



Zhejiang Provincial Key Laboratory of Biometrology and Inspection & Quarantine, College of Life Sciences, China Jiliang University, Hangzhou 310018, PR China

Jinhua Academy of Agricultural Science, Jinhua 321000, PR China

College of Animal Sciences, Zhejiang University, Hangzhou 310058, PR China

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ABSTRACT

А I. 1 1 1 1 , fl Н 1 , 1 C 1 ; C 1 1 n Ac , Apis cerana. fl 1 $(\lambda = 332)$ 1 . D 1 fi 11 11 1 , $\Delta H > 0$, ΔS 1 1 1 fi > 0, С 1 1. 3 fl fl С 1 A ١, 1 fi 1 1. M -C h 1 1.4, С (CD) С α-1 1 6, C 1 ١, С β- I.H 1. II 1 fl (K_A) 0028-2.53 / 1 50% 1 1 1 Adel fi 11. 1 OB95% fi OB, 1 1 1.1 Frankliniella occidentalis 9, Bemisia te 1 **,** 1 1 fi 1 . M , C 1 1 1 1

> Schistocerca gregaria 11, Carausius morosus Camponotus japonicas 14 ۱.

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^{*} C 1 1

E-mail address: @126. (H. L).

Ν 1 1 1 15 . A 1 1 1 1 -1 1 1 1 1 16. 1 fi 1 1 (AO) LD₅₀ . F 72 69.68 / 17. 1 fi 1.1 Ι, 1) 18. (I fl I I 1 19,20. 1 1 С , Plutella xylostella, CSP8 21, CSP1 CSP2 22, CSP1 fl, Bombyx mori, Bemisia tabaci, 1 1 1 23. С 1 1 -1 1 1 1 С 1 , , Apis cerana. А 1 1 1 1 fl 24.II C 1 1 , 1 fi۱ 1.1 1

β- Ι Ι .Ι Ι С 1 1 1 A. cerana 25. A 1 1 1 . 11, 1 26-28, 1 fl 1 fi , C 1 1 1 С 1 1 1 1 1 1 1 1 , A. cerana, 1

1 1 1 1 1 1 1 1 1 1 .

2. Materials and methods

2.1. Chemicals and reagents

I (>97%)(1 1 F .1(A)) β- ι ι (>98% CI) .J 1, 1 1 1 L^{-1} 1.0 \times 10 $^{-3}$ (A) 1, 1 4 °C ∣ .M -(18.2 MΩ, M) **,** 1 1 1 1 1 .

2.2. Preparation of recombinant CSP1 protein

 CSP1
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 MD18 29

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	C 1	.A	1
1 1	1 $L^{-1}I$ G,	1 1	C 1 -
fi	fi	1	I тм
N ²⁺ -N A	I, I	В	(H 7.4)
72 4 °C		C 1	١.
fi	C 1	В	,
fi	1μ L ⁻¹ ,	−20 °C	

2.3. Multiple fluorescence spectra of CSP1 protein with imidacloprid



2.4. Circular dichroism (CD) spectra

2.5. Molecular docking analysis



2.6. Functional inhibition of CSP1 by imidacloprid

3. Results and discussion

3.1. Expression of recombinant CSP1 protein and fluorescence quenching spectra

E -32 (+)/C 1 1 1 BL21 (DE3) E. coli. A 1 I G, I fi N $^{2+}$ -N A С 1 ۱. 1 1 Β. D - AGE 1 fi 1 1 1 1 1 | **F**. 1, L | 1 | | 2 E 32-C 1 1 1 $L^{-1}I$ G.L 1 3 I I C 1 1 fi ۱. 1 1 C 1 28 KD, 95%. C 1 1 Ý۷. F. 2(A), fl 1 C 1 1 332 1 -, 1.I I fl 1 С 1 ۱. 1 1 C 1.

3.2. Synchronous fluorescence spectra

I١ 1 fl (1 1 1) C 1 1 fl 1 1 111 $\Delta \lambda = 15$ 1 60 В fl 1 1 1 1 1 fl 1 35.II ۱, 1 1 1 1 1

KDa 2 3 Μ 1 37.2 -66.4 ----44.3 -29.0-- CSP l 20.1 — 14.3 -

Fig. 1. SDS-PAGE of induced and purified recombinant CSP1 protein. M .L 1 1 2 1 E 32-C 1 1

L⁻¹ I G, .L | 3 fi IIC 1 ١, fi



3.3. Fluorescence quenching mechanism

F 1 1 1 1 1 1 1 1 1 1 40.D-1 1 1 1 1 1 1 ۱. 1

fl **41**.D 42 :

$$\frac{F_0}{F} = 1 + K_q \tau_0[Q] = 1 + K_{s\nu}[Q]$$
(1)

 F_0 fl 1 1 1 fl 1 <u>م</u> ; F fl fl 1 1 1 $Q; K_a$ fl 1 1;($\tau_0 = 10^{-8}$); K_{sv} I Y fl 43. 284 294 K . A I F . 3(A) 1 1, Ksv 1 1 44. 1 45.A F. 3(B), С 1 ¹), Ι (1 μ L^{-} C 1 ۱fi 1.II I С 1 1 1 1 1 A 2 A. cerana 46,

3.4. Thermodynamic analysis

I١ 1 1 1 **X** 47. :

۱.

300 320 340

 $\Delta G = -RT + K = \Delta H - T\Delta S$

$$\Delta H = \frac{RT_1T_2 + (K_{0,2}/K_{0,1})}{T_2 - T_1}$$
(3)

(2)

(4) $\Delta S = (\Delta H - \Delta G)/T$

Table 2

3.5. Circular dichroism (CD) spectra



1		•
1	Ν	E
	44	-24.1035
G	63	-16.0482
Α	9	-9.4608
	43	-9.3838
Α	40	-8.6277
Н	47	-7.3377
<u>1</u> ,	62	-6.9446
Y	11	-4.0133
E :	1	1 1 1

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3.7. Functional inhibition of CSP1 by imidacloprid

3.6. Molecular docking

 F
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 1:1, 1:5, 1:9
 1:13,
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 C
 1:
 1:1, 1:5, 1:9
 1:13,
).

 332
 .
 1
 1
 1
 K

 L
 151:
 .
 51:

$$\frac{F_0 - F}{F} = K_A + n \quad [Q] \tag{5}$$



 Fig. 4. Molecular docking of CSP1 with imidacloprid (A) and the Double-Log plots of the fluorescence of the mixture of CSP1 and imidacloprid quenching by β-ionone (C).

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