ELIMINATING GLUTARALDEHYDE FROM CROSSLINKED COLLAGEN FILMS USING SUPERCRITICAL CO_2

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Collagen has received considerable attention as a biomaterial for tissue engineering because of its low immunogenicity, controllable biodegradation, and ability to influence cell growth and proliferation. Frequently, collagen scaffolds require crosslinking to improve mechanical strength, requiring agents like glutaraldehyde that have high residual cytotoxicity. A novel method for extracting residual glutaraldehyde from crosslinked collagen films with supercritical carbon dioxide (CO_2) is presented. CO_2 is a non-toxic, non-flammable substance that is relatively inert and can be used to process biomaterials at mild pressures and physiologic temperatures.

In this work, it was first determined that type I collagen is chemically compatible with both liquid and supercritical CO_2. Treated collagen showed minimal changes in physico-chemical properties as determined by differential scanning calorimetry, gel electrophoresis, and circular dichroism. CO_2 was subsequently used to extract residual glutaraldehyde from crosslinked collagen films. Glutaraldehyde concentration was reduced by over 95%, from over 20 ppm before treatment to about 1 ppm, in only 1 hour. CO_2 treatment caused negligible alteration of thermal stability, but did significantly increase film stiffness and tensile strength. However, these changes were minor compared to heat-based removal of glutaraldehyde.

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