Ameliorating process parameters for zeaxanthin yield in *Arthrobacter gandavensis* MTCC 25325

CURRENT STATUS: UNDER REVISION

AMB Express Springer

Shristi Ram

Central Salt and Marine Chemicals Research Institute- CSIR

Sushma Rani Tirkey

Central Salt and Marine Chemicals Research Institute CSIR

Madhava Anil Kumar

Central Salt and Marine Chemicals Research Institute CSIR

Sandhya Mishra

CSIR-Central Salt and Marine Chemicals Research Institute

smishra@csmcri.org *Corresponding Author*

DOI:

10.21203/rs.2.22112/v1

SUBJECT AREAS

General Microbiology

KEYWORDS

Zeaxanthin, Arthrobacter gandavensis, Central Composite Design, Nutraceutical

Abstract

The present study aims to screen potential bacterial isolates for the production of a prophylactic agent zeaxanthin; which is considered to be an inevitable inclusion in human diet. A freshwater bacterium *Arthrobacter gandavensis* was isolated from Bor Talav, Bhavnagar and screened as a promising producer of zeaxanthin. The chemo-metric tools were employed to optimize the influencing factors such as pH, temperature, inoculum size, agitation speed, carbon source and harvest time on its yield. Thereafter, 6 parameters were narrowed down to 3 factors and were optimized using the central composite design (CCD) matrix. Maximum zeaxanthin (1.51 mg/g) was derived when *A. gandavensis* was grown under pH 6.0, 1.5% (w/v) glucose and 10% (v/v) inoculum size. A high regression coefficient ($R^2 = 0.92$) of the developed model indicated the accurateness with the tested parameters. To the best of our knowledge, this is the first report on tailoring of process parameters using chemo-metric optimization for escalating the zeaxanthin production by *A. gandavensis*.

Full Text

Due to technical limitations, full-text HTML conversion of this manuscript could not be completed.

However, the manuscript can be downloaded and accessed as a PDF.

Tables

Table 1 Development of various zone of inhibition (mm) exerted by the bacterial isolates on different antibiotics

‘-’ indicates resistant

Table 2 CCD matrix showing the zeaxanthin yield on third day, agitation at 120 rpm and 40°C using *A. gandavensis*

Antibiotics	<i>Planomicrobium oceanokoites</i>	<i>Arthrobacter gandavensis</i>	<i>Kocuria flava</i>	<i>Rhodococcus ruber</i>	<i>Planococcus maritimus</i>	<i>Kocuria sp.</i>
Ampicillin	-	29	40	13	18	23
Clarithromycin	12	33	22	-	10	16
Gentamicin	33	25	14	23	21	33
Amoxyclav	-	23	31	19	19	30
Vancomycin	-	26	19	17	17	26
Cephalothin	-	24	40	36	34	40
Amikacin	28	21	14	22	18	33
Novobiocin	-	31	34	30	34	40
Erythromycin	10	32	34	-	-	10
Teicoplanin	-	24	25	16	16	24
Co-Trimoxazole	21	30	28	10	-	22
Penicillin	-	33	40	18	15	25
Azithromycin	32	38	37	-	22	10
Oflaxacin	20	20	20	19	24	28
Methicillin	-	26	33	37	33	37
Linezolid	-	37	31	24	25	32
Clindamycin	-	38	40	10	-	20
Tetracycline	20	28	32	11	15	40
Chloramphenicol	10	37	33	20	18	25
Oxacillin	-	16	23	26	32	39

Run	pH	Inoculum (%)	Glucose (%)	Zeaxanthin (mg/g)
1	5.0	10	1.0	0.07
2	7.0	10	1.0	0.22
3	5.0	12	1.0	0.06
4	7.0	12	1.0	1.07
5	5.0	10	2.0	0.12
6	7.0	10	2.0	0.52
7	5.0	12	2.0	0.02
8	7.0	12	2.0	0.93
9	5.0	11	1.5	0.00
10	7.0	11	1.5	0.12
11	6.0	10	1.5	1.51
12	6.0	12	1.5	1.36
13	6.0	11	1.0	0.92
14	6.0	11	2.0	1.13
15	6.0	11	1.5	0.83
16	6.0	11	1.5	0.83
17	6.0	11	1.5	0.83
18	6.0	11	1.5	0.83
19	6.0	11	1.5	0.83
20	6.0	11	1.5	0.83

Table 3 ANOVA for response surface polynomial equation and corresponding F-values and *p*-values for Zeaxanthin production by *A. gandavensis*

Figures

Source	Degree of Freedom	Adj SS	Adj MS	F-Value
Model	9	3.95944	0.43994	14.4
Linear	3	0.78525	0.26175	8.6
X_1	1	0.67081	0.67081	22.0
X_2	1	0.10000	0.10000	3.2
X_3	1	0.01444	0.01444	0.4
Square	3	2.90165	0.96722	31.7
X_1^2	1	2.46055	2.46055	80.8
X_2^2	1	0.50633	0.50633	16.6
X_3^2	1	0.00100	0.00100	0.0
2-Way Interaction	3	0.27254	0.09085	2.9
X_1X_2	1	0.23461	0.23461	7.7
X_1X_3	1	0.00281	0.00281	0.0
X_2X_3	1	0.03511	0.03511	1.1
Error	10	0.30422	0.03042	
Lack-of-fit	5	0.30422	0.06084	*
Pure Error	5	0.00000	0.00000	
Total	19	4.26365		
R^2	0.928

Figure 1

Graphs showing characteristic peaks of Zeaxanthin ESI-LCMS (MS/MS) in methanolic extract of *A. gandavensis*

Figure 2

Phylogenetic tree of identified strains positive for zeaxanthin productions

Figure 3

(a) Response surface plot of zeaxanthin Yield vs Inoculum, pH. The regions of surface plot are divided in 3 regions depicting zeaxanthin yield in mg/g, Glucose concentration, and inoculum size in percentages. (b) Yield vs Glucose, Inoculum, and (c) Yield vs Glucose, pH.

The values are presented as mean values $\pm$ SD, $n=3$

Supplementary Files

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