

A Review on Study of Keratin Hydrogel for Wound Healing from Chicken Feathers.

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ABSTRACT:

Keratin became extracted from wonderful segments of disposable waste fowl feathers collectively with complete feathers calamus/rachis (β -sheet) & barbs/barbules (α -helix), the usage of reductant. Quality of feather keratin is less difficult to govern than that of human hair keratin perming & coloring-dyeing. The keratin hydrogel is ready for wound recovery the use of keratin-ginestin, keratin-chitosan. Keratin's inherent bioactivity, biocompatibility, and bodily residences make it exceedingly appealing for wound recovery applications. The characterization assessments for keratin hydrogel is FTIR, X-ray diffraction, SEM, solubility test, swelling test. Keratin fibers extracted from fowl feathers certainly own the ones residences, making them environmentally pleasant options for numerous applications. They are non-abrasive, biodegradable, insoluble, and may be applied in numerous industries which include textiles, bioplastics, and whilst reinforcement substances in composites.

KEYWORDS: Chicken feathers, reductants, keratin, hydrogel, wound healing, FTIR, SEM, X-ray diffraction.

I. INTRODUCTION

Keratin is a tough, fibrous protein and, being the primary thing of hair, feathers, nails, wools, hooves and horns of mammals, reptiles and birds, it's far the 1/3 maximum considerable polymer within the surroundings after cellulose and chitin. It has precise biodegradability and biocompatibility houses and non-toxic. It may be changed and evolved in numerous forms which include gels, films, beads and nano/micro particles. As such it constitutes an essential of renewable and sustainable uncooked fabric for plenty of applications. Indeed keratin has several applications in inexperienced chemistry, meals science, the pharmaceutical, biomedical and cosmetic industries, and composite materials. Keratin proteins are self-assembling proteins and they are able to polymerize right into a complicated three-dimensional system like hydrogel and cell scaffold.

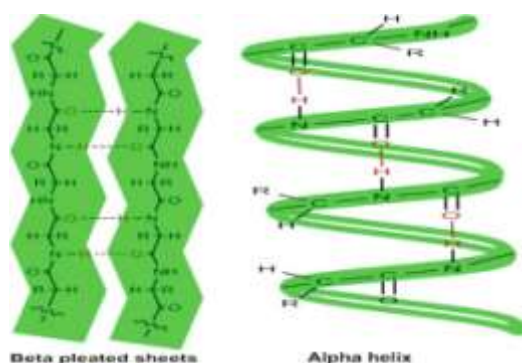


Fig: alpha helix and beta pleated sheet of keratin

The solid structural morphology of the keratin certainly lends itself properly to numerous packages in bioproducts. Its versatility lets in for the advent of films, scaffolds, sponges,

nanoparticle, and hydrogels, allowing a huge variety of uses in fields inclusive of biomedicine, cosmetics, and substances science. Keratin protein may be extracted from many

supply, one in every of sample supply is bird feathers.

The chicken feathers possess 91% of keratin. Chicken feathers abundant as polutary waste. Thus it become another advantage to produce the environmentally friendly product. The chicken feathers are extracted by various reducing agents. The reducing agent like thioglycolic acid or sodium sulfide disrupt the disulfide bonds in keratin fibers, decreasing their stability and allowing for the manipulation of feathers.

Feather keratins are small proteins, uniform in size, with a molar mass pronounced to be ~10–36 kDa . The shape of keratin confers insolubility, mechanical balance and resistance of feathers to not unusualplace proteolytic enzymes and chemicals . Keratins are stabilized with the aid

of using many intra- and intermolecular disulfide cross-hyperlinks in addition to different structural functions. Its excessive energy and stiffness are because of the excessive percentage of cysteine residues withinside the polypeptide backbone, bonded with the aid of using disulfide hyperlinks. These functions purpose insolubility in polar solvents like water, vulnerable acids and bases, in addition to in a polar solvents . Keratin stays reactive however, due to the fact the cysteine gadgets may be reduced, oxidized and hydrolysed . The keratin shape is stabilised with the aid of using a number non-covalent interactions (electrostatic forces, hydrogen bonds, hydrophobic forces) and covalent interactions (disulfide bonds), which should be disrupted to facilitate dissolution of feathers.

Table: Amino acid composition of chicken feathers.

Amino acids	uM/mg Protein*1	Amino acids in Protein %
Aspartic acid	0.358	4.76
Threonine	0.345	4.11
Serine	1.292	13.75
Proline	0.875	1.01
Glutamic acid	0.624	9.18
Glycine	1.008	7.57
Alanine	0.411	3.66
Valine	0.618	7.24
Cystine	0.088	2.11
Methionine	0.017	0.025
Isoleucine	0.376	4.93
Leucine	0.570	7.48
Tyrosine	0.102	1.85
Phenylalnine	0.267	4.11
Lysine	0.039	0.57
Histidine	0.001	0.016
Arginine	0.377	6.57

Hydrogels are three dimensional network structures or polymeric structure which can absorb and retain significant amount of water. Usually it is made of natural or synthetic polymers as a structural backbone. Hydrogels are polymeric substances characterised as an organized cross-related networks that soak up and preserve sizeable quantities of water. Hydrogels were explored in numerous promising application regions consisting

of wound healing, wound dressings and pores and skin substitutes. Hydrogels can hold a wet wound surroundings that accelerates healing, lessen ache and infections, as a consequence contributing to reduced normal fitness care costs Keratin hydrogel could be prepared from different keratin sources, using different extraction conditions and gelatin methods.

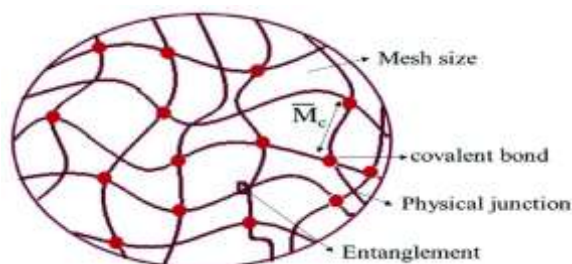


Fig: structure of hydrogel at molecular level

Keratin hydrogels are also used for wound healing. Wound healing agents are added to promote wound healing process. Wound healing agents are chitosan, aloe vera, honey etc. To test the properties of hydrogel, it's far characterised via way of means of Fourier Transform Infra Red Spectroscopy (FTIR), X-ray Diffraction (XRD), swelling test and solubilizing test functionality below widespread condition. Curcumin is a bright yellow chemical found in turmeric, which is derived from the *Curcuma longa* plant. It's anti-inflammatory and antioxidant properties making it beneficial for various health conditions, including wound healing and respiratory issues like cough and cold.

Extraction of keratin from chicken feathers:

1. Pre treatment of the feathers: Feathers are collected from chicken processing plant and soaked in ether for 24 hrs. Wash with soap water and dried under sunlight then blend the feathers and kept carefully in sealed plastic bag.
2. Dissolving of chicken feathers: Dissolve 50g of blended chicken feathers in 2L of 0.5 M sodium sulfide solution. Heat the solution to temperature 30°C, pH is maintained about 10-13. Stirr the solution for 6 hrs, filter and centrifuged at 10000rpm for 5 min. Supernatant liquid cautiously gathered then

filtered with the use of filter paper to make it particle free

3. Preparation of ammonium sulphate: Dissolve 700g of ammonium sulphate in 1L of deionized water, stir and filter.
4. Protein precipitation: Feather collected solution placed in a beaker and stirred and ammonium sulphate solution is added slowly drop wise. The ratio should be 1:1. Centrifuge the solution at 10000rpm for 5 min and solids particles are carefully collected and repeat step 2 and 3.
5. Protein purification: Solid particles collected are added into 100ml deionized water and stirred. Centrifuge it at 10000rpm for 5 mins and the solids are gathered. Solid particles are dissolved in 100ml of 2 M NaOH solution. Centrifuge at 10000rpm for 5 min and all the liquids are collected carefully and stored while the solids are discarded. The precipitating, washing and dissolving steps are repeated 3 times.
6. Biuret test: 1% of copper sulphate solution and 1% of potassium hydroxide solution are prepared. The 5 ml of keratin solution collected is mixed with KOH solution with 1:1 ratio. Add 3 drops of copper sulphate solution to the mixture. Changes is observed and recorded.



Fig : steps of extraction of keratin from feathers.

II. CONCLUSION:

Researching at the wound recuperation impact and biocompatibility of feather keratin may

want to certainly beautify the improvement of keratin primarily based totally materials. Additionally, the controllability of feather keratin

quality, facilitated with the aid of using procedures like preening and dying, gives blessings over human hair for such application. The keratin hydrogel display first-rate bodily properties. Curcumin indicates the first-rate wound recuperation belongings. To beautify the wound recuperation belongings of hydrogel chitosan-curcumin aggregate may be used.

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