Protection of Algal Crops: Identification of Carbon Sources that Induce Protective Expression in Probiotics

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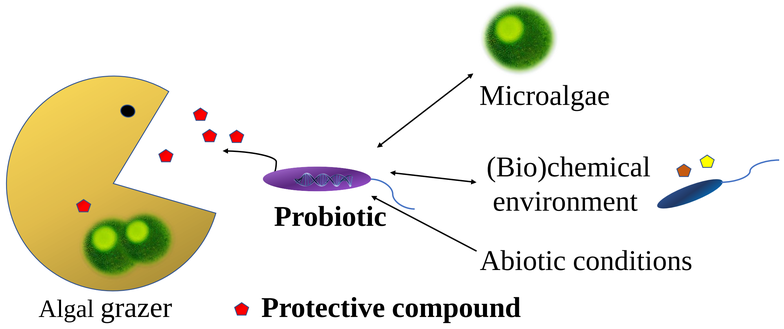
Abstract

This research aims to identify the carbon sources that induce the expression of violacein by *Janthinobacterium* strains. We incubated six *Janthinobacterium* strains under fifteen variable carbon source conditions, and then measured the concentration of violacein in the cultures at different incubation time points. Through comparing the concentration of violacein production between different carbon sources and *Janthinobacterium* strains, we identified the most effective carbon sources that can support both biomass growth and violacein production are D-Maltose and D-Mannitol. The most promising strain to produce violacein is ATCC 12473, which can utilize the most types of carbon sources in comparison to other strains.

Introduction

- Probiotic treatments, involving beneficial bacteria that produce protective compounds to mitigate algal grazers, can be a new approach at increasing economic efficiency of algal biofuel. [1]



- Preliminary results showed ***Janthinobacterium*** can be a promising probiotic candidate against rotifer. Its protective compound **violacein** exhibits important antimicrobial and antiviral properties. The biological activities of violacein have been studied extensively, the way to optimize growing conditions for *Janthinobacterium* to maximize violacein production remains only partially understood.

Materials and Method

- Six *J. lividum* cultures were grown in RCH_2 medium, a low nutrient media without any carbon element, containing 15 different carbon sources (20 µl) separately.
- All the experiments were performed at least three times in triplicate. The data are reported as means.
- Optical density OD_{600} were taken twice daily until stationary phase was observed.

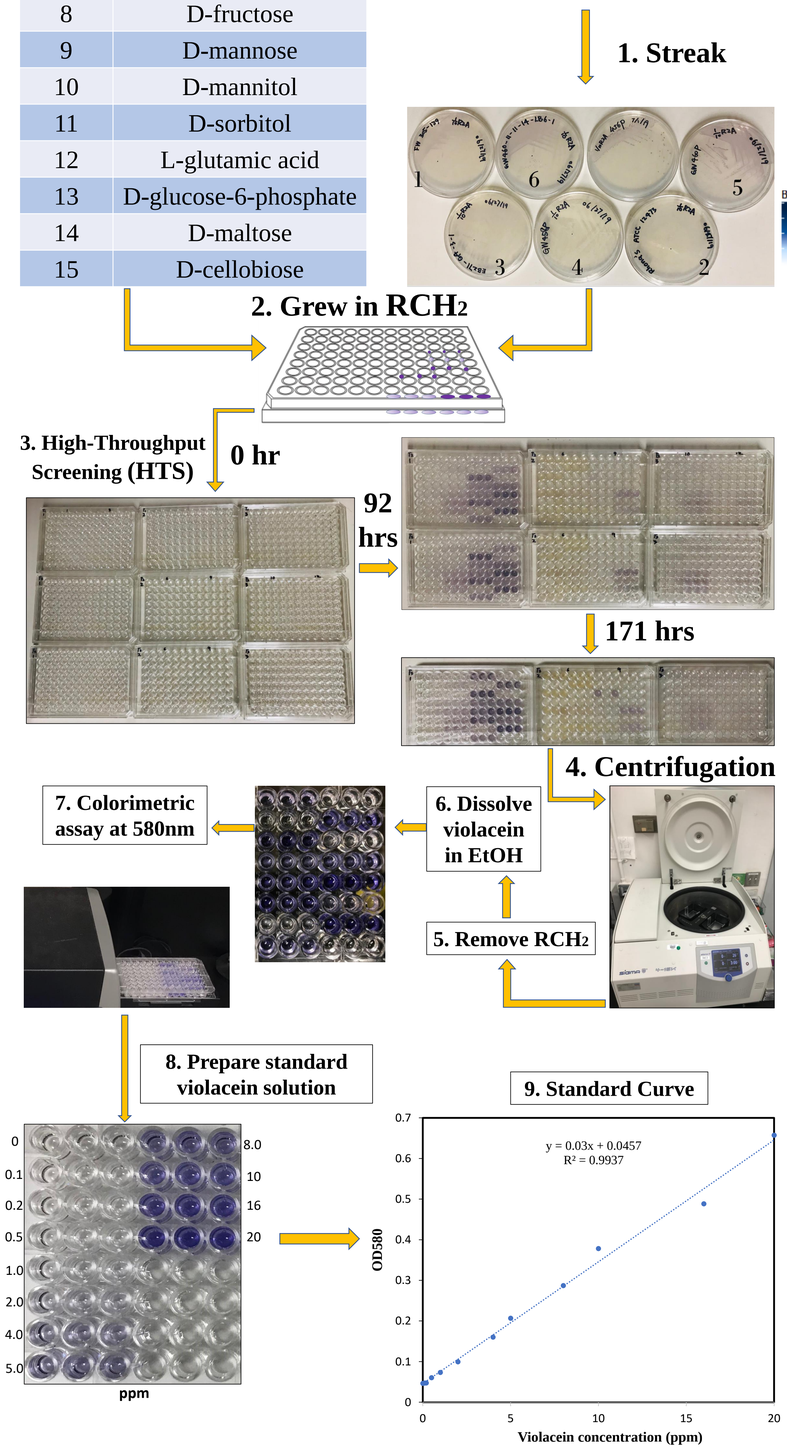
References

[1] A. M. Stark, "Project aims to use probiotic bacteria to protect algal crops and increase ecosystem resilience", News and Articles on Science and Technology, Jul. 22, 2015

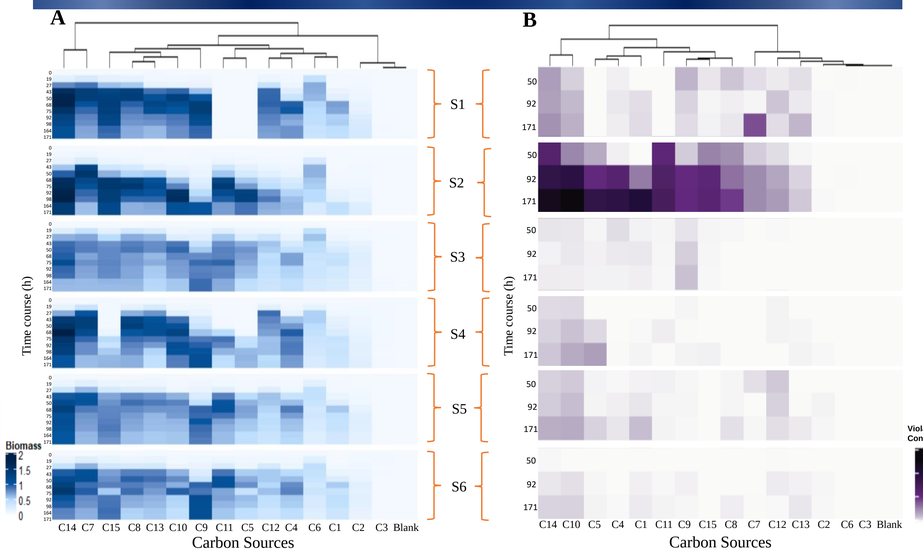
[2] Gu, Z. (2016) Complex heatmaps reveal patterns and correlations in multidimensional genomic data.

Number	Carbon Source
1	Glycerol
2	L-asparagine
3	L-glutamine
4	D-ribose
5	xylitol
6	L-malic acid
7	D-glucose
8	D-fructose
9	D-mannose
10	D-mannitol
11	D-sorbitol
12	L-glutamic acid
13	D-glucose-6-phosphate
14	D-maltose
15	D-cellobiose

Strain Number	*Janthinobacterium* Strain Name
1	FW 305-129
2	ATCC 12473
3	EB271-G4-3-2
4	GW458P
5	GW460P
6	GW460-11-11-14-LB6-1



Results



Heatmap A [2]
Optical density measurements (OD_{600}) of *Janthinobacterium*. The darker blue indicates higher levels of biomass growth.

Heatmap B [2]
Violacein concentrations (ppm) were calculated using the standard curve. The darker purple indicates higher levels of violacein production.

- **Heatmap A** showed the growth of *Janthinobacterium* is dependent on carbon sources
- **Heatmap B** illustrated that violacein was produced significantly in the presence of D-Maltose (C14) and D-Mannitol (C10)
- **Heatmap A&B** suggest that the growth of *Janthinobacterium* is not associated with violacein production.

Conclusion and Future Work

1. Violacein production could be regulated by carbon sources.
2. The most effective carbon sources that can induce both biomass growth and violacein production are D-Maltose and D-Mannitol.
3. The most promising strain to produce the violacein is ATCC 12473, which can utilize the more types carbon sources in comparison to other strains.
4. Future research must be implemented for growing algae, *Janthinobacterium*, and rotifers in the conditions of D-Maltose and D-Mannitol.

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