NOVEL BIO-COMPOSITE FILM MADE OF COLLAGEN EXTRACTED FROM TILAPIA FISH SKIN TO TREAT OPEN WOUNDS IN ELDERLY

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College ***:*** *Dayananda Sagar College of Engineering, Bengaluru*
Branch ***:*** *Department of Biotechnology*
Guide(s) ***:*** *Dr. Blessy Baby Mathew*
Dr. Anantharaju K.S.
Student(S) ***:*** *Ms. Hanisha A*
Ms. M. Jahnavi Chowdhary
Ms. R. U. Sakthi
Ms. Supritha M.

Keywords:

Collagen, bio-composite, chitosan, Tilapia fish, open wounds.

Introduction:

Wound healing is a major clinical issue in older people. There are natural delays in the healing of older individuals [1]. Collagen is structurally and functionally a key protein of the extracellular matrix which is also involved in the scar formation during the healing process [2].It is obtained from numerous sources like bovine and porcine. Due to the outbreak of diseases like Bovine spongiform encephalopathy, avian flu among the land animals, search for alternative source is necessary. Marine sources are reliable and economic source of collagen. This includes fishes [3]. Fish type 1 collagen is an effective material as a scaffold replicating the natural extracellular matrix which directs site specific cellular regulation. Tilapia fish is used to extract the collagen for wound dressing material. Fish collagen generally has a low degenerative temperature but, the skin of the tilapia fish is a powerful candidate for use in making a clinical scaffold as an alternative to bovine collagen because it has high collagen content, exhibits properties similar to type-I human collagen, high level of moisture content and has higher denaturation temperature when compared to other fish [3][4][5]. The ultimate goal in the management of open wounds is to obtain physiological closure in the shortest period of time. Synthetic dressings have lot of disadvantages because of which continued research for good functional biological dressing resulted in the evolution of collagen based wound dressing. This collagen is haemostatic, has low antigenicity, supports cellular growth and forms the essential substrate for cellular adhesion and migration [6]. Therefore, collagen is considered to be an important factor in the regenerative process. Collagen dressings have an easier application and are natural, non-immunogenic, aids in bioavailability of fibronectin, preservation of leukocytes and macrophages and it peels off once wound is healed [7].

Objectives:

1. To develop a collagen based novel bio-composite film.
2. To analyze and characterize the fabricated film.

3. To evaluate compatibility of collagen-based film bio composite to treat open wounds in elderly.

Upon extracting collagen from fish skin, it is mixed other natural biomaterial like chitosan that was extracted from shrimp shell as collagen does not have anti-bacterial activity of its own and has a low mechanical stability. The morphology and structure of the synthesized bio-film & scaffold is being currently investigated through SEM and key functional groups are being examined by FTIR analysis. The evaluation of bio-compatibility of the fabricated wound dressing material using cell lines is also under progress. Additional studies like anti-bacterial assay, porosity, swelling ratio and mechanical testing will be done.

Methodology:

Extraction of collagen from Tilapia fish skin

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Characterisation of extracted collagen

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Extraction of chitosan from shrimp shell

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Characterisation of extracted chitosan

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Fabrication of biocomposite film using collagen and chitosan

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Fabrication of biocomposite scaffold using collagen and chitosan

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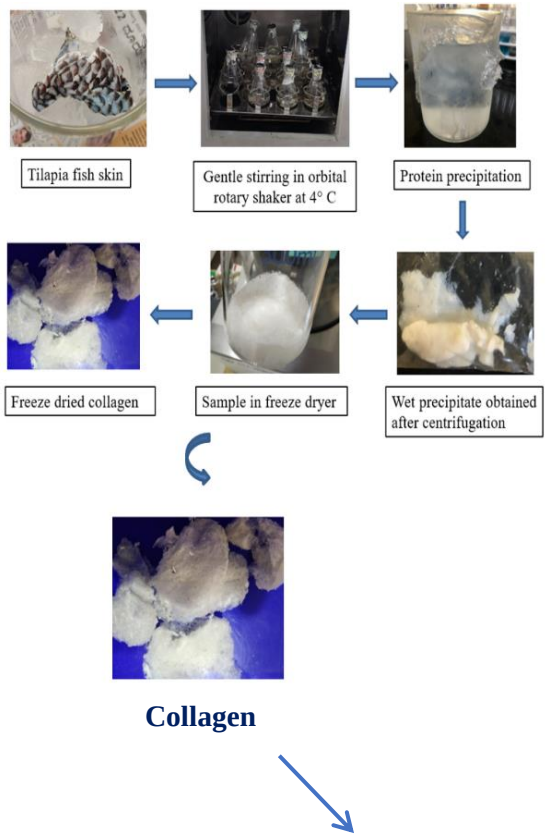
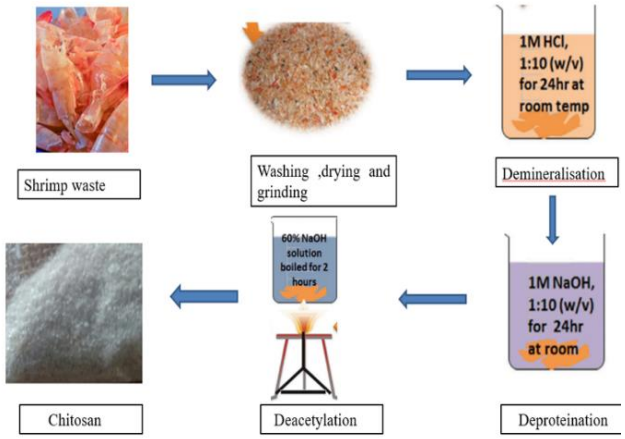
Characterisation of fabricated biocomposite film and scaffold

Extraction of collagen from Tilapia fish skin



Collagen

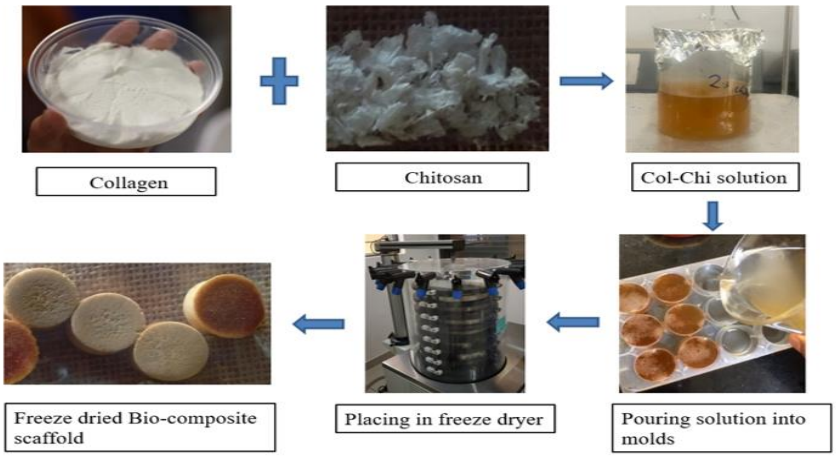
Extraction of chitosan from shrimp shell



Chitosan

Formulation of bio-composite films for wound healing application

Formulation of bio-composite scaffold for wound healing application



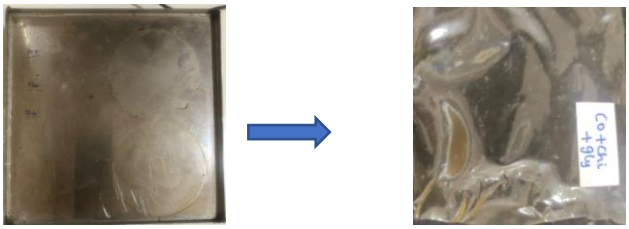
Results and Discussion:

Extracted Collagen from Tilapia fish skin

Extracted chitosan from shrimp shell

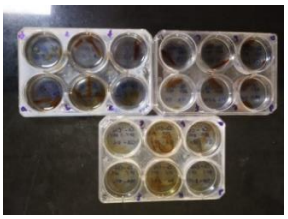
Bio-Composite Films:

Bio-composite films was fabricated using solvent casting technique, where films were made stable by using cross-linkers. Bio-composite films without cross linker got shredded in water showing no stability.

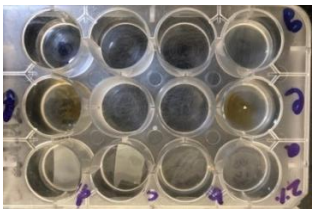


Solvent-casting method **Bio-composite Films**

Water Stability of the Films:



Without cross-linkers



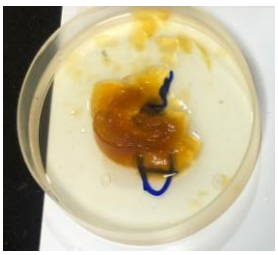
With cross-linkers

Bio-Composite Scaffolds:

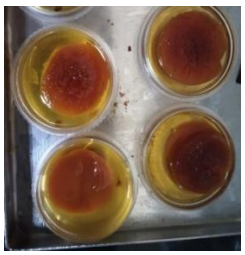
Bio-composite scaffolds were obtained by freeze drying, where scaffolds were made stable by using cross-linkers. Bio-composite scaffold without cross linker got shredded in water showing no stability.

Bio-composite scaffold

Water Stability of the Scaffold:



Without cross-linkers



With cross-linkers

Scope for future work:

Developing collagen based wound dressing to treat second degree and third-degree burns. A cost effective, highly efficient, easily accessible and usable product developed to treat burns. Advanced studies can be done in tissue engineering and regeneration using collagen. Application of collagen extracts in drug delivery, cell culture, food processing and other therapeutic agents, to develop many useful products in the respective fields. Further study, research and product development can be done for having healthy joints and strengthen our bones in body using collagen. Future research directions on collagen application for cosmetic purposes may be focused on increasing the denaturation temperature of several types of collagen extracted from fish species. Such an increase of denaturation temperature may expand collagen application not only in cosmetic fields.

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