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The Utilisation of Gelatin Biopolymer in Textile Wet Processing

Ahmed G. Hassabo [a]*, Menna Zayed [b], Mai Bakr [b] and Hanan A. Othman [b]

[a] *National Research Centre (Scopus affiliation ID 60014618), Textile Research and Technology Institute, Pretreatment and Finishing of Cellulose-based Textiles Department, 33 El-Behouth St. (former El-Tahrir str.), Dokki, P.O. 12622, Giza, Egypt.*

[b] *Benha University, Faculty of Applied Arts, Printing, Dyeing and Finishing Department, Benha, Egypt.*

Gelatin is a natural polymer that is biocompatible and biodegradable. It is derived from collagen. Beneficiation of gelatin can lead to their conversion into high-value biomaterials, provided that cost-effective, long-term technology for converting this biopolymer into usable bioproducts exists or is developed. In this review, sources of gelatin, extraction of gelatin, the chemical composition of gelatin, as well as its application in the textile industry were reviewed. Gelatin is non-toxic, low cost, and high availability, so it can be used as a bio-material in textile treatment to improve the dyeability of textiles, and the pretreatment process such as the bleaching process. Gelatin also can be used as a finishing agent because of its antibacterial, antioxidant, and anti-fungal activities.

Keywords: Gelatin, Pre-treatment, Dyeing, Finishing.

Introduction

Gelatin made from animal tissue has been used as glue since antiquity, dating back to 6000 BC. Gelatin was a common component in recipes at Henry VIII of England's court throughout the 16th century. Its production has been more industrialized over time, and the number of uses has grown. [1]. It is currently widely utilized in industries such as food, photography, pharmaceuticals, and textiles. [2].

Gelatin is a polypeptide with a high molecular weight that is non-toxic and biodegradable [3, 4]. Gelatin is a soluble protein compound produced by the partial hydrolysis of collagen, the major fibrous protein component in bones, cartilages, and skins; hence, the source, age of the animal, and type of collagen are all inherent variables determining the qualities of gelatins [5, 6].

Collagen does not have the same structure, composition, and characteristics. Although up to 27 various kinds of collagen have been found, type I collagen is the most common in connective tissue. Interstitial collagen molecules are made up of three a-chains that are interlaced in a form known as the collagen triple-helix [5].

During the gelatin-making process, Proteins are extracted from skin and bone using acid or alkaline baths and thermal pre-treatments. The proteins are subsequently separated from the remaining raw material using a heat process [1]. Depending on the production procedure, the extract is subsequently deionized, sterilized, and dried, but further processes might be added. Gelatin is the dried substance obtained. A and B gelatin are created by acid and alkaline pre-treatments, respectively [2, 5].

In this study, we review the possibilities of using gelatin in textile applications. We believe that gelatins are a valuable resource because they are high in proteins and amino acids; their beneficiation can result in their conversion into high-value

Corresponding author, Ahmed G. Hassabo, Email, aga.hassabo@hotmail.com, Tel., +20 110 22 555 13
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materials and products, provided that cost-effective technologies for converting this waste into useful products exist or are developed. the chemical composition, application, and source of gelatin and gelatin-based hydrogels are also reviewed.

Sources of gelatin

Gelatin may be manufactured from a variety of collagen sources. The primary commercial sources are cattle bones, hides, pig skins, and fish. There are no plant sources of gelatin, and no chemical link exists between gelatin and other compounds classified as vegetable gelatin, such as seaweed extracts [7].

Mammalian gelatin

Mammalian gelatin is produced from collagen, which is the main component of vertebrate animals' connective tissues and bones. The analysis of two separate mammalian gelatin, namely those derived from bovine (type B) and porcine (type A), found that both sources included components with a wide range of different molecular weights ranging from 10 to 400 kDa. The results also revealed a strong correlation between gelatin's average molecular weight and gel strength, as well as high isoelectric and melting temperatures. The most popular and commonly utilized gelatins are mammalian gelatin (porcine and bovine) [8].

Insect gelatin

Many edible insects are consumed in Sudan, with the desert locust being the most well-known in many regions of the nation, alongside sorghum and melon bugs. Aspongopus viduatus (melon bug) and Agonoscelis pubescens (sorghum bug), are commonly known in Sudan as Um-bugga and Dura andat, respectively. In some areas of Sudan, the collected bugs were extracted and the resulting oil was used for food and medical uses. Melon bug crude oil and phenolic compound-free oil showed strong antibacterial activity against various test species. The protein from the two bugs included 16 known amino acids, including all of the necessary amino acids. [7].

Fish gelatin

Gelatin has recently been produced alternatively from aquatic animal byproducts such as fish skins, bones, scales, and fins. In reality, many fish gelatins have poor gelling or rheological qualities due to lower amino acid content (proline and hydroxyproline) when compared to mammalian gelatin[9]. The dark colour, stronger odour, and increased water solubility further limit the manufacture and application of fish gelatin on a broad scale [10].

Denaturation of soluble collagen to gelatin

The simplest method of converting collagen to gelatin is to denature soluble collagen (see Fig. 1) [11]. It entails hydrolysis that is catalyzed by enzymes, acid, or alkali. Thermal denaturation occurs in mild conditions by heating the collagen to about 40°C in neutral or slightly acidic conditions. The transition is abrupt and complete in a few minutes using a small temperature. The denaturation activation energy is around 81 Kcal. At that moment, only the hydrogen bonds and hydrophobic bonds that aid to support the collagen helix are destroyed, leading the collagen fibres and fibrils to dissociate into tropocollagen units. The next stage in collagen hydrolysis is to break the intramolecular bonds between the three chains of the helix.[7]

Chemical composition of gelatin

Gelatin is made up of eighteen various amino acids, the most common of which are proline, hydroxyproline, and glycine. By connecting, these amino acids produce polypeptide chains. These polypeptide chains contain more than a thousand amino acids. Gelatin is made up of primary, secondary, and tertiary helicoid structures and has a stick-like molecular structure (Fig. 2) [12].

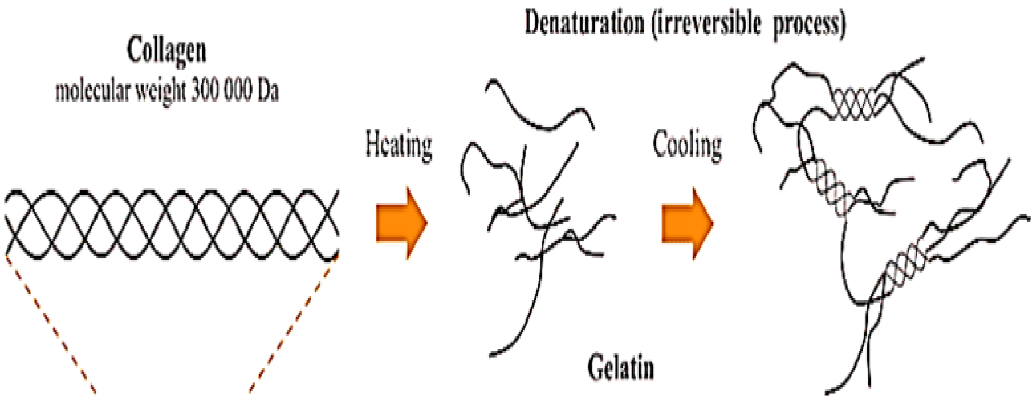

Fig. 1. Denaturation of soluble collagen to gelatin.

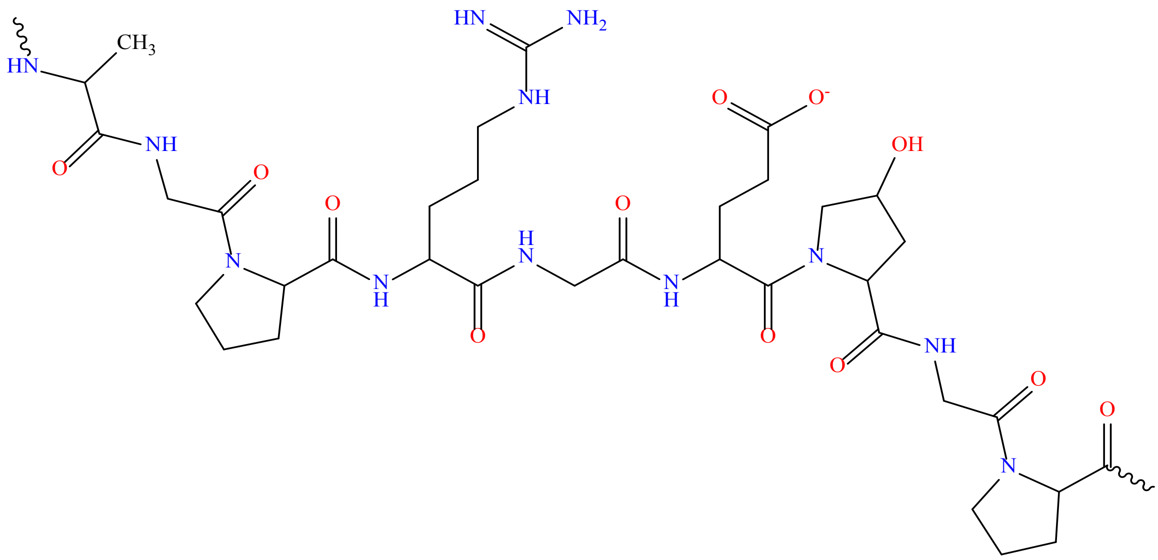

Fig. 2. Molecular structure of gelatin.

Application of gelatin in the textile industry

The gelatin in pretreatment processes

Tang et al. investigated the use of cationic gelatin protein in scouring and bleaching cotton fabric to reduce bleaching temperature and improve bleaching efficiency. The cationic gelatin protein agent is applied to cotton fabric scouring and bleaching, and the effect of the treatment process on cotton fabric whiteness and reactive dye uptake is investigated. The process conditions for one bath scouring, bleaching, and cationic modification on the cotton fabric were then determined. It is bleached at 60°C for 40 minutes, then heated to 90°C at a rate of 3°C/min for 10 minutes using hydrogen peroxide 15 mL/L, sodium hydroxide 2 g/L, scouring agent 2 g/L, and cationic gelatin protein agent 6 g/L. The results show that cotton fabric scoured and bleached using the new method can essentially approximate the performance of the conventional approach. Meanwhile, the cotton fabric has been cationic modified, which considerably improves the fabric dyeing ability for reactive dyes. This method offers the advantages of a shorter processing time, a lower processing temperature, and less alkali agent and cotton fabric damage [13].

There was an investigation that prepared gelatin–copper complex and then used it as a catalyst in a hydrogen peroxide bleaching bath. Cotton was bleached at a low temperature (70°C) using the novel technique. The gelatin–copper complex can be used as a catalyst for hydrogen peroxide bleaching. When added to the bleaching bath in an appropriate amount, it improves fabric whiteness, decreases fibre damage, and reduces sodium hydroxide dose. The hydrogen peroxide/ gelatin–copper complex bleaching system is an efficient low-temperature and low-alkali bleaching system that solves the disadvantages of the standard high-temperature and high-alkali hydrogen peroxide bleaching method [14].

Another study investigated the UV and VIS absorption spectra of the gelatin copper complex and it was observed that the gelatin copper complex differs from gelatin and copper (II) sulphate. When gelatin copper complex or copper (II) sulphate is added to the bleaching solution, the rate of breakdown and bleaching of hydrogen peroxide increases dramatically. The rates of hydrogen peroxide breakdown and bleaching in the hydrogen peroxide /gelatin copper complex system are comparable to those in the hydrogen peroxide /copper (II) sulphate system. The whiteness and capillary effects of the bleached cotton fabric (at 70°C) in the H_2O_2/gelatin copper complex system and the H_2O_2/copper (II) sulphate system can be nearly close to those of conventional high-temperature (90°C) bleaching, but the damage to the bleached fibre in the H_2O_2/gelatin copper complex bleaching system is less than that of conventional high-temperature bleaching and catalytic low-temperature bleaching by copper (II) sulphate. The damage of the bleached cotton in hydrogen peroxide /copper (II) sulphate is the biggest among the three bleached fabrics. As a result, Gelatin copper complex can be a more effective catalyst for peroxide low-temperature bleaching of cotton than copper (II) sulphate [15].

Improving the Dyeability of fabrics using Gelatin

Ha et al studied the treatment of Cotton fabrics with gelatin to enhance their dyeability and colour strength when dyed with cochineal dye. gelatin treatment process (10g/L concentration) was applied using the Pad-dry-cure method. The scanning electron micrograph (SEM) showed that the gelatin was deposited on the surface of cotton. Fabrics that had been pretreated were mordanted with 10% (owf) alum. The fabrics were then dyed with cochineal. The K/S value with cochineal dyes on gelatin treated cotton was substantially higher than on the original cotton fabric. Because gelatin contains a considerable number of hydrophilic groups, treating cotton with 10g/L concentration gelatin resulted in greater cochineal dye adsorption [16].

Another study also investigated the impact of Pretreatment of cotton fabric with gelatin on improving the dyeability of Caesalpinia sappan dye. When untreated and gelatin-treated samples were compared, it was discovered that the K/S in the gelatin-treated fabric increased twice as much as in the untreated fabric[17]. H XU et al pretreated cotton/polyester blended fabric with cationic gelatin to enhance the dyeability and the results showed that The treated fabric had a greater k/s than the untreated fabric [18].

Mohamed et al. treated cotton fabrics with gelatin to improve their dyeability using reactive dyes and antibacterial properties. Pad-dry- cue technique was used for the treatment process. The treatment pad-bath was made up of dimethylol dihydroxy ethylene urea (DMDHEU), ammonium dihydrogen phosphate as a catalyst, and gelatin at a concentration of 5% (w/w) and a non-ionic wetting agent. Then reactive dyes were used to dye the fabrics. The results revealed that pretreatment fabrics' dyeability and antibacterial activity were improved, allowing them to be employed as medical textiles in the medical and pharmaceutical industries. Furthermore, the fastness of all dyed samples to washing, rubbing, and perspiration was excellent to very good [19].

Gelatin as a finishing agent

Zheng et al developed a hemostatic material capable of stopping wound bleeding fast by layering carboxymethyl chitosan (CMC), gelatin, and alginate onto a cotton gauze surface in a simple layer-by-layer (LbL) technique. In a brief, they grafted CMC onto cotton fibres via an esterification reaction with the hydroxyl groups of the cellulose chains and then used ionic interactions with CMC to build a gelatin layer on the CMC layer. Finally, they incorporated alginate via the lamellar structure via cross-linking reactions by Ca^{+2} ions diffused through the gelatin layer. according to characterization analyses, the final composite dressing has good fluid absorption, excellent biocompatibility, and hemocompatibility. In animal studies, it demonstrated superior hemostatic efficacy as compared to cotton gauze, with a short hemostasis time and little blood loss in the mouse liver damage model and mouse-tail amputation test. Furthermore, in a mouse defect wound model, the composite dressing promoted wound healing significantly. This novel composite dressing, made from natural raw materials, is a good candidate for wound dressing and has shown significant promise in medical applications [20].

In another study, Gelatin was also used as an antibacterial agent for cotton fabrics via the pad-dry-cure method. The optimum condition for cotton treatment was a gelatin concentration of 7%, a DMDHEU concentration of 60 g/l, and an ammonium dihydrogen phosphate concentration of 1 g/l, which was dried at 80 C for 5 minutes and cured at 160 C for 3 minutes. FT-IR spectroscopy showed that gelatin bonded with fabrics. SEM confirms the fixation of gelatin onto the cotton surface due to the etherification reaction. Gelatin has been demonstrated to have stronger antibacterial activity than ciprofloxacin and may be used as a safe and powerful natural antibacterial agent for cotton fabrics. The treated cotton fabric had more antibacterial action against Gram-positive bacteria than Gram-negative bacteria. In addition, it was found that the treated fabrics were durable for 25 washing cycles. [21].

A study was conducted to create nonwoven viscose textiles containing AgNPs covered with three natural hydrophilic polymers, namely gelatin, carbohydrate carboxymethyl chitosan, and alginate. different Characterization was used to evaluate the physicochemical properties of the nonwoven viscose. The results showed that larger concentrations of AgNPs were taken up by viscose fabric while increasing the concentration of AgNPs in the colloidal solution during the padding process. Overall, the treated nonwoven viscose, both with and without polymer coatings, demonstrated outstanding antibacterial activity in vitro against two bacterial types. In addition, they obtained high and rapid wound healing in rats, which was nearly identical to commercial dermazin therapy [22].

In an investigation, patchouli oil was microencapsulated using chitosan and gelatin using a complex coacervation technique, then immobilized on cotton fabrics by the etherification crosslinking reaction. The microcapsules ranged in size from 1 to 20 nm and had a spherical form with a rough surface. Because of their tiny size, microcapsules may be diffused into the fabric fibre space and grafted onto the fibre via the crosslinking reaction. SEM and FTIR revealed that the etherification of 2D resin, chitosan–gelatin microcapsules, and cellulose hydroxyl groups was successful. Furthermore, the crosslinking reaction and bacteriostatic activity of chitosan and patchouli oil would account for the treated materials' remarkable antibacterial efficacy and washing durability, with the antimicrobial rate for S. aureus and E. coli remaining about 65 % even after 25 washing [23].

The cinnamon bark oil was also successfully encapsulated in gelatin-chitosan complex film. The elemental analysis and IR analysis support the presence of gelatin chitosan microcapsules containing cinnamon bark oil on the linen fabric. The composition of cinnamon bark oil, gelatin, and chitosan worked together to provide the final fabric with outstanding antibacterial and antioxidant properties. Furthermore, the finished linen fabric has excellent mosquito repellent and aroma properties. under pressure, temperature, or alkaline conditions, the stable microcapsules were projected to produce a slow release of cinnamon bark oil by diffusion or rupture [24].

Murugan et al. investigated the effectiveness of citronella oil (CO) in repelling Aedes aegypti mosquitos. citronella oil was microencapsulated using complex coacervation of gelatin and Arabic gum and was then treated on cotton using the pad dry technique. The repellent effect of cotton textiles with concentrations15%, 30%, and 50% of the repellent mixture on Aedes aegypti was tested using cage and outdoor tests with human arms wrapped in treated and untreated fabrics. In this investigation, microencapsulated citronella oil-treated cloth had the best repellent effect, with 50% of the microcapsules providing a 90 to 100% repellent effect against mosquitoes compared to the other over the first nine days without washing. However, the directly 50% citronella oil-treated fabric showed the highest efficacy only for the first two days, after which it was gradually decreased. [25].

Application of Gelatin-Based Hydrogels for Medical Textiles

Hydrogels composed of hydrophilic components are three-dimensional, porous, and have an interpenetrating polymeric network that contains large amounts of biological fluids, allowing them to maintain their structure at physiological pH and temperature [26]. Hydrogels are widely employed in biomedical applications due to their efficient control over swelling kinetics and high-water holding capacity. From a biomedical standpoint, self-healing and in situ forming hydrogels are important [27-31].

Textile applications of gelatin-based hydrogels have begun in drug delivery systems where transdermal drug transport has been achieved, and thermoresponsive gelatin-based hydrogels are successfully building drug transport systems for textile applications [32]. Textile-based transdermal treatment using drug-loaded gelatin-based hydrogel has become more successful in human skincare. Functionalized textiles covered with gelatin-based hydrogel (stimuli-responsive) could balance body temperature by managing moisture on the skin and giving comfort to smart textile users[33].

Gelatin-based hydrogels are utilized in wound healing in various forms such as patches, gels, and so on. It absorbs exudates while keeping tissue repair materials like lysosomes and growth factors in touch with the damaged region, keeping it wet and speeding up the healing process[34].

Baseer et al. developed smart cotton textiles with many functionalities, including antibacterial activity and UV protection, by in situ coating with conductive polymer and conductive hydrogel. 3-(furan-2-carboamido) propionic acid was synthesized followed by polymerization using ceric ammonium nitrate. Cotton textiles were also coated with 3-(furan-2-carboamido) propionic acid by in situ polymerization, as well as a gelatin hydrogel based on poly (3-(furan-2-carboamido) propionic acid) and gelatin that has been performed by in situ gelation process. Treated cotton fabric demonstrated high antibacterial and UV protection, making it useful in biological applications, particularly those functionalized with hydrogel[35].

The gelatin in the electro spun matrix

In the textile industry, the electrospinning technique offers several advantages, including the ability to produce mixtures of fibres with diameters ranging from microns to nanometers that assemble in a highly interconnected porous microstructure that resembles a natural extracellular matrix (ECM) [36], (ECM) is a complex network made up of a variety of multidomain macromolecules that are arranged in cell/tissue-specific ways. The ECM's components bond together to produce a structurally stable composite that contributes to the tissue's mechanical characteristics. [31, 37]

Due to their physicochemical features, such as oxygen permeability, infection resistance, and maintaining a moist environment, the produced electrospun matrices have great potential as functional wound dressings. [38] In vitro and in vivo experiments supported the use of these novel materials for the treatment of skin wounds due to their excellent skin healing when compared to conventional wound dressings. [39]

Recently, blow spinning was needed to produce gelatin nanofibres encapsulating carvacrol, which have promising potential for wound dressing applications in terms of antibacterial activity [40]. Blow spinning is a technique that uses a syringe pump to feed a polymer solution to an apparatus comprised of concentric nozzles, with the polymer solution pushed through the inner nozzle and a steady, high-velocity gas flow maintained via the outer nozzle[41]. A solution blow spinning technique was developed, combining elements of both electrospinning and melt blowing technologies, as an alternative method for producing nonwoven webs of micro and nanofibres with diameters comparable to those produced by the electrospinning process, but with the added benefit of fibre production rate.

There was a study that successfully manufactured AgNPs-incorporated gelatin fibre utilizing simple, environmentally friendly, and cost-effective methods, including (1) UV-assisted AgNPs synthesis, and (2) wet spinning methods. Water and gelatin were utilized as a green solvent system, biocompatible dispersant, and stabilizer of the AgNPs nanoparticles, respectively. The green chemistry-based antibacterial gelatin fibre production technique offers the following advantages: (a) no requirement for extra reduction chemicals; (b) mild processing conditions; and (c) variable size of generated AgNPs through Ag precursor concentration. Furthermore, the sugar cross-linking procedure significantly improved the water stability of AgNPs-loaded gelatin fibres, resulting in consistent Ag^{+} release. 50 ppm AgNPs-incorporated gelatin fibres might be an ideal antibacterial gelatin fibre production condition when considering fibre surface shape, mechanical qualities, and prolonged antibacterial activity. The gelatin fibres containing AgNPs have the potential to be used in a variety of applications, including biomedical textiles and the functional clothing sector. [42]

In another study, The gelatin-based, silver-doped bio mats created by centrifugal spinning are natural, free-standing, water-resistant, stable, and antibacterial fibrous materials with high air permeability, and with all of these characteristics, they can be suitable candidates for wound dressing applications[43].

The fabrication of coconut oil-loaded poly(caprolactone)/gelatin (PCL/Gel) nanofibres were investigated. To improve mechanical strength and decrease water solubility, nanofibres were cross-linked with glutaraldehyde vapour. The inclusion of coconut oil and a surfactant lowered the nanofibres' viscosity, surface tension, and nanofibres diameter. The crosslinking process and the presence of Coconut oil in nanofibres were confirmed by the FTIR and DSC data, respectively. The use of the surfactant and Coconut oil improved the hydrophilicity and mechanical properties. Water vapour permeability increased in Coconut oil-loaded samples, suggesting that electrospun membranes are suitable for wound dressing applications. Webs were also shown to be biodegradable, and coconut oil increased the hydrophilicity of samples. Even though the sample containing 10% Coconut oil had higher mechanical performance, nanofibre membranes with 20% Coconut oil showed superior antibacterial properties [44].

Using the electrospinning process, a cellulose acetate/gelatin nanofibrous dressing containing berberine was fabricated and employed as a diabetic foot ulcer dressing material. The characterization findings showed that the manufactured dressing was appropriate for wound dressing and had no detrimental effects on cultured cells, as well as antibacterial efficacy against both gram-positive and gram-negative bacteria. The wound healing process was improved in STZ-induced diabetic rats using the Cellulose acetate/gelatin/berberine dressing, according to animal research[45].

Inal et al. were successfully produced Gelatin and gelatin- poly([2-(methacryloyloxy)ethyl] trimethylammonium chloride) (PMETAC) nanofibres by the electrospinning method. The SEM data demonstrate that the nanofibres have a uniform size distribution and smooth, bead-free structure. It was observed that the proportion of PMETAC in the nanofibre had a significant impact on the diameters of the nanofibres. According to the results of FTIR, TGA, and Elemental Analysis, gelatin and PMETAC successfully enter the nanofibre structure and may be used jointly. after the crosslinking with glutaraldehyde, it was found that the thermal stability of the nanofibres increased significantly. According to the results of the degradation tests, all nanofibres are biodegradable. These findings also indicate that adding PMETAC to the structure improves nanofibre resistance. The nanofibres showed good antibacterial properties. The findings revealed that nanofibre can be used as an antibacterial wound dressing material [46].

Applications of gelatin for contaminant removal

The global dye output is roughly 700000 tons per year, with at least 5 to 15% of this entering the environment via untreated wastewater [47]. Dyes can decrease photosynthetic activity in aquatic species by blocking light and oxygen penetration [48]. Dyes are not biodegradable and enter the human body, causing mutagenic and carcinogenic impacts, allergies, skin irritation, and cardiac issues in all living organisms[49]. The researchers are attempting to integrate various materials or modify the gelatin composites to increase the efficacy of the Contaminant adsorption. Xu et al. developed modified gelatin with a greater degree of quaternization by nucleophilic substitution of gelatin with a double epoxy quaternary ammonium salt, achieving a dye adsorption rate of 98.5 percent in the leather industry. [50].

The principal mechanism for dye adsorption by the gelatin molecule, as reported by the majority of studies, is electrostatic interaction. However, it is significant to note that this is not the only criteria, since cationic and anionic dye adsorption is also affected by the pore size, surface, volume, and particular properties of the adsorbent utilized. As a result, ion exchange, sorption, - electron acceptor–donor interactions, dipole-dipole interactions, cation–cation exchange, and hydrogen bonding can all contribute to the process. [51] Fig. 3 showed the mechanism involved in the adsorption of dyes by gelatin. [52] Adsorption of dyes by gelatin composites takes place primarily on a homogenous surface, where the ions form a monolayer on the adsorbent's external surface and the intermolecular forces adsorbent drop rapidly with time. [53]

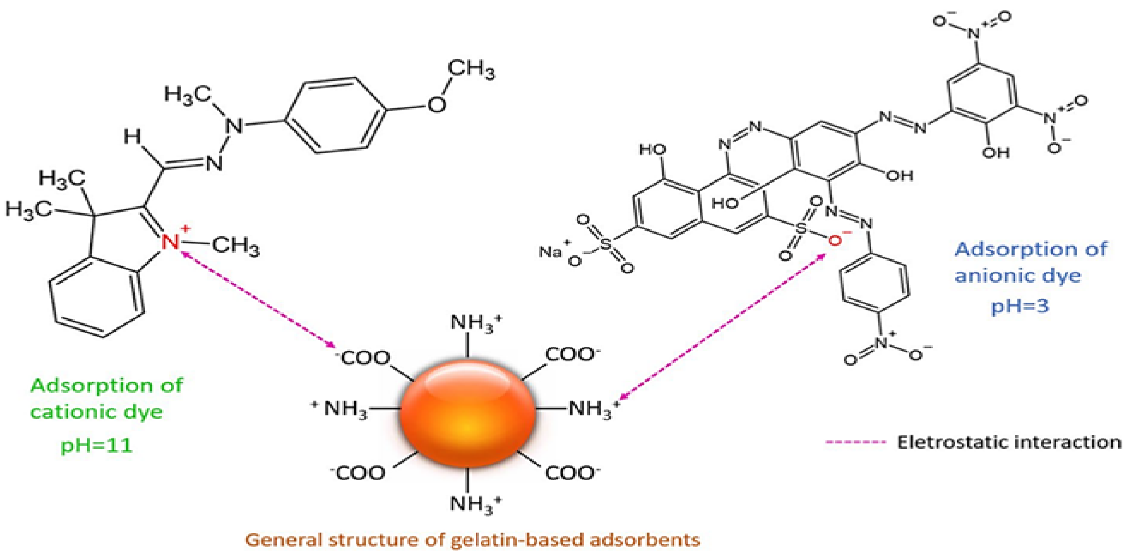

Fig. 3. General mechanism of dye adsorption by gelatin

Gelatin composites integrated with $CoFe_2O_4$ and multi-walled carbon nanotubes demonstrated higher efficiency in acid red dye adsorption in the first 10 minutes, with slow progress after that due to the adsorbent particles being nearly exhausted and with no space to catch other contaminant molecules [54].

Perumal et al. created gelatin and chitosan hydrogel particles embedded in graphene oxide and used them in adsorption experiments using a multi-component solution, resulting in removing more than 75% of metals like Pb (II), Cd (II), Hg (II), and Cr (III). [55] Dolgormaa et al. observed that functional groups on the surfaces of adsorbents, such as carboxyl, amino, and hydroxyl, played a critical role in interacting with metal ions like Zn (II) and Cu (II). Using mesoporous hybrid composites based on gelatin, polar or ionic interactions were mentioned for Hg (II) ions.[56].

Summary

Gelatin is a polypeptide with a high molecular weight that is non-toxic and biodegradable. Gelatin is a soluble protein compound produced by the partial hydrolysis of collagen. The primary commercial sources are cattle bones, hides, pig skins, and fish. Gelatin is made up of eighteen various amino acids, the most common of which are proline, hydroxyproline, and glycine. Gelatin can be used to improve the pretreatment processes such as bleaching and scouring to reduce the temperature, the use of alkali and improve bleaching efficiency. Gelatin can also be used to improve the dyeability of the textile .it can be used in the treatment of textiles to have a multi-functional textile.

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Declaration of Interest

The authors declare that there is no conflict of interest.

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استخدام البوليمر الحيوي الجيلاتيني في المعالجات الرطبة للمنسوجات

أحمد جمعه حسبو[1]*، منة الله زايد[2]، مي بكر[2]، حنان علي عثمان[2]
[1] المركز القومي للبحوث (رقم إنتساب Scopus ID 60014618) - معهد بحوث وتكنولوجيا النسيج - قسم التحضيرات والتجهيزات للألياف السليلوزية (شارع التحرير سابقاً) - الدقي ، ص.ب 12622 - الجيزة - مصر.
[2] جامعة بنها - كلية الفنون التطبيقية - قسم طباعة المنسوجات والصباغة والتشطيب - بنها - مصر.

الجيلاتين هو بوليمر طبيعي متوافق حيوياً وقابل للتحلل. مشتق من الكولاجين. يمكن أن يؤدي إثراء الجيلاتين إلى تحويله إلى مواد حيوية عالية القيمة ، بشرط وجود أو تطوير تقنية فعالة من حيث التكلفة وطويلة الأجل لتحويل هذا البوليمر الحيوي إلى منتجات حيوية قابلة للاستخدام. في هذا الاستعراض تمت مراجعة مصادر الجيلاتين ، واستخلاص الجيلاتين ، والتركيب الكيميائي للجيلاتين ، وكذلك تطبيقاته في صناعة النسيج. الجيلاتين مادة غير سامة ومنخفضة التكلفة وموفرة عالية ، لذلك يمكن استخدامه كمادة حيوية في معالجة المنسوجات لتحسين قابلية صبغ المنسوجات وعملية المعالجة المسبقة مثل عملية التبييض. يمكن أيضًا استخدام الجيلاتين كعامل نهائي نظرًا لأنشطته المضادة للبكتيريا والأكسدة والفطريات.