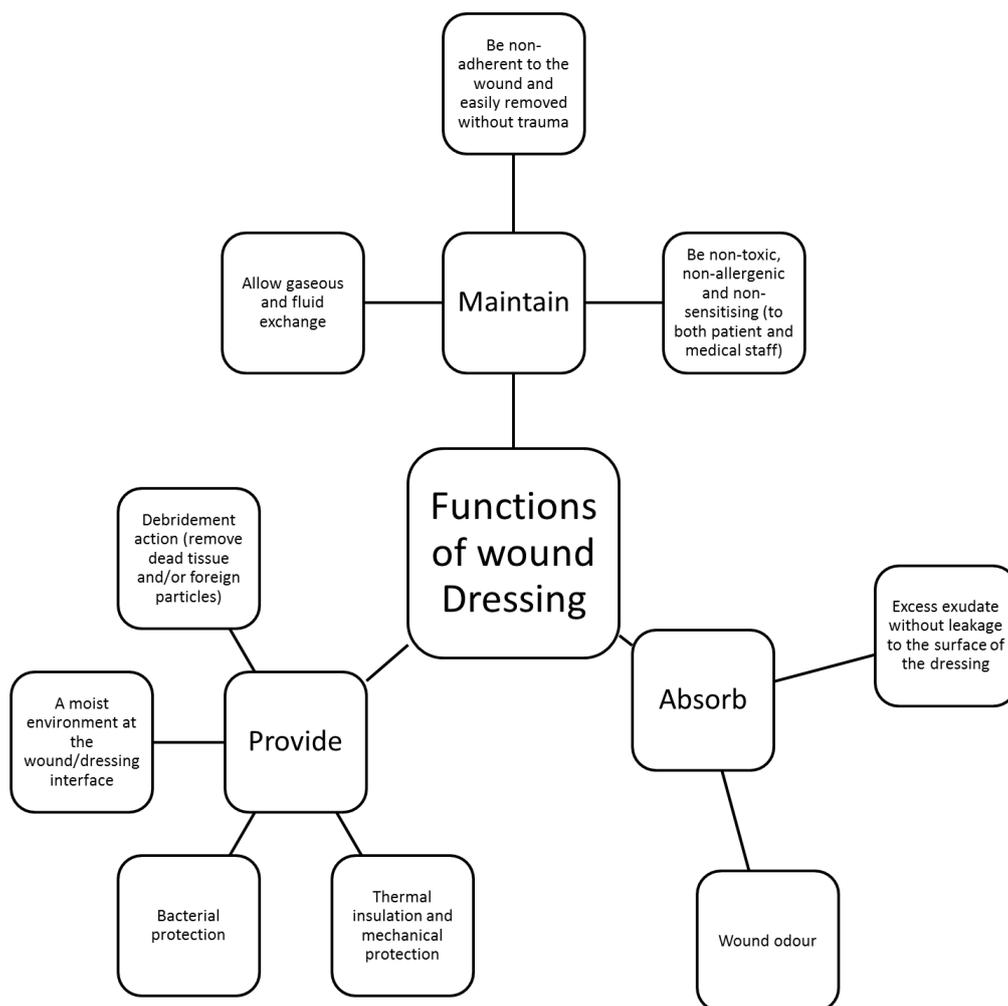


Figure 2: Functions of Wound Dressing

Literature Review

Textile substrates are widely used as wound dressing materials. A wound dressing material treated with chitosan, which is effective against bacteria, will be an ideal material for wound care applications without losing their inherent textile characteristics. Textile substrates used as wound closing materials should act as reservoir of antimicrobial agents and should release them gradually at the affected site for a prolonged period of time¹. New artificial wound coverings has been developed to treat major wound in the skin using hydrogel technology². It has been found that delay in healing of Wound is

due to wound colonization by microorganisms and infections.³ In case of burn wounds, bacterial infections can frequently which cause of the accumulation of dead tissues, compromised immune system and blood supply⁴. But in In chronic wounds the presence of bacteria persist in an adhesive matrix biofilm form causes more resistant to antimicrobial therapy⁵. Acute and chronic wound infections lead to multidrug-resistant organisms thus compromising the chance of therapeutic options⁶. New approaches for the treatment of biofilm-associated infections were developed by overcoming the intrinsic resistance of bacterial cell within biofilm. It Research work using silver Nano particles reveals that the use of silver preparations leads to a new

antimicrobial activity. It has been found that silver interferes with multiple components of bacterial cell structure and very much effective in wound dressing process⁷. Investigation on wound healing found that the property expected for good wound dressing material is to maintain a moist environment, contamination prevention, oxygen permeation, absorb excess exudates, non-adherent to the wound and easily removable after treatment⁸. For speedy wound healing wound dressings with hydrocolloids can be used⁹.

MATERIALS AND MEHODS

Materials

The wound dressing consists of Primary layer and wound contact layer, both are joined by adhesives and finally it is covered by releasable label. Primary layer is Spunbond - meltblown - spunbond (SMS) nonwoven white fabric primarily composed of polypropylene filaments. The SMS fabric is considered to possess good filtration ability. Wound Contact layer is a Spunlace nonwoven fabric composed of viscose and polyester. This material is placed on to the primary layer which help to adhere in the wound.

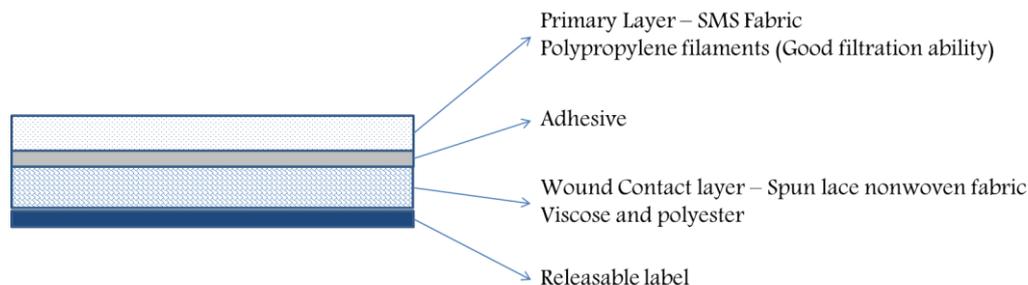


Figure 3: Different layer of Wound dressing

Preparation of Herbal Solution

In this paper two herbal components have been identified based on the fact that these components aid in the process of wound healing by providing an anti-microbial and anti-bacterial effect. The herbal components are extracted from neem and Curcumin as the above herbal components have been identified as the complementary constituents in promoting accelerated wound healing. All these components are in powder form, which are taken in known weights and are mixed thoroughly in lukewarm distilled water. There different solutions were prepared initially:

1. 50% : 50% Neem: Curcumin
2. 70% : 30% Neem: Curcumin
3. 30% : 70% Neem : Curcumin

The test solutions were allowed to settle down in the room temperature with intermittent shaking given to those containers containing the solutions. In the subsequent stages, the herbal constituent was modified due to reduced shelf life of the herbal impregnated wound contact layer, as the fabric structure developed fungus/mildew at room temperature. In addition, the fine particles of herbal constituent also produced very rough fabric surface. Therefore, the herbal solution was filtered twice to remove coarse particles and a clear and fine herbal solution free from undissolved particles was obtained. A mild colorless clear liquid, 8% of Cross linking agent that is soluble in water was used as a preservative to increase shelf life of the dressing. The following combinations were explored:

Table 1: Combination of Herbal Dressing

Samples	Neem %	Curcumin %
Sample 1	1%	1%
Sample 2	0.7%	0.3%
Sample 3	0.3%	0.7%

M:L = 1:50

Methodology

Various types of textile substrates primarily composed of nonwoven fabric free from lint and hypoallergenic to skin are proposed for the study. The wound contact layer reinforced on to the textile substrate is a liquid repellent nonwoven fabric. The contact layer is incorporated with desired composition of neem and curcumin extracts, the composition and method of application is carried out using padding mangle method. However several percentage of composition of neem and curcumin would be evaluated for its performance. The primary layer is given an adhesive coating on the side which adheres on to the skin. The wound contact side of the dressing is protected using release label. The wound dressing is a flexible adhesive based dressing which can be applied on to various contours of body. The wound contact layer of each dressing is protected from external environment with adhesive release paper. The dressing is proposed to be sealed and packed in a transparent pouch which allows the user to examine the dressing prior to application.

Procedure for Wound Dressing Preparation

The primary layer was cut according to the required length. That layer is a non-woven material produced by SMS technique. And the wound contact layer is cut according to the primary layer width [non-woven material produced by spunlace technique] and reinforced that two layer by using adhesive and finally the releasable lable is pasted on the surface to protece the wound dressing is Shown in Figure 4.



Figure 4: Preparation of Wound dressing

RESULT AND DISCUSSION

Testing of Dressing Layers

The water repellency and spray impact test and moisture vapour permeability of the primary layer (Polypropylene produced by SMS technique) was excellent because polypropylene has low moisture absorption. But the alcohol repellancy was failure.

Table 2: Test parameters for primary layer (SMS) – Nonwoven fabric

Test parameter	Standards	Outcome	Interpretation
Water repellency	AATCC 22-2005	Rating 0 (ISO5)	No sticking or wetting on the surface
Spray impact test	AATCC 22-2005	0	Difference in before and after weight; percentage.
Alcohol repellency	BS7209	Fail	Liquid absorption
Moisture vapour permeability (g/m ² / 24 hours)	BS7209	2487	Higher value

Table 3: Test parameters for spunlace fabric (WZ70JX) wound contact layer

S. NO	Parameters	WZ70JX
1	Area density in g/m ²	76
2	Thickness in mm	0.4
3	Bulk density in g/cm ³	0.189
4	Tearing strength in gm	75
5	Bursting strength in kg/cm ²	6
6	Abrasion resistance in % (5000 cycles)	24.5
7	Absorption capacity in g/g	4.6
8	Vertical wicking g cm	8.7
10	Bending length in cm	1.25
11	Flexural rigidity mg cm	1.015
12	Bending modulus kg/cm	194.25
13	Air permeability in ltr/m ² /sec	73

Table 4: Breathability of Bandaid

Breathability of the wound dressing	32.93 cc/s/cm
-------------------------------------	---------------

Antimicrobial activity test (Broth Dilution Test)

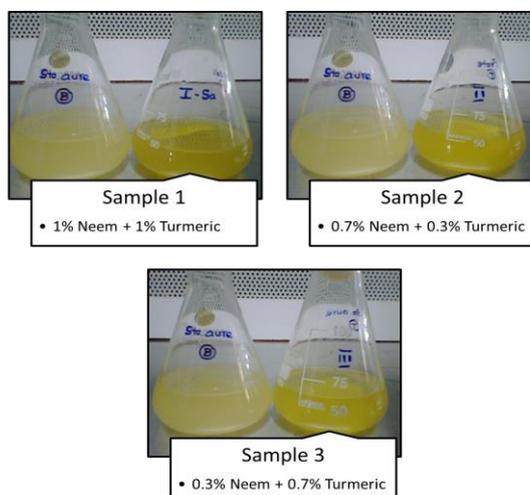


Figure 5: Testing of antimicrobial activity of different samples with the organisms *Staphylococcus aureus*

This method is used to determine the minimum concentration of extract required for inhibit the growth of microorganisms

Table 5: Result of antimicrobial test (Organism: Staphylococcus aureus)

Sample	0 h	1 h	2 h	24 h
1 1% Neem + 1% Turmeric	0.97	0.90	0.88	0.44
2 0.7% Neem + 0.3% Turmeric	0.98	0.92	0.89	0.50
3 0.3% Neem + 0.7% Turmeric	0.97	0.91	0.86	0.49

We test the sample of three different neem and curcumine concentrations. All the three concentrations tested in two organism [Staphylococcus aureus and equilie]. In that all concentration shows better result because neem and curcumine has high anti-microbial activity.

Table 6: Result of antimicrobial test (Organism: Equillie)

Sample	0 h	1 h	2 h	24 h
1 1% Neem + 1% Turmeric	0.99	0.92	0.85	0.40
2 20.7% Neem + 0.3% Turmeric	0.99	0.95	0.91	0.55
3 30.3% Neem + 0.7% Turmeric	0.94	0.90	0.84	0.45

Wound Dressing Test

The three different concentration of wound dressing were tested by using rabbit. The following figure 6, shows three different concentration of wound dressing.



Figure 6: Testing of wound dressing on rabbit

The wound dressing was tested on rabbit (Figure 6). All three concentration sample shown good healing but the sample 1 give better healing property.

CONCLUSION

In anti- microbial activity test all the three concentration samples shows better result because both neem and curcumine have high anti-microbial activity. From the test results it can be concluded that the herbal wound dressing has a good scope of promoting the wound healing process as neem and curcumine process anti-bacterial, anti septic values. The dressings with

neem and curcumine extract can serve as a primary first aid to minor wounds preventing from further infection.

REFERENCES

1. Shanmugasundaram, O. L. et al Drug release and antimicrobial studies on chitosan-coated cotton yarns. Indian Journal of Fibre & Textile Research 2006; 31(4): 543-547.
2. Bhuvanesh Gupta et al "Textile-based smart wound dressings" Indian Journal of Fibre & Textile Research 2010; 35: 174-187
3. Percival, S.; Slone, W.; Linton, S.; Okel, T.; Corum, L.; Thomas, J.G. The antimicrobial efficacy of a silver alginate

- dressing against a broad spectrum of clinically relevant wound isolates. *International Wound Journal* 2011; 8: 237–243.
4. Bloemasma, G.C.; Dokter, J.; Boxma, H.; Oen, I.M. Mortality and causes of death in a burn center. *Burns* 2008; 34: 1103–1107.
 5. Abedini, F.; Ahmadi, A.; Yavari, A.; Hosseini, V.; Mousavi, S. Comparison of silver nylon wound dressing and silver sulfadiazine in partial burn wound therapy. *International Wound Journal*
 6. Rhoads, D.D.; Wolcott, R.D.; Percival, S.L. Biofilms in wounds: Management strategies. *J. Wound Care* 2008; 17: 502–508.
 7. Lipsky, B.A.; Hoey, C. Topical antimicrobial therapy for treating chronic wounds. *Clinical Infect. Diseases* 2009; 49: 1541–1549.
 8. Bowler, P.G.; Welsby, S.; Towers, V.; Booth, R.; Hogarth, A.; Rowlands, V.; Joseph, A.; Jones, S.A. Multidrug-resistant organisms, wounds and topical antimicrobial protection. *International Wound Journal* 2012; 9: 387–396.
 9. Napavichayanun, S.; Amornsudthiwat, P.; Pienpinijtham, P.; Aramwit, P. Interaction and effectiveness of antimicrobials along with healing-promoting agents in a novel biocellulose wound dressing. *Material Science Engineering* 2015; 55: 95–104.
 10. Khundkar, R.; Malic, C.; Burge, T. Use of Acticoat™ dressing in burns: What is the evidence? *Burns* 2010; 36:751–758.

Cite this article as:

Dhinakaran M *et al.* Detailed study on the synergistic effect of neem extract loaded with curcumin in wound healing using textile substrate. *Int. Res. J. Pharm.* 2017;8(7):104-109
<http://dx.doi.org/10.7897/2230-8407.087126>

Source of support: Nil, Conflict of interest: None Declared

Disclaimer: IRJP is solely owned by Moksha Publishing House - A non-profit publishing house, dedicated to publish quality research, while every effort has been taken to verify the accuracy of the content published in our Journal. IRJP cannot accept any responsibility or liability for the site content and articles published. The views expressed in articles by our contributing authors are not necessarily those of IRJP editor or editorial board members.