AMINO ACIDS COMPOSITION AND QUALITY IN BYSSAL THREADS AND DISCS *OF MYTILUS GALLOPROVINCIALIS*

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Abstract
The objective of the present study is to characterise biochemically the byssus of *Mytilus galloprovincialis* for further valorisation. Byssal threads are 67.07±2.59 percent water by weight. The proximate composition expressed as percent dry weight (DW) included ash (9.01 ± 2.13), total nitrogen (13.50 ± 0.24), lipids (1.94 ± 0.27) and carbohydrates (0.84 ± 0.05). Amino acid analysis showed that there is a considerable difference in amino acid composition between the threads and the discs of the byssus with high amounts of amino acids specific to collagen sequences.

Keywords: Chemical analysis, Bivalves, Lagoons, Mediterranean Ridge

Introduction
Survival of sessile marine invertebrates depends mainly on the performance of their attachment strategies [1]. *M. galloprovincialis* binds to the surfaces of various substrates by producing a large number of byssal threads. An investigation on this single biological adhesion system will be useful in the development of bioadhesives and related products used in medical and industrial fields. The purpose of this study was the biochemical characterization of *M. galloprovincialis* byssus with a purpose of valorisation.

Material and methods
The mussels were harvested in a farm located in the lagoon of Bizerte (North of Tunisia). Samples (approximately 150 individuals) were collected monthly from March to May 2015. The mussels were separated by carefully slitting their byssus, and then transferred to an aquarium of 50 l of filtered seawater taken from the sampling site. Every two days the byssus threads produced by each mussel were cut and collected individually, then stored at -80°C until biochemical analyzes. Analysis of variance (ANOVA) was used to identify differences in the different amino acids content between the thread and the disc of the mussel's byssus.

Results and discussion
Proximate chemical composition of *M. galloprovincialis* byssus is shown in Table 1. In this study, high ash content reflecting mineral levels was found in mussel's threads. It is well established that the byssal threads mineral contents is related to the geochemical nature of the environment [2].

Tab. 1. Compositional analysis of *M. galloprovincialis* byssal threads. The amounts of ash, carbohydrates, lipids and total nitrogen are expressed per g/100g of the dry weight (DW) ± SE.

Byssal thread analysis	
Moisture	67.07±2.59
Ash	9.00 ± 2.13
Carbohydrate	0.87 ± 0.05
Lipids	1.94 ± 0.27
Total nitrogen	13.50 ± 0.24

The relative higher percentage of ash found in *M. galloprovincialis* byssus compared to other studies carried out in different environments [1,2] can be explained by the difference of environmental factor such as the higher salinity of the lagoon of Bizerte. Carbohydrate content in mussel byssus has not been much studied, the amount measured in this study can be explained by the presence of glycoproteins [2]. Data on the lipid content of mussel byssus are scarce. The structural role of these lipids is unknown. Our results reveal a higher concentration of lipids compared to other species and other environments [3]. The percentage of relatively large lipid byssus is probably due to the characteristic of the Tunisian mussel which has a particularly strong reproductive effort. Indeed, in the lagoon of Bizerte, sexual cycle *M. galloprovincialis* is spread throughout the year. The storage of fat including in the byssus could be then continuous.
The different amino acids concentrations in the thread and the disc of mussel byssus are shown in figure 1.

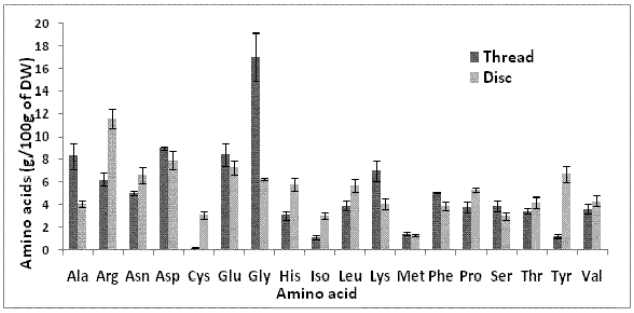

Fig. 1. Amino acid composition (g/100g DW± SE) of mussel's byssus

Statistical analysis (ANOVA) showed a significant difference ($p<0.05$) in amino acid between the threads and the discs of byssus except glutamine, methionine and valine (figure 1). This could be related to a differencein protein composition between these two parts. Such heterogeneity has been reported in other species of Mytilidae [4]. Byssus contains high amounts of amino acids that are characteristic of collagen. The amino acids of the *Mytilus galloprovincialis* are comparable to that of *Mytilus edulis* and *Mytilus californianus* especially as regards the large amount of glycine which form collagen [4].

Conclusion and Future perspective
The byssus is a natural fiber very complex and still unwell understood, this research present a primary understanding that can be useful to researchers that explore potential applications from the adhesion of mussels, including the development of biomimetic adhesives. Considerable progress has been made in this area, but the biochemistry of proteins responsible for the strong adhesion of the mussel and adhesion mechanisms have not been fully investigated. Indeed, the identification and characterization of the adhesive mussel proteins will improve our understanding of their biological roles in the adhesion mechanisms and advance research biomimetic products.

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