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Joseph LANDOLINA
Veti-Gel Bandage

http://www.suneris.co/vetigel/

Suneris' premier product, VETIGEL™, is designed exclusively for veterinarians to stop internal and external bleeding.

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https://en.wikipedia.org/wiki/Vetigel

Vetigel

Veti-gel is a veterinary product, a plant-derived gel that is claimed to quickly stop traumatic bleeding on external and internal wounds. It uses a plant-based haemophilic polymer made from polysaccharides that forms a mesh that seals the wound.[1] It is manufactured by Suneris Inc, an American biotechnology company, which is also exploring human products derived from its technology, slated to launch as early as 2016.[2] The company plans on releasing a product for the military and the emergency medicine market first, followed by a product for the human surgical market when FDA approval is granted.[3]

Suneris, Inc. is headquartered in Brooklyn, New York City, United States. The company was founded in 2010 by Joe Landolina and Isaac Miller, while they were students at NYU Poly.[4][5] Suneris focuses on wound care products, specifically those in the field of hemostasis. The company operates out of a 2500 sq. ft. animal health manufacturing facility located in Park Slope, Brooklyn.[6]

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25 November 2014

Vetigel: The Plant-Based Gel That Stops Traumatic Bleeding Wounds in 15 Seconds

by Mary-Ann Russon

A graduate from Polytechnic Institute of New York University (NYU) has invented a gel that can stop bleeding and seal serious wounds in just 15 seconds, and hopes his invention will soon be used by the military, paramedics and even vets to save lives.

Vetigel works by using a plant-based haemophilic polymer made from polysaccharides that grab onto the blood and form a mesh that seals over the wound, without any need to apply pressure.

In a medical emergency, a first responder could simply apply the gel from a syringe-shaped applicator with no preparation required, and the bleeding will stop, which means that this could be a viable replacement for plasters and bandages today.

The gel is the brainchild of Joe Landolina, 21, the founder and CEO of Suneris, who came up with the concept when he was just 17 in 2010.

"I was always interested in science and my grandfather owned a winery, so from a really young age I learned how to work in a chemistry lab and had a love for chemistry," he told IBTimes UK.

"As I was playing around, I stumbled upon two polymers that when you mix them together, they become a solid mass. That was the Eureka moment for me."
Working on his invention after school

Landolina started a combined Undergraduate and Masters degree in chemical engineering and biomedical engineering with NYU a year later, but while many of his peers were enjoying being away from home and getting into university life, Landolina was working on building a startup company.

"I initially started with just classmates, but in the end it took four years of research, hiring PHD [researchers] and getting lots of lab equipment in to test and develop the product," he said.

"I did it after school and sometimes I even had to skip classes."

Luckily Landolina was supported by his university. In 2011, he took both the first prize in a competition held by NYU's engineering school, as well as second prize in another competition held by the business school.

From these two competitions he won $5,000 (£3,187) – just enough to start working on his idea, while his university mentored him with coaching on how to start a business and tried to help find private investors.

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Today, Vetigel is still two years away from getting FDA approval to distribute the product in the US, so he is going down the veterinary route first.

"One of my very first employees was affiliated to the New York Aquarium, where they had lost an animal due to bleeding," he said.

"Veterinarians have almost no time to stop the bleeding before an animal dies. There's no product [to help], and there's a huge need for it in the market."

There are also less regulatory hurdles into getting into the market, and essentially Vetigel is ready to be launched, but Landolina wants to make sure that his manufacturing facilities are properly set up before putting out the product.

Getting Vetigel to market

The veterinary version of Vetigel will hopefully be available from early 2015 in the US and UK, followed by Europe, Asia, Australia and Africa.

Early estimates show that each application of the gel will roughly cost about $30 per application.

For the first FDA approval, Vetigel will need to be removed by a doctor or surgeon and the wound will need to be stitched up or treated the usual way in a hospital, but Landolina is also working on a version of the gel that can be left in the body and absorbed over time as the body's natural healing process takes place.

"For the veterinary field, the product is meant to be used internally. If you were to put it on the liver, within two weeks it would be absorbed into the organ," he said.

"It depends on where you put the product, but the technology is such that once you put it on, the clot will not reopen."

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IN-SITU CROSS-LINKABLE POLYMERIC COMPOSITIONS AND METHODS THEREOF

Inventor(s): LANDOLINA JOSEPH A [US] +

A biocompatible polymeric composition for cross-linking in-situ in a wound is disclosed comprising 1) one or more polyanionic polymers such as alginates or hyaluronates, able to be cross-linked the surface of the wound and 2) one or more polycationic polymers such as chitosan or DEAE-Dextran, that assists in the solidification process as well as speeds up hemostasis without the need for applying pressure. The biocompatible polymeric composition may further comprise a cross-linking agent such as aqueous calcium chloride. The invention encompasses an initial polymeric composition, the solidified matrix cross-linked and integrated at the wound site, including the methods of using, applying, and cross-linking the composition.

FIELD OF THE INVENTION

[0002] The present invention relates generally to a composition using a biocompatible polymeric formulation and, in particular, to a hemophilic polymeric matrix for use in wound healing, blood coagulation, and cosmetic use.

BACKGROUND OF THE INVENTION

[0003] Wound healing is an intricate, orchestrated process involving the interactions of various cells and matrix components to first establish a provisional tissue and then remodel this while forming the mature replacement. Initially, the hemostatic platelet plug reestablishes the infection-limiting and desiccation-limiting barrier, and elicits the first wave of cellular infiltrates. This consists mainly of leukocytes that provide both innate and acquired immunity. These cells produce enzymes and biocidal molecules to eliminate microbial contamination; however, these same defense mechanisms are detrimental to the keratinocytes, fibroblasts and endothelial cells required to regenerate the lost tissue. Thus, as healing proceeds, the events and processes of the inflammatory phase need to regress.

[0004] A particular challenge is offered in the case of skin wound repair, which occurs at a contaminated surface. If a wound becomes infected, the normal healing is disrupted as the inflammatory phase becomes chronic, suppressing the regenerative phase. Further, the enzymes liberated by both the microbes and leukocytes break down the wound tissue as well as surrounding skin. Thus, it is critical to ensure proper healing to prevent infections being established by normal skin wound contaminants.

[0005] Wound healing is usually divided into three phases: the inflammatory phase, the proliferative phase, and the remodeling phase. Fibronectin has been reported to be involved in each stage of the wound healing process, particularly by creating a scaffold to which the invading cells will adhere. Initially, there is a release of many mediators to the wound site, such as fibronectin and fibrinogen. Fibronectin promotes inflammatory cell migration into the wound and debris phagocytosis by monocytes. Thereafter, angiogenesis and reepithelialization take place. At this stage, fibronectin exerts chemotactic activity on

endothelial cells, and promotes epithelial cell and fibroblast migration onto the basal membrane. Fibronectin also appears to be essential in the remodeling phase where it plays a major role in the organization of collagen fibrils. The fibrillar collagen ultimately forms fibrous bundles that enhance the tissue tensile strength, leading to would closure.

[0006] Hydrogels have typically been utilized as topical formulations for promoting the wound healing process. The gel compositions have been selected for their properties of swelling degree, biocompatibility, permeability, and swelling kinetics. Examples of such compounds have included vinyl polymers (e.g. polyacrylic acid), cellulose, and cellulose derivatives. Polyacrylic acid polymer, also referred to as carbomer, has been used because of its superiority in delivering fibronectin to skin wounds.

[0007] Naturally occurring biopolymers have applications in tissue engineering, regenerative medicine, drug delivery, medical implant, plastic surgery, and others. Such products have components including hyaluronic acid (HA), chitosan, heparin, chondroitin sulfate, alginate and other glucosamine and glycosaminoglycans, other polysaccharides, and derivatives thereof.

[0008] In combination, concentrations of fibronectin (and similar proteins) have been utilized with alginate salt to treat chronic ulcers. The dressing system has been solidified, converting the gel into fibers, by a process of freeze-drying. This procedure creates a sponge-like structure with hydrophilic properties. In the presence of fluids, the dressings can return to a gel-like state, absorbing up to 20 times their weight in wound exudate. The dressing is easily removed after the wound treatment because of its sponge-like structure and moisture retention. However, once hydrated with saline solution, the fibronectin-cellulose dressing does not provide the desired fibrous protective film on the surface of the deepithelialized human skin. Debridement is then performed upon removal of the dressing to remove any necrotic material.

[0009] Thus, problems exist in the treatment of acute and chronic wounds, including delayed healing, reduced granulation and epithelialization, and persistent wound inflammation. Compromised wound healing can result in other complications and problems, such as infection, pain, and development of chronic (non-healing) wounds.

[0010] Current needs exist in the treatment of chronic wounds which would assist healing, decrease inflammation, reduce pain, and prevent scar formation with both acute and chronic wounds. Such acute wounds that could be treated include burns, abrasions, dry skin, post-op surgical incisions, cuts, puncture wounds, blisters, insect bites, and other severe tissue injury. Chronic wound treatment might encompass slow to heal wounds including pressure ulcers, venous ulcers, diabetic foot ulcers, decubitus ulcers, and non-healing tissue injuries.

[0011] Overall, a composition is desired that will be easily applied, forming a matrix conducive to the healing of a tissue, and having anti-microbial properties. The composition may be biocompatible or quickly reacted to avoid possibilities of cytotoxicity. Further, the composition will stimulate and maximize wound healing while providing a controlled method for providing thin and thick layers of a solidified wound dressing, as desired.

[0012] Indirect effects may include reduced need for medical procedures such as debridement, decreased hospitalization time, reduced postoperative recovery times, shortened return interval to daily functions and work, and reduced overall treatment costs. Desirably,

these improvements to wound healing, including application and method of use, will be valuable in treating and repairing various tissue(s).

SUMMARY OF THE INVENTION

[0013] The following invention is a biocompatible polymeric composition that is a gelatinous wound healing and hemostatic matrix able to be formed and solidified both internally and externally.

[0014] In one embodiment of the invention, the biocompatible polymeric composition comprises 1) one or more than one polyanionic polymer and 2) one or more than one polycationic polymer. In one embodiment of the invention, the one or more than one polyanionic polymer includes at least one cross-linkable polyanionic polymer. In another embodiment of the invention, the one or more than one polyanionic polymer includes at least one cross-linkable polyanionic polymer and at least one non-cross-linkable polyanionic polymer.

[0015] In one embodiment of the invention, the biocompatible polymeric composition comprises a mixture of 1) one or more than one polyanionic polymer able to be formed on the surface of a wound and 2) one or more than one polycationic polymer that assists in the solidification process as well as speeds up blood clotting. In another embodiment of the invention, the biocompatible polymeric composition comprises a mixture of 1) one or more than one polyanionic polymer able to be formed on the surface of a wound; 2) one or more than one polycationic polymer that assists in the solidification process as well as speeds up blood clotting; and 3) a cross-linking mist that cross-links the gel in the wound while disinfecting the surrounding area.

[0016] In one embodiment of the invention, the one or more than one polyanionic polymer comprises alginates or hyaluronates. In one embodiment of the invention, the one or more than one polycationic polymer comprises chitosan. In one embodiment of the invention, the cross-linking mist may be aqueous calcium chloride.

[0017] One or more methods of using the medical gel of the invention are also disclosed, including rapidly achieving hemostasis without the need to apply pressure, and providing a biocompatible wound healing matrix.

[0018] Various embodiments of the invention allow the formulation to be adjusted and implemented for varying the desired viscosity and pre-determined characteristic functions. In one aspect, the ratio of the polycationic polymer to the polyanionic polymer may be improved, having varying degrees of efficiency in wound healing. In another aspect, therapeutics can be added to integrate drug formulations for drug delivery options. Further, other features may encompass controlling temperature(s) and/or pressure(s) during the preparation of the medical gel, during application of the gel, and implementing a control for the elasticity or rigidity of the solidified matrix. The matrix formulation, both liquid and solidified structures, may also be dependent on anatomical and physiological measurements and conditions.

[0019] Various embodiments of the invention allow the composition to be adjusted and implemented at a first tissue site or a second tissue site, and such modification deemed obvious may be integrated and combined in varying quantities to provide for a structural

matrix of any size, shape, and configuration.

DESCRIPTION OF THE DRAWINGS

[0020] FIG. 1 is a side view of an embodiment of the present invention.

[0021] FIG. 2 is a microscopic depiction of how the present invention interacts with blood and itself.

[0022] FIGS. 3A to 3I show various polymeric subunits that can be used to make up the polycationic or polyanionic polymers.

[0023] FIG. 4 shows the benefits of the present invention as compared to existing technology.

DETAILED DESCRIPTION OF THE INVENTION

[0024] In the following detailed description, for purposes of explanation and not limitation, exemplary embodiments disclosing specific details are set forth in order to provide a thorough understanding of the present invention. However, it will be apparent to one having ordinary skill in the art that the present invention may be practiced in other embodiments that depart from the specific details disclosed herein. In other instances, detailed descriptions of well-known compositions and methods may be omitted so as not to obscure the description of the present invention.

[0025] Biocompatible polymeric compositions of the present invention may be used to treat external wounds as well as internal wounds. In one embodiment of the invention, the biocompatible polymeric composition may be applied to a variety of wounds. Non-limiting examples of wounds include, but are not limited to: an external laceration, an abrasion, a burn, an ocular laceration, damage to a parenchymal organ, an internal laceration, a laceration in the gastrointestinal tract, superficial cuts and scrapes, internal bleeding, an arterial bleed, a venous bleed, dental or oral bleeds and incisions. Subjects who can benefit from such wound treatment include a variety of animals including humans, mammals such as horses, sheep, cattle, hogs, dogs, cats, and marine animals such as whales, dolphins, seals, otters, fish, and reptiles such as turtles.

[0026] An illustration of a structural matrix in accordance with one embodiment of the invention is shown in FIG. 1. As depicted, a damaged section of tissue, wound (112), has vasculature (116) protruding throughout. A biocompatible polymeric composition (114) has been applied to the wound (112), which has been coated with protective coat (110).

[0027] FIG. 2 shows a magnified view of one embodiment of biocompatible polymeric composition (114), which comprises structural polymer (226) and hemophilic polymer (224). Structural polymer (226) comprises about 0.1% to 95% by total composition weight of a cross-linkable polyanionic polymer and 0% to 95% by total composition weight of a non-cross-linkable polyanionic polymer. Hemophilic polymer (224) comprises about 1% to 90% by total composition weight of a polycationic polymer. Red blood cell (210) is shown in relation to the cationic function groups (212) via a red blood cell-cationic group linkage (216).

[0028] FIGS. 3A to 3I show various polymers that can be chosen as structural polymer (226) or hemophilic polymer (224). Polymers can be modified through the addition of carboxymethyl (CM) groups to gain anionic functional groups (218). FIG. 3E shows carboxymethyl cellulose. Alginate (3A), sodium hyaluronate (3F), ?-carrageenan (3G), t-carrageenan (3H), and sodium polyacrylate (3I) are examples of polymers that would function as structural polymer (226). Likewise, chitin (3B) and chitosan (3C) are examples of polymers that would function as hemophilic polymer (224). FIG. 3D shows how any polymer (340) can be modified with a diethylaminoethyl (DEAE) group to gain cationic functional groups (212).

[0029] Biocompatible polymeric composition (114) contains about 0.1% to 99.8% by total composition weight of a solvent. In one embodiment of the invention, the solvent is ethanol. Preferably the solvent is a 5% aqueous solution of ethanol in water. Non-limiting examples of solvents include water, ethanol, amyl acetate, acetone, methyl ethyl ketone, isopropanol, and tetrahydrofuran. In solution, structural polymer (226) and hemophilic polymer (224) experience intermolecular interactions which bind them together. Cationic function groups (212) on hemophilic polymer (224) attract anionic functional groups (218) on structural polymer (226) and result in ionic cross-linking (214). Additionally, hemophilic polymer (224) and structural polymer (226) can be covalently cross-linked (228), similar to a Schiff base or azomethine linkage.

[0030] Protective coat (110) comprises 0.1% to 30% by weight of a di- or higher valent cation (220), 0% to 90% by weight of a hydrophobic polymer, and 5% to 99.9% by weight of a solvent. Protective coat (110) cross-links composition (114) by diffusing divalent cation (220) inwards, which results in divalent cation cross-linking (222) of structural polymer (226). This increases the rigidity of composition (114) and allows for better stability. Protective coat (110) can also contain hydrophobic polymers, which limit the water loss from composition (114) and improve durability. The hydrophobic polymer may be a polyurethane, nitrocellulose, a cyanoacrylate, a styrene, a polytetrafluoroethane, and a silicone, and combinations thereof. The solvent may be water, amyl acetate, acetone, methyl ethyl ketone, isopropanol, and tetrahydrofuran, and combinations thereof. The di- or higher valent cation may be Ca2+, Fe2+, Fe3+, Ag2+, Ag3+, Au2+, Au3+, Mg2+, Cu2+, Cu3+, and Zn2+. In one embodiment of the invention, the cation is Ca2+.

[0031] In one embodiment of the invention, structural polymer (226) comprises 0.1% to 5% by weight of sodium alginate and 1% to 5% by weight of sodium hyaluronate, hemophilic polymer (224) comprises 2% to 25% by weight of chitosan chloride, and the solvent comprises 65% to 96.9% by weight of a 5% aqueous solution of ethanol in water. In this embodiment, the composition functions as a wound healing matrix to facilitate faster tissue regeneration.

[0032] In another embodiment, structural polymer (226) comprises 2% to 5% by weight of sodium alginate and 0% to 2% by weight of sodium hyaluronate, hemophilic polymer (224) comprises 5% to 20% by weight of chitosan chloride, and the solvent comprises 73% to 93% by weight of a 5% aqueous solution of ethanol in water. In this embodiment, the composition functions as a thick gel for rapidly achieving hemostasis without the need to apply pressure. The composition can be delivered topically to the compromised blood vessel.

[0033] In another embodiment of the invention, structural polymer (226) comprises 0.1% to 4% by weight of sodium alginate and 1% to 5% by weight of a lysine-rich polypeptide,

hemophilic polymer (224) comprises 5% to 25% by weight of diethylaminoethyl-dextran (DEAE-Dextran), and the solvent comprises 65% to 93% by weight of a 5% aqueous solution of ethanol in water. The biocompatible polymeric composite (114) is then cross-linked in situ by applying an aerosol mist comprising 0.1% to 1% by weight of calcium chloride, 1% to 5% by weight of nitrocellulose, and 94% to 98.9% by weight of amyl acetate. In this embodiment, the composition functions as a protective covering for cuts and scrapes that is durable and limits water loss from the wound.

[0034] In one embodiment of the invention, the biocompatible polymeric composition comprises about 3.6% by weight of sodium alginate, about 7% by weight of chitosan chloride, and about 89.4% by weight of a 5% aqueous solution of ethanol in water. This embodiment may function as a composition to treat arterial bleeds.

[0035] In one embodiment of the invention, the protective coat comprises a solution comprising about 0.1% to about 30% by weight of a di- or higher valent cation; 0% to about 90% by weight of a hydrophobic polymer; and about 5% to about 99.9% by weight of a solvent. In one embodiment of the invention, the protective coat comprises a solution comprising about 0.1% to about 1% by weight of a di-valent cation; about 1 to about 5% by weight of a hydrophobic polymer; and about 94% to about 98.9% by weight of a solvent.

[0036] In one embodiment of the invention, composition (114) is used as a carrier for a therapeutic agent such as a drug or biologic molecule. The use of composition (114) as a drug delivery system improves the efficiency of the wound healing gel. In one aspect, protective coat (110) is prepared with a salt of silver, increasing the antimicrobial properties of the gel. In one embodiment, the therapeutic agent is selected from the group consisting of: antimicrobial agents, antibiotics, hormones, proteins (such as calreticulin, thrombin, prothrombin, Factor VIII), and iodine, and combinations thereof. In one embodiment of the invention, the therapeutic agent is preferably iodine. In another embodiment of the invention, the therapeutic agent is a protein.

[0037] In one embodiment of the invention, the cross-linkable polyanionic polymer may be a polystyrene sulfonate (such as sodium polystyrene sulfonate), a polyacrylate (such as sodium polyacrylate), a polymethacrylate (such as sodium polymethacrylate), a polyvinyl sulphate (such as sodium polyvinyl sulphate), a polyphosphate (such as sodium polyphosphate), Iota carrageenan, Kappa carrageenan, gellan gum, carboxyl methyl cellulose, carboxyl methyl agarose, carboxyl methyl dextran, carboxyl methyl chitin, carboxyl methyl chitosan, a polymer modified with a carboxyl methyl group, an alginate (such as sodium alginate), a polymer containing a plurality of carboxylate groups, a xanthan gum, and combinations thereof. Preferably, the crosslinkable polyanionic polymer is an alginate, more preferably sodium alginate.

[0038] Preferably the cross-linkable polyanionic polymer comprises about 1% to about 95% by weight of the biocompatible polymeric composition; preferably the cross-linkable polyanionic polymer comprises about 5% to about 40% by weight of the biocompatible polymeric composition; preferably the cross-linkable polyanionic polymer comprises about 10% to about 30% by weight of the biocompatible polymeric composition.

[0039] In one embodiment of the invention, the non-cross-linkable polyanionic polymer may be a hyaluronate (such as sodium hyaluronate), a polynucleotide (such as RNA), a polypeptide chain having an average residue isoelectric point below 7, a glucosaminoglycan,

and a proteoglycan, and combinations thereof. Preferably the non-cross-linkable polyanionic polymer is a hyaluronate, more preferably sodium hyaluronate.

[0040] Preferably the non-cross-linkable polyanionic polymer comprises about 0 to about 95% by weight of the biocompatible polymeric composition; preferably the non-cross-linkable polyanionic polymer comprises about 5 to about 25% by weight of the biocompatible polymeric composition; preferably the non-cross-linkable polyanionic polymer comprises about 0 to about 5% by weight of the biocompatible polymeric composition; preferably the non-cross-linkable polyanionic polymer comprises about 0 to about 2% by weight of the biocompatible polymeric composition; preferably the non-cross-linkable polyanionic polymer comprises about 1 to about 5% by weight of the biocompatible polymeric composition.

[0041] In one embodiment of the invention, the polycationic polymer may be a chitosan (such as chitosan chloride), chitin, diethylaminoethyl-dextran, diethylaminoethyl-cellulose, diethylaminoethyl-agarose, diethylaminoethyl-alginate, a polymer modified with a diethylaminoethyl group, a polymer containing a plurality of protonated amino groups, and a polypeptide having an average residue isoelectric point above 7, and combinations thereof. Preferably the polycationic polymer is a chitosan, more preferably chitosan chloride. Preferably the polycationic polymer is diethylaminoethyl-dextran (DEAE-Dextran).

[0042] Preferably the polycationic polymer comprises about 1% to about 90% by weight of the biocompatible polymeric composition; preferably the polycationic polymer comprises about 2% to about 80% by weight of the biocompatible polymeric composition; preferably the polycationic polymer comprises about 2% to about 25% by weight of the biocompatible polymeric composition.

[0043] The individual components of the biocompatible polymeric composition may be stored in a variety of different containers for a variety of different applications, including for example, packets, sachets, tubes, tubs, pumps, syringes, bottles, bags, and aerosol-based spray cans. The components may be stored in containers made of a variety of materials, including for example, plastic, metal, or glass. The components may be provided in operably connected configurations, or as separate components for a user to set up prior to use.

[0044] The compositions and systems described herein may be included in a kit or article of manufacture for forming a biocompatible polymeric composition comprising one or more of: a solution comprising a polyanionic polymer; a solution comprising a polycationic polymer; a solvent; and a solution comprising a di- or higher valent cation, a hydrophobic polymer, and solvent. The kit or article of manufacture may further contain gauze, bandages, tape, brushes, spatulas, and sponges.

[0045] A number of implementations have been described. Nevertheless, it will be understood that various modifications may be made without departing from the spirit and scope of this document. In particular, for example, various compositions of the solutions have been described, but varying similar components and elements may be integrated or utilized in substitution to achieve the same or similar effect. Moreover, varying matrices may be employed to target diverse wound locations, internal or external to the dermal layers of the skin, including organ transplantation, tissue grafting, and/or various surgical incisions and lesions at any site or location external and/or internal to the body. Accordingly, other implementations are within the scope of the following claims.

[0046] Further, the studies described may utilize one embodiment of the composition to form a rigid matrix while another composition may be designed with an increased elasticity, alone or in combination. Further, the methods of mixing and formulating the composition may be performed in any order and combination so as to achieve the same or similar effects of the embedded solidified matrix, the matrix integrating the formation of naturally restructuring tissue. In one embodiment, the one or more than one polyanionic polymer is first applied to a wound and then the one or more than one polycationic polymer is applied to the said one or more than one polymeric polymer at the wound site. In one embodiment, the one or more than one polyanionic polymer is mixed with the one or more than one polycationic polymer and then the mixture is then applied to the wound. In one embodiment, the one or more than one polyanionic polymer is applied to a wound at the same time, or about the same time, that the one or more than one polycationic polymer is applied to a wound.

[0047] In one embodiment, a method of treating a wound comprises applying one or more than one polyanionic polymer to a wound and then applying one or more than one polycationic polymer to the said one or more than one polymeric polymer at the wound site. In one embodiment, a method of treating a wound comprises mixing one or more than one polyanionic polymer with one or more than one polycationic polymer and then applying the mixture to the wound. In one embodiment, a method of treating a wound comprises applying one or more than one polyanionic polymer to the wound at the same time, or about the same time, as one or more than one polycationic polymer is applied to a wound.

Related Technology :
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11 September 2015

New bandage rips bacteria right out of your wound

by Meredith Placko

It looks like scientists have discovered how to suck bacteria right out of a wound, in what may be one of the biggest medical advancements for those of us who are prone to accidents. While we have ointments that help quell the bacteria after a scratch or puncture, and bandages that keep other bacteria from getting into fresh wounds, this new material would allow for an all-in-one binding. It doesn't just apply a topical cream to your cut, but in fact pulls the bacteria right out of it...
