Procollagen effect of microalgal exopolysaccharides on human dermal fibroblasts: some structural and mechanistic aspects

Toucheteau C.[1], Deffains V.[1], Gaignard C.[2], Probert I.[3], Pierre G.[2], Laroche C.[2], Rihouey C.[4], Picton L.[4], Le Cerf D.[4], Arnaudin-Fruitier I.[1], Michaud P.[2], Bridiau N.*[1], Maugard T.[1].

[1] *LIENSs laboratory (UMR CNRS 7266), Equipe BCBS, La Rochelle Université, France.*

[2] *Pascal Institute (UMR CNRS 6602), Université Clermont Auvergne, France.*

[3] *Roscoff marine station, CNRS/Sorbonne Université, France.*

[4] *PBS laboratory (UMR CNRS 6270), Université de Rouen-Normandie, France.*

*Corresponding author e-mail: nicolas.bridiau@univ-lr.fr

OBJECTIVE: Exopolysaccharides (EPS) are produced and excreted by bacteria or microalgae. Unlike other microorganisms, studies on EPS from microalgae are scarce. The present work was part of the ANR POLYSALGUE project (figure 1), whose purpose was to increase the current knowledge regarding microalgae EPS and their valorisation. In this context, we aimed at investigating the dermo-cosmetic potential of 6 new EPS from microalgae [1].

METHODS: The first part of this work consisted in the development of a supported depolymerization method to reduce the molecular weight of these biopolymers. Depolymerized EPS were characterized, analysing their molecular weight by SEC-MALS/RID/VD methods, and levels of sulfate groups and uronic acids were determined. The second part was the evaluation of the anti-aging potential of these EPS. For this purpose, *in vitro* productions of collagen by human dermal fibroblasts from 20-years and 46-years old female donors were quantified.

RESULTS: A principal component analysis highlighted the correlation between the anti-aging activity of EPS and their proportion of low molecular weight polysaccharides (< 10 kDa), while their uronic acid content was shown essential but only if EPS size was previously reduced. Enzymatic kinetic analyses of metalloproteases and hyaluronidases were also conducted, indicating that the inhibition of metalloproteases seemed to be correlated with sulfate group content of EPS. Finally, an analysis of transcripts showed that the increase in collagen production by fibroblasts could be due to the activation of the TGF-β1 signalling pathway and the inhibition of metalloprotease biosynthesis.

CONCLUSION: At least 3 of the 6 new isolated EPS were shown to be strong procollagen stimulants. Besides, the structure-function relationship of their procollagen effect was investigated, providing better understanding of such biological activity.

Keywords: Microalgal exopolysaccharide, depolymerization, solid acid-catalyzed hydrolysis, human dermal fibroblast, procollagen effect, structure-function relationship.

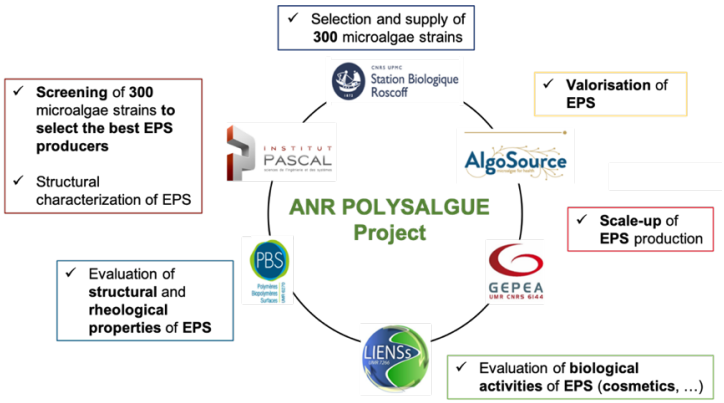

Figure 1: organization of the ANR POLYSALGUE project.

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