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Evaluation of the adsorption properties of fibroin peptides

Lara WEHBE¹, Erwann GUENIN¹, Alla NESTERENKO¹

Université de Technologie de Compiègne, ESCOM, TIMR (Integrated Transformations of Renewable Matter), Compiègne, France

Silk is a biopolymer produced by different varieties of silkworms. Mulberry silk is obtained from the silkworm *Bombyx mori* L., which feeds exclusively on the leaves of mulberry plant¹. Silk is thought to be the oldest and valuable textile material due to his good mechanical properties. It is composed of two kinds of proteins: fibroin, a fibrous protein, that imparts mechanical strength to the cocoon, and sericin, a glue-like protein, that binds the fibroin fibers together in a cocoon.² The silk fiber for textile is produced by removing sericin protein to give the softness and the lustrous appearance to the silk fiber. In addition to its use in textile industry, fibroin fibers are used in biomedical applications due to their biodegradability, biocompatibility and low immunogenicity. The appropriate mechanical properties of silk fibroin as biomaterial are major prerequisite for its use in bioengineering. Moreover, various drugs can be loaded or encapsulated using silk fibroin as nanoparticle.^{2,3}

In order to diversify and improve the functional properties of fibroin, the hydrolysates obtained by acid or enzymic hydrolysis can be considered for applications in foods, cosmetics and pharmaceutical preparations. Fibroin hydrolysates also have been suggested as an antidiabetic, antioxidant and antihypertensive agent.^{4,5} Silk protein derived peptides represent a great potential in cosmetic industry as cosmetic additives (antioxidant, cleaning, moisturizing and restoring agent). Silk fibroin is composed of different amino-acids with hydrophilic and hydrophobic domains which imparts potential amphiphilic properties to this protein. This class of amphiphilic molecules is interesting since it derives from non-food raw material so it doesn't give rise to ethical and environmental concerns as compared to surfactants produced from food biomass (sugar, starch, vegetable proteins). Nevertheless, the evaluation of surface adsorption properties of silk fibroin peptides remains little described.

The main objective of this work is to evaluate the potential of fibroin peptides to reduce surface tension for the production of silk-derived amphiphilic molecules. The first step involves the separation of two fractions of silks derived from silkworms: sericin and fibroin, using standard procedures largely described in the literature.^{6,7} After extraction, silk fibroin solution is directly hydrolyzed using Alcalase enzyme under different experimental conditions, varying the amount of enzyme and the reaction time. The degree of hydrolysis (DH), is determined by the absorbance measurement of primary amino groups by o-phthalaldehyde (OPA) method. Finally, the adsorption properties of the hydrolysates were evaluated by surface tension measurements using the pendant drop method.

The results demonstrated that DH of fibroin is mainly affected by the enzyme/substrate ratio, but not significantly influenced by the reaction time. The first results on the surface tension measurements showed the good ability of fibroin peptides to reduce the air/water surface tension (Fig 1). This underlines the interest of their potential of use as amphiphilic molecules. Future research will be focused on the functionalizing of fibroin peptides by grafting of hydrophobic chains for improving of their amphiphilic character.

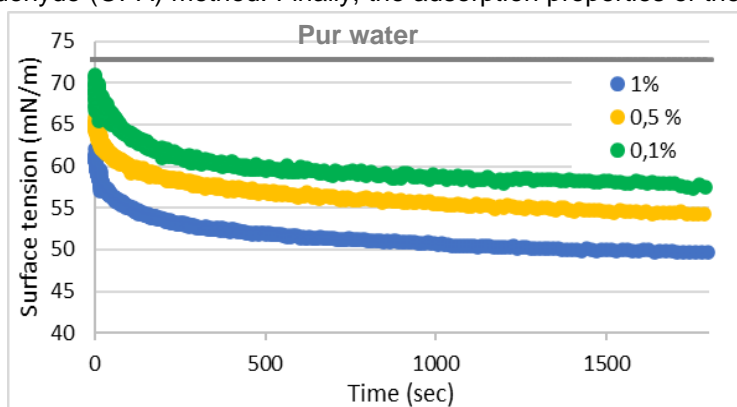


Fig 1. The surface tension of fibroin peptides at different concentrations

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