

**CHEMICAL COMPOSITION OF COLLAGEN AND USE IN MEDICINE****N.T.Muydinov**

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**Abstract.** This article examines collagen, its structure and chemical composition. Also, the articles that can use collagen in medicine are analyzed.

**Keywords.** Collagen, structure, amino acid, film.

Collagen (from the Greek word "kolla - glue, genesis - origin, birth") - makes up 25% of the dry residue in the body of mammals (mainly skin, tendons, bones, tendons, etc.). To date, there are 29 types of collagen, all of which have a triple helix structure. Approximately 25 different  $\alpha$ -chain configurations of collagen have been identified, each of which is produced by genes, resulting in 29 types of collagen. A collagen molecule consists of three  $\alpha$ -chains, and the joining of the chains forms a triple helix structure. Each  $\alpha$ -chain consists of more than 1000 amino acid residues based on the sequence -Gly-X-Y-. In order for the three  $\alpha$ -chains in the tropocollagen molecule to be tightly packed, it is essential that every third position of the amino acid contains glycine. Because X and Y positions are mostly filled with proline and 4-hydroxyproline.

Collagen types I, II, III, IV are common (Table 1), and are widely studied. Although there are many types of collagen, only a few types are used in the production of biomaterials. Mainly type I collagen is important in the production of biomaterials.

Type I collagen is mainly found in tendons, bones and skin, while type II collagen is mainly found in cartilage. Type III collagen is called embryonic collagen and is found mainly in fetal tissues and in the structure of tumor cells. This type of collagen is also found in blood vessels and skin. The composition of the basement membrane is composed of type IV collagen (Table 1).

Table 1

**Collagen types and properties**

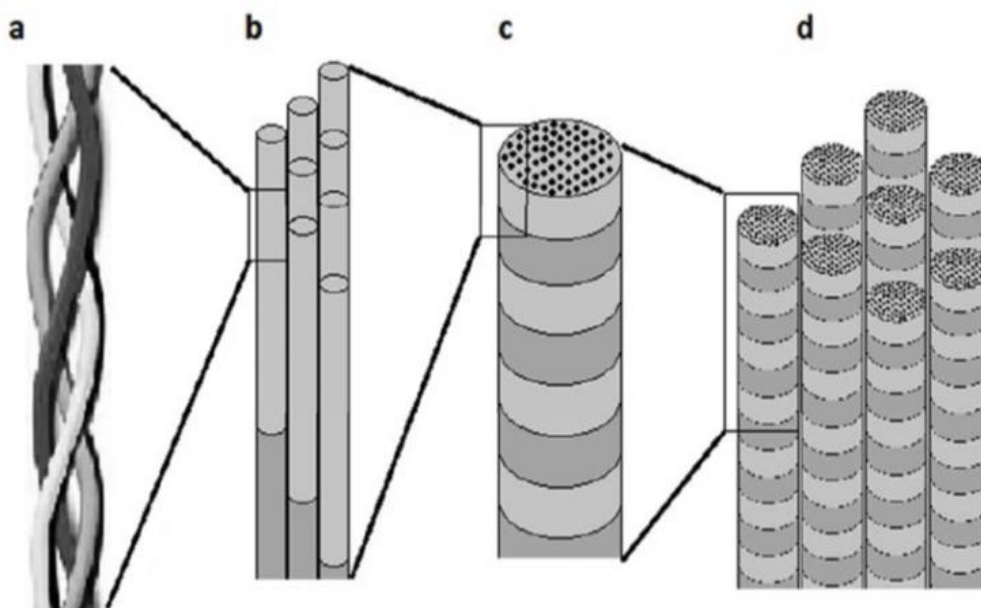
Types	Chain combination	Location
I	$[\alpha 1(I)]_2, \alpha 2$	Skin, bone, sinew
II	$[\alpha 1(II)]_3$	Uncle
III	$[\alpha 1(III)]_3$	In fetal and tumor tissue
IV	$[\alpha 1(IV)]_3$	Basal membrane

Collagen forms the basic movement system in the body. This function of the collagen protein depends on the mutual primary, secondary and tertiary structures of the amino acids that make up its composition. The structure, chemical composition and physicochemical properties of collagen protein have been studied in detail by many

foreign and Russian scientists.

Synthesis of the polypeptide molecule in the  $\alpha$ -chain of collagen and the formation of its three-helix structure are widely covered in scientific literature. A collagen triple helix structure is formed from the spiral wrapping of all three of the resulting  $\alpha$ -chains, and from its assembly, a tropocollagen molecule is formed. The tropocollagen molecule is divided into fibril fibers with a size of 10 nm to 300 nm, and the fibril fibers assemble to form collagen fibers with a size of 0.5 to 3  $\mu$ m (Figure 1). Biomaterials are produced based on collagens that form fibril fibers.

The tropocollagen molecule is 280 nm, 1.4 nm in diameter, and about 300,000 daltons in molecular weight. Polypeptide chains in tropocollagen are of  $\alpha$ -type, each consisting of 1000-1040 amino acid residues.



**Figure 1.** Diagram of the three-helix structure of collagen (a), assembled tropocollagen molecule (b), collagen fibril with a diameter of 10 to 300 nm (c), collagen fibers with a diameter of 0.5 to 3  $\mu$ m (d).

The peculiarity of the collagen structure is the formation of strong hydrogen bonds between hydroxyproline ON-groups and bridging water molecules in triplets of the Gly-X-Hyp type.

Type I collagen is widely used in the production of biomaterials due to its lack of antigenic and immunogenic effects and non-toxicity. However, it is worth noting that there is information about the immunological effect of collagen. Such negative effects are not caused by the collagen molecule itself, but by the presence of residual  $\alpha$ -Gal or DNA molecule in its composition, which causes acute immune reactions.

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