

CHITOSAN BANDAGE FOR FASTER BLOOD CLOTTING AND WOUND HEALING

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[Received-10/07/2012, Accepted-12/01/2013]

ABSTRACT

The major components of the shells of shrimps, lobsters, crabs and other arthropod shells, chitin is a natural macromolecule abundant in the natural environment. Chitosan is the deacetylated derivative of chitin. Crude Chitosan and crab Chitosan coated muslin cloth shows good blood clotting time in comparison with control. Chitosan containing dressing can be used for cut wounds with potential healing property.

Key words: Chitosan, wound, blood clotting, healing

INTRODUCTION:

Chitosan is a high-molecular copolymer with acetyl glucosamine and glucosamine radicals in its chain. After dissolution in diluted organic and inorganic acids, it forms viscous polyelectrolytes. Solutions of chitosan are prone to yield fibres, film and coatings. Its good miscibility with other polymers means that complexes and chelates are readily formed. The presence of active groups in chitosan molecules allows for easy chemical modification. This is why chitosan is used in many fields, including medicine, namely its specific biological features like biodegradability, biocompatibility, antibacterial activity and ability to bind lipids, thus reducing cholesterol level. [3] Chitosan is a suitable functional material, as its natural polymer has excellent biocompatibility, biodegradability, non-toxicity and adsorption

properties. It is the most abundant polysaccharide next to cellulose and is looked at as a potential. Polysaccharide source [4]. Chitosan can be degraded by soil microorganisms and water microorganisms. This makes chitosan environmental friendly. The US Environmental Protection Agency had exempted chitosan from tolerance level testing [2,7,8,1,12]. Chitosan is a versatile biopolymer and therefore its derivatives have shown various functional properties, which make them possible to be used in many fields including, food, cosmetics, biomedicine, agriculture, environmental protection, wastewater management and fibre industries [8].

MATERIAL & METHODS:

1. Preparation of chitosan coated strip:

a) Preparation of chitosan solution:

Chitosan is soluble in the lactic acid and acetic acid. For applying chitosan on muslin cloth it should be in liquid form. Therefore, chitosan solution is prepared by dissolving chitosan 1.4% (w/v) in 2% (w/v) in acetic acid.

The solution of standard chitosan and chitosan extracted from the prawn shell is prepared by adding 0.7 gm of chitosan in 50 ml of 2% (w/v) acetic acid separately. Each sample is stirred overnight using magnetic stirrer.

b) Application of chitosan on muslin cloth:

Before application of chitosan, the muslin cloth was washed well under tap water and dried. Then, three rectangular shaped pieces were cut from the cloth. These pieces were labelled as normal, standard and test which indicated no chitosan, standard chitosan and chitosan extracted from prawn shell respectively. The standard and test strips were dipped in respective solutions very well and allowed to dry at room temperature.

2. Blood clotting test:

Clotting activity was evaluated as follows

- a) Pricked the finger tips using lancet the blood was made to flow continuously.
- b) At time of pricking the stopwatch was started simultaneously.
- c) Blood drops were blotted after every 30seconds time intervals on one strip at a time. The same procedure was repeated for the remaining two strips and blood clotting time was measured.

Wound healing activity:

a) Preparation of chitosan solution:-

Chitosan is soluble in acetic acid. For applying chitosan on muslin cloth it should be in liquid form. Therefore chitosan solution is prepared by dissolving chitosan 1.4% (w/v) in 1% (w/v) lactic acid or 2% (w/v) in acetic acid.

The solutions of standard chitosan and crude chitosan were prepared by adding 0.7 gm of each chitosan in 50 ml of 2% (w/v) acetic acid separately solution was prepared and stirred overnight using magnetic stirrer.

b) Preparation of bandage: -

Bandage was prepared using crude chitosan and STD chitosan. Like surgical bandage, bandage had cotton gaze on outer side and in inner side thin layer of cotton was present. Then, these bandages were dipped in chitosan solution and then dried at room temperature. Bandages were sterilized before their use.

c) Wound Healing Test:-

Two healthy male rats were taken for test, M1 and M2 respectively. The animals were anesthetized, Then, M1 rat was taken into sterilized tray; hairs from rat back were removed using sterilized razor. Skin of rat was cut using scissor at two sites and bandages (containing standard and crude chitosan) were applied. Similar, anaesthetic process was used for M2 rat. Hairs from rat back were removed using sterilized razor. Metal rod was heated used and burn wounds were created. (All experimentations were done as per INSA rules for animal experimentation). Then, bandages (containing standard and crude chitosan) were applied on back. Both, M1 & M2 rats were kept under observation for 7 days. And wound healing was checked

RESULTS & DISCUSSION

Comparative study on different properties of Standard Chitosan and Chitosan extracted from Prawn Shell indicated that chitosan takes two fold less time to clot the blood than that taken by the natural blood clotting process Fig. No. 1 & Table No. 1. Also the chitosan extracted from prawn shell shows wound healing properties. It has shown significant healing effect on cut made on back, on application of bandages dipped into both standard & crude chitosan respectively It can be used effectively used in medical treatment to

reduce blood loss and induce faster wound healing in case of heavy blood loss resulting from injury. Chitosan extracted from the prawn shell can be used as active blood clotting agent. Tanveer et. al.[11] have studied Mechanical, Bioadhesive strength and Biological Evolutions of Chitosan films For Wound Dressing. Shelma et al , [10] has Chitin Nanofibre Reinforced Thin Chitosan Films for Wound Healing Application. .Abhay, [6] has Hemostatic wound dressing US patent. Jayasree *et al.*, [5] has done the Development of Artificial Skin (Template) and also reports studies on influence of different types of sterilization procedure on wound healing pattern in rabbits and guinea pigs. Our results on the blood clotting and wound healing with crude extract of chitosan shows promising results.

1) Blood Clotting test:



Fig. No.1 Control, standard chitosan & Chitosan extracted from Prawn Shell

	Control	Strip having Standard Chitosan	Strip having Chitosan extracted from Prawn Shell
Numbers of blood drops	8	5	4
	8	5	4
	8	5	4
	8	5	4

Table 1: blood clotting test

Blood Coagulation time (in Seconds):

Bleeding time = 30 × (number of blood drops)

1. For Control;

Coagulation time = 30× 8 = 240 sec.

2. For standard chitosan;

Coagulation time = 30×5 = 150 sec.

3. For Chitosan extracted from Prawn Shell;

Coagulation time = 30×4 = 120 sec .

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