From *Crassostrea gigas* oyster larvae adhesion studies to potential biotechnological development of marine adhesives

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- Pacific oyster, *Crassostrea gigas*: species of major ecological and economical interest
- Genome of *C. gigas* available
- Larval adhesion poorly documented

The pediveliger larvae (last larval development stage before benthic life) of *C. gigas* and *O. edulis* are morphologically similar, *C. gigas* and *O. edulis* are relatively closed phylogenetically: is it the same adhesion process?

We used modern molecular approaches to characterize biochemically and structurally the adhesive of *C. gigas* larvae, in view of potential future valorization.

Behavior observations:

Pediveliger larvae of *C. gigas* seem to adopt identical behavior to the observations of Cranfield (1973) on *O. edulis*. Larvae stop swimming, fall to the bottom and begin substrate exploration: the crawling. The foot has a locomotion and sensitive role during this crawling phase. Progressively, reducing explored area, the larvae remain in the same zone (Fig. 1, steps 4, 5, 6). At this time, the foot widens and spreads in front of the shell on the substrate for several minutes. Immediately after adhesive’s released from the foot, larvae slide over the secreted adhesive and foot retracts. The attachment is definitive and metamorphosis starts.

Morphological description of the foot

- Byssal duct in *C. gigas*: similar to *O. edulis*
- Ciliate foot: motility / tactile function?
- Flattened zone extremity: pressure point during crawling?
- Numerous vesicles at the base of cilia: adhesive excretion during crawling?

Adhesive ultrastructure observation

C. gigas foot structure is very similar to *O. edulis*. However, specific ultrastructure zones were observed in adhesive secretion.

Compositional analysis of the adhesive footprint

- 44 proteins
- Protein signal was detected by Fourier Transform Infra Red spectroscopy

Biotechnological development

- Proteins
- Sugars
- Lipids?
- Adhesion strength
- Aging resistance
- Biocompatibility
- Application fields
- Use constraints
- Eco production
- Formulation
- Production / Extraction / Purification
- Innovating adhesive

References

Cranfield H. J., 1973a, b - Marine Biology.


Fig 2. Adhered *C. gigas* on glass slide - binocular.

Fig 3. SEM observations of *C. gigas* larvae fixed during crawling phase.

Fig 4. SEM observations of *C. gigas* larvae fixed after adhesion. f-h: Larvae were removed and return for adhesive visualization.

Fig 5. Sulfur SEM-EDX map of *C. gigas* adhesive.

Energy dispersive X-ray spectroscopy with SEM revealed presence of Sulfur:

Proteins or sulphated polysaccharides?

Proteomic analysis from adhesive footprint

- 44 proteins
- Binding
- Catalytic activity
- Structural activity
- molecular activity

Fig 6. Percentage of GO annotation “Molecular function”.

To Pursue

- Confirm the role of this proteins in adhesion by localization of gene expression and protein production
- Understand interactions between proteins and carbohydrate fraction of adhesive