

STUDY CONCERNING THE NANOBIOTECHNOLOGY OF OBTAINING OF COLLAGEN GELS FROM MARINE FISH SKIN AND YOUR RHEOLOGICAL CHARACTERISATION FOR USING IN DENTAL MEDICINE

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Type I fibrillar collagen is a triple-helix structure protein present in the skin and in cartilaginous tissues. The acknowledged disadvantages related to obtaining collagen by extraction from fish skin consist mainly in the persistence of pigments and fish odour, the denaturation temperature values being lower – usually under 30° C – which is a disadvantage concerning their use as bio-nanomaterials. Nonetheless, fish-derived collagens can be widely used due to their indisputable advantages:

- they are easier to extract and they have shown better performance compared to collagens extracted from mammals' skin;
- they bear a relatively low risk of containing unknown pathogens;
- the denatured collagen-based matrixes allow better tissue regeneration compared to the native collagen-based ones [1], and the reticulate matrixes derived from fish collagen are likely to contain partially denatured structures due to the lower denaturation temperature.

Although fish-derived collagen does not form high-viscosity gels, it is extremely convenient for some applications, such as micro-encapsulation or obtaining photosensitive coatings. Films and porous matrixes can be obtained from the collagen-based gels, as well as from those derived from animal skin. They can be successfully used in dental medicine for treating oral diseases – they form bio-absorbable membranes and matrixes and they can incorporate various active ingredients which can be subsequently released in order to obtain the expected therapeutic effects.

Depending on the treatment applied, we can distinguish between four categories of bionanotechnologies used for obtaining collagen from marine fish:

- basic and acid treatments [2];
- acid treatment [3, 4-6];
- enzyme treatment [5, 6];
- combined treatments.

This study aims at presenting the biotechnology used to obtain collagen-based gels from shark (*Squalus acanthias*) and brill skin, marine fish growing in the Black Sea. Due to the structure of its microfibrils, the collagen can be considered a nanomaterial - in order to use collagen-based matrixes as biomaterial, rheological studies will be performed to prove their stability. In order that the triple-helix structure remains stable within these gels at room or human body temperature, they will be stabilized by reticulation.

Reticulation has been performed by using glutaric aldehyde at 4-6°C for different concentrations of collagen derived from the two species of fish.

The rheological behaviour has been determined by using a rheoviscosimeter Haake VT 550 with the following layout: S₃ (MV1) sensors system, d₁ and d₂ measuring ranges, shearing speed range, $\dot{\gamma}$, between 1.17 and 1872 s⁻¹. The measurements have initially

been performed at a $25 \pm 0.1^{\circ}\text{C}$ temperature, with a thermostatic time of 20 minutes, and then – using ice – at $20 \pm 0.1^{\circ}\text{C}$. In order to establish whether the dispersed systems show a time-dependant rheological behaviour or not, measurements have been performed when increasing and decreasing the shearing speed values, which allowed the tracing of the hysteresis loops for the film-forming systems with time-dependant rheological behaviour. The position of the two rheograms in figures 1 and 2 – meant to represent the hysteresis loop – proves that the gels obtained from shark skin (Fig. 1) and brill skin (Fig. 2) have a time-dependant rheological behaviour, namely strongly thixotropic, without structure recuperation at low shearing speed values.

The conclusions we have reached confirm the fact that the gels based on collagen derived from shark and brill skin have an ideal-plastic behaviour, which allows their use for creating different pharmaceutical formulations.

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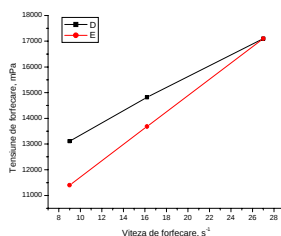


Figure 1. Rheograms obtained when: D – increasing; E – decreasing the shearing speed values

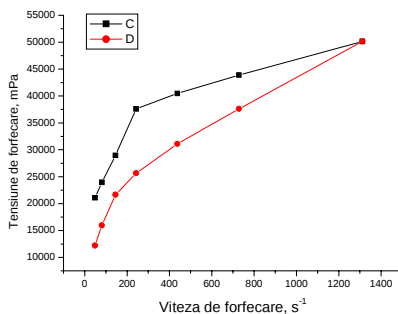


Figure 2. Hysteresis loop obtained for the brill skin-derived gel when: D – increasing; E – decreasing the shearing speed values