1/400) and kept at 20° C. for five days with intermittent stirring. The resulting viscous solubilized collagen was filtered through cheesecloth, its pH adjusted to 10 (NaOH) and allowed to stand for 24 hours at 4° C. to inactivate the pepsin. The pH of the collagen was then adjusted to 7 to 8 (HCl) and collagen precipitate was collected by centrifuging. Fatty constituents were then removed from the collagen. To one part of collected collagen was added two parts of fat solvent, e.g., ethanol-ethyl ether mixture (1:1) and the mixture was homogenized in a Waring blender. Collagen was separated from solvent by squeezing in cheesecloth and homogenized again with the same volume of solvent. After being squeezed it was air dried to remove solvent and redissolved in acidified water (pH about 3.0) to make a viscous pourable collagen gel.

A 50–50 mixture of 0.2 g. 5% clear collagen gel of this Example 3 and of the viscous dispersion of Example 1 was placed on the lower concave part of a lens mold (glass) and centrifuged for 30 minutes at 3000 rpm at 10° C. to make the collagen gel spread evenly across the mold surface. After 10 minutes evacuation in vacuum, the upper convex part of the lens mold was pushed onto the lower mold containing the collagen gel and the entire mold transferred to an irradiation vessel. The vessel was flushed and filled with nitrogen and gamma-irradiated for 10 hours at a dose rate of 82 K rads per hour. The molded collagen lens was neutralized with phosphate-saline buffer, (pH 7.2) and transferred to normal saline. The lens was placed on the convex part of a teflon mold, frozen and trephined while the lens was frozen. The finished lens was kept in normal saline solution. This lens is optically clear, flexible and stable, and displays excellent properties as a soft contact lens and showed no deterioration when exposed to bacteria that produce enzymes.

Irradiation is carried out in a Gammator M type gamma irradiator obtained from Radiation Machinery Corporation, Parsippany, New Jersey. The glass vessel containing the lens mold during irradiation was a standard, relatively wide-mouth, two-hole rubber-stopped vessel permitting removal of air and replacement with nitrogen.

The lens molds (which do not form part of this invention) were manufactured from brass, glass and plastic. The mold consists of a lower concave part and an upper convex part. The surface of the convex part, when the mold is closed, reaches the surface of the concave section, except for the desired thickness of the collagen lens. The desired thickness is approximately 0.4 millimeters, preferrably about 0.3 millimeters. Most lens material was finished with a trephine (cylindrical instrument with one razor-sharp circular cutting end), to a tapered edge lens. Instead of trephining, however, a lathe operation may also be used to finish the lens material.

EXAMPLE 4

A soft lens was prepared by procedures of Examples 1 and 3, except 12% clear collagen gels, a stainless steel mold and irradiation time of 20 hours were substituted. Again the resulting lens was optically clear, flexible and stable, and displayed excellent mechanical and physiological properties as a soft contact lens.

EXAMPLE 5

Solubilized, defatted collagen prepared in Example 3 was succinylated by the following procedure: Five grams of collagen were solubilized in 2 liters of acidified water (pH 3.0 HCl) and the pH thereafter adjusted to 9.0 with NaOH solution. Acetone (100 ml) containing 2 g succinic anhydride was added gradually to the collagen suspension. During the addition of succinic anhydride the pH of the collagen suspension was maintained at about 9.0 by adding NaOH solution. Succinylated collagen was precipitated by acidification to about pH 4.2, washed repeatedly with water and freeze-dried. Transparent succinylated collagen gel of pH 7 and an equal amount of tendon fibril collagen was placed on the lower mold part (brass) indicated and processed in the same way as Example 3. The resulting lens was completely transparent, pliable, and sufficiently strong to function as a soft contact lens. It is very comfortable to wear.

Collagen gel lenses are kept in sterile water or saline solution and display excellent storage properties. They have approximately the same refractive index as water itself. Should a lens become dehydrated, partly or completely, due to exposure to heat or sunlight, it is resotred unimpaired to its original condition by simple immersion in water, thus displaying its "perfect memory" characteristic. A lens purposely allowed to become dry and shriveled returned to normal in less than twenty minutes after water immersion.

All of the lenses prepared above can be modified by known optical techniques to prescription values. Thus, soft contact collagen lenses can be prepared for use by patients requiring known normal sight corrective measures, e.g., incorporation of spherical power.

The advantages of soft lenses made from fibril collagen and fibril collagen:solubilized collagen mixtures from a medical standpoint are summarized as follows:

1. Collagen gel lenses are highly permeable to water, oxygen, carbon dioxide, etc. and tests show that their gas diffusion characteristics are practically the same as pure water. To date, collagen is the only natural material used for contact lenses that can be so implanted without subsequent human rejection.

2. The collagen/water ratio of the cornea and the collagen contact lens are strikingly similar. These two materials are closely related structurally, physiologically and immunologically. All other contact lens materials are totally unrelated to the collagen protein of the cornea.

The advantages from the consumer or wearer standpoint are summarized as follows:

1. The gas and water vapor permeability of the collagen membranes make it ideally suited for a constant wear contact lens without disrupting essential metabolic processes in the cornea.
2. The similarity of this protein and the principal protein of the cornea make allergic and toxic reactions between the two very unlikely.
3. The low cost of preparation of the collagen lens material indicates a low cost to the consumer.
4. Collagen contact lenses are soft, pliable and transparent, and can be worn for extended periods of time without removal for cleaning, etc. Spherical power can be incorporated into them.

Having described the invention in sufficient detail that it may be practiced by those skilled in the art

What is claimed is:

1. As an article of manufacture a soft contact lens consisting of a lens-shaped, subsequently crosslinked gel of defatted fiber collagen, said gel comprising 1.0 to 30.0 wt. % collagen and the balance water.