

Challenges in Chemistry for Sustainable Development



PACCON
PURE AND APPLIED CHEMISTRY
INTERNATIONAL CONFERENCE **2010**

PROCEEDINGS

**Pure and Applied Chemistry
International Conference 2010**

January 21-23, 2010
Ubon Ratchathani University
Ubon Ratchathani
THAILAND



PROFESSOR Dr.HER ROYAL HIGHNESS PRINCESS CHULABHORN

KEYNOTE SPEAKER

PROGRAM SUMMARY

WEDNESDAY: January 20th, 2010

Time	
14.00-18.00	Registration Setting and Putting up Poster Presentation at <i>Tubtim Siam-III room, 5th Floor</i>

THURSDAY: January 21st, 2010

Time		<i>Tubtim Siam-I room</i>
08.00-09.00	Registration	
09.00	OPENING CEREMONY Guests are requested to be seated in the room	
10.00	Arrival of Professor Dr. Her Royal Highness Princess Chulabhorn - Present the Conference Package of Professor Dr. HRH Princess Chulabhorn by President of Chemical Society of Thailand - Reported by the Director of University Council, Ubon Ratchathani University	
10.15	Professor Dr. Her Royal Highness Princess Chulabhorn graciously presents the Plaques of appreciation to 6 Plenary Lecturers, 4 sponsors of PACCOCN 2010 and 5 recipients of The CST Awards	
10.25	Royal Opening Address by Professor Dr. HRH Princess Chulabhorn	
10.40	Introduction of Professor Dr. Her Royal Highness Princess Chulabhorn by the President of Ubon Ratchathani University, the chairman of the PACCOCN2010 Organizing Committee	
10.50	Special Keynote Lecture by Professor Dr. Her Royal Highness Princess Chulabhorn	
11.35	Professor Dr. Her Royal Highness Princess Chulabhorn has photographs taken with two groups of organizing committee	
12.00	Departure of Professor Dr. Her Royal Highness Princess Chulabhorn	
12.00-13.00	Setting and putting up Poster Presentation at <i>Tubtim Siam-III room, 5th Floor</i>	
12.00-13.00	Lunch at the 4 th Floor	
13.00-13.40	Plenary lecture I Chairperson: Prof.Dr. Vichai Boonsang Prof.Guoan Luo "Research and development of traditional Chinese medicine in the post-genome era"	

PROGRAM SUMMARY

THURSDAY: January 21st, 2010

ORAL PRESENTATION									
Time	Pathumwan room	Pathummas room	Tubtim Siam-II room	Pathumchart room	Pathumtip room	CK B6 room	CK A12 room	CK B8 room	CK B7 room
13.40	Material Science and Nanotechnology 1	Material Science and Nanotechnology 2	Organic Chemistry and Medicinal Chemistry/ Cosmetics	Analytical Chemistry	Physical and Theoretical Chemistry	Polymer Chemistry	Industrial Chemistry and Innovation/ Food Safety	Inorganic Chemistry	Environmental Chemistry
-	Invited Lecture MSN-INV-1: Teerakiat Kerdechaoen	Invited Lecture MSN-INV-5: Mas Subramanian	Invited Lecture ORC-INV-1: Vatcharin Rukaachaisirikul	Invited Lecture ANC-INV-1: Kate Grudpan	Invited Lecture PTC-INV-1: Masahiro Ehara	Invited Lecture POC-INV-1: Quan Lin	Invited Lecture ICI-INV-1: Pailin Chuchottaworn	Invited Lecture INC-INV-1: Thawatchai Tuntulani	Invited Lecture ENC-INV-1: Pisana Toochinda
14.05	MSN-OR-1 MSN-OR-2 MSN-OR-3 MSN-OR-4	MSN-OR-38 MSN-OR-39 MSN-OR-40 MSN-OR-41	Invited Lecture ORC-INV-2: Somdej Kanokmedhakul	ANC-OR-1 ANC-OR-2 ANC-OR-3	Invited Lecture PTC-INV-2: Habibah A. Wahab	POC-OR-1 POC-OR-2 POC-OR-3 POC-OR-4	Invited Lecture ICI-INV-2: John L. Lombardi	INC-OR-1 INC-OR-2 INC-OR-3 INC-OR-4	ENC-OR-1 ENC-OR-2 ENC-OR-3 ENC-OR-4
15.05			ORC-OR-1 ORC-OR-2		Invited Lecture PTC-INV-3: Vudhichai Parasuk		ICI-OR-1 ICI-OR-2		
15.05 -15.20	Coffee break								
15.20	MSN-OR-5 MSN-OR-6 MSN-OR-7 MSN-OR-8 MSN-OR-9 MSN-OR-10 MSN-OR-11 MSN-OR-12 MSN-OR-13	MSN-OR-42 MSN-OR-43 MSN-OR-44 MSN-OR-45 MSN-OR-46 MSN-OR-47 MSN-OR-48 MSN-OR-49 MSN-OR-50	Invited Lecture ORC-INV-3: Khamit Suwanborirux	Invited Lecture ANC-INV-2: Dirk Janasek	Invited Lecture PTC-INV-4: Guenter Grampp	Invited Lecture POC-INV-2: Charoen Nakason	Invited Lecture FOS-INV-1: Pakawadee Sutthivaiyakit	Invited Lecture INC-INV-2: Khamphree Phomphrai	ENC-OR-5 ENC-OR-6 ENC-OR-7 ENC-OR-8 ENC-OR-9 ENC-OR-10 ENC-OR-11
-			Invited Lecture ORC-INV-5: Mongkol Sukwattanasimit	ANC-OR-4 ANC-OR-5 ANC-OR-6 ANC-OR-7	Invited Lecture PTC-INV-5: Koichiro Mitsuke	POC-OR-5 POC-OR-6 POC-OR-7 POC-OR-8 POC-OR-9	Invited Lecture FOS-INV-2: Piyasak Chaumpluk	INC-OR-5 INC-OR-6 INC-OR-7 INC-OR-8 INC-OR-9 INC-OR-10	
17.35			COS-OR-1 ORC-OR-3 ORC-OR-4 ORC-OR-5 ORC-OR-6		PTC-OR-1 PTC-OR-2 PTC-OR-3 PTC-OR-4 PTC-OR-5		FOS-OR-1 FOS-OR-2 FOS-OR-3		
18.30-20.30	WELCOME DINNER								



Synthesis and activity test as antioxidant of two hydroxydibenzalacetones

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Abstract: Synthesis and antioxidant activity test of two hydroxydibenzalacetones have been conducted. 2,2'-Dihydroxydibenzalacetones and 3,3'-dihydroxydibenzalacetones were synthesized by crossed aldol condensation in base condition with water-ethanol solvent from 2-hydroxybenzaldehyde and 3-hydroxybenzaldehyde as raw material respectively. The synthesise reaction was conducted in ice bath environment under stirring and followed by precipitation and purification by recrystallization with methanol-water as solvent. After filtration, 60.15% blackish green crystalline of 2,2'-dihydroxydibenzalacetone and 78.94% yellow crystalline of 3,3'-dihydroxydibenzalacetone were obtained. The IC₅₀ of two compounds were 791.62 and 196.56 µg/mL respectively.

Introduction

As curcumine analogue, dibenzalacetone is an attractive compound to be developed. Curcumine and dibenzalacetone structure was distinguished by a carbonyl and a methylene group so they have been predicted having similar activity. Itokawa et.al. [1] reported the relationship between structure and activity of curcuminoid compounds as antioxidant, anti-inflammatory, chemopreventive and anti prostate cancer. Antiinflammatory and antioxidant activity was found not only in curcuminoid compounds, but also in dibenzalacetone [2]. Previous research was resulting that symmetric [3] and asymmetric dibenzalacetone also have antioxidant activity [4].

Dibenzalacetone could be synthesized by crossed aldol condensation easily. Aldol Condensation is occurred by a nucleophilic addition of the enolate ion to a carbonyl. Acetone also undergoes aldol condensation, but the equilibrium concentration of the product is generally small. Analogue benzalacetones still have a potential development based on previous reports of its biological activity. Some of researchers had reported dibenzalacetone synthesis by different method. Sardjiman had synthesized some of analogue hydroxydibenzalacetones using hydrochloric acid as acid catalyst while Pudjono [5] used sulphuric acid. Affandi [6] had synthesized 4-hydroxydibenzalacetone in base condition. Solvent also has a significant influence in benzalacetone synthesis [7].

2,2'-dihydroxydibenzalacetone and 3,3'-dihydroxydibenzalacetone will be synthesized in this research. Dihydroxydibenzalacetone compound has phenolic group that performing very reactive oxidative

reaction and could produced free radical, so it was predicted that dihydroxydibenzalacetone has potency of an antioxidant activity.

Materials and Methods

General. All materials used was supplied from Merck, some of these are acetone, 2-hydroxybenzaldehyde, 3-hydroxybenzaldehyde, ethanol, chloroform, hexane, and ethyl acetate. The ¹H, ¹³C-NMR, HMQC and HMBC Spectra were recorded on 500 MHz Jeol spectrophotometer. IR spectra were conducted using a Shimadzu 8300 FTIR spectrometer.

2,2'-dihydroxydibenzalacetones(4). Into a solution of acetone (0.01 mol, 0.58 g) in 5 mL ethanol that was prepared at ice bath environment, 2-hydroxybenzaldehyde (0.02 mol, 2.44 g) and NaOH (0.025 mol, 1 g) were added drop wise alternately. After stirring for 3 hours, the mixture was kept under 10°C for 24 hours before filtering and purification by recrystallization using methanol as solvent. The obtained product was identified by thin layer chromatography, FTIR and NMR spectrophotometer.

3,3'-dihydroxydibenzalacetone (5). Into a solution of acetone (0.01 mol, 0.58 g) in aquades that was prepared at ice bath environment, NaOH (0.025 mol, 1 g) and 3-hydroxybenzaldehyde (0.02 mol, 2.44 g) were added drop wise alternately. After additional stirring for 3 hours, 3 mL HCl 37% and 5 mL aquades were added. The mixture was kept under 10°C for 24 hours. Then, the mixture was filtered and followed by purification by recrystallization with ethanol-water as solvent. The yield was identified by thin layer chromatography, FTIR and NMR spectrophotometer.

Deoxyribose assay

The assay was performed by the following method as described by Halliwell [8]. All solutions were freshly prepared. Into a solution of 6 mM 2-deoxyribose (0.2 mL), 0.01 mM ascorbic acid (0.2 mL); buffer phosphate pH 7.4 (0.2 mL); 0.01 mM H₂O₂ (0.2 mL); 0.1 mM ferrosulphate (0.2 mL) and 0.02 mL of sample in various concentration (62.5; 125; 250; 500; 1000 µg/mL) were added. After an incubation period of 30 minutes at 310°K, the extent of deoxyribose degradation was measured by the TBA reaction. 3 ml of TBA and 3 ml of TCA were added to the reaction mixture and heated for 15 minutes at

353°K. After cooling, the absorbance of mixture was measured at 532 nm against a blank solution (the same solution but without sample). The percentage inhibition was calculated by the formula:

$$I(\%) = \frac{A_{blank} - A_{sample}}{A_{blank}} \times 100\%$$

The IC₅₀ value represent the concentration of the compounds that caused 50% inhibition. BHT was used as a positive control.

Results and Discussion

The Synthesis of 2,2'-dihydroxydibenzalacetone (4). The preparation of compound **4** was initiated by the mixing of **1** and **3** with sodium hydroxide as catalyst in ethanol solvent (Figure 1). After stirring for 3 hours followed by filtration, 60.15% blackish green crystalline solid was obtained. The structure of **4** was determined by chromatographic and spectroscopic data: R_f (TLC; methanol: chloroform=1:9) 0.36; FTIR (KBr) cm⁻¹: 3425.58; 2939.52; 1589.34; 1543; 1458 and 1118.71.

The multiple bond correlation of HMBC supported the structure (Table 1, Figure 2). In the ¹H-NMR spectrum (500 MHz, CD₃OD), four equivalent protons with multiplicity as doublet and two equivalent protons with the multiplicity as triplet were observed. The doublet signal at δ = 8.4 ppm was assigned to H1 and H5, δ = 7.6 ppm to H6' and H6'', δ = 7.1 ppm to H2 and H4 and δ = 6.69 ppm to H2' and H2''. The triplet signal at δ = 6.47 ppm was assigned to H4' and H4'' meanwhile δ = 7.06 ppm to H5' and H5''. Support spectra data provided by the IR (KBr), which indicates the existence of C=O (1589.34 cm⁻¹), aromatic C=C (1543-1458 cm⁻¹) and CO (1118.71 cm⁻¹). Therefore, the structure of **4** was 2,2'-dihydroxydibenzalacetone.

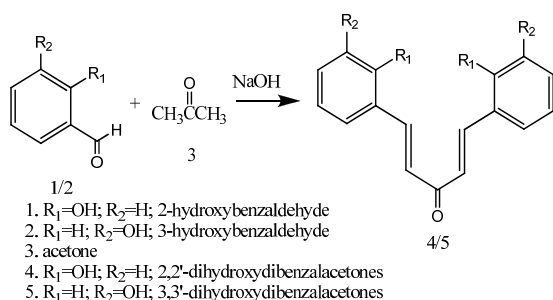


Figure 1. Synthesis reaction of **4** and **5** by crossed aldol condensation

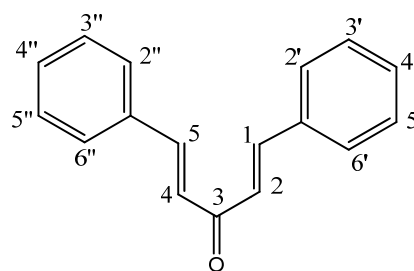


Figure 2. Numbering of dibenzalacetone structure for NMR data

Table 1: ¹H and ¹³C-NMR data of compound **5** (CD₃OD)

C no.	δH (ΣH; m; J Hz) ppm	δC ppm	HMBC (500 MHz)
1	8.42 (1H; d; 15,9)	143	C3, C2', C6'
2	7.15 (1H; d; 15,9)	122	C3, C1'
3	-	193	-
4	7.15 (1H; d; 15,9)	122	C1'', C3
5	8.42 (1H; d; 15,9)	143	C3, C4, C6''
1'	-	124	-
2'	-	169	-
3'	6.68 (1H; d; 15,9)	121	C1', C4'
4'	6.47 (1H; t; 8)	115	C3', C6'
5'	7.06 (1H; t; 8)	133	C2', C6'
6'	7.55 (1H; d; 8)	128	C2', C1, C5'
1''	-	124	-
2''	-	169	-
3''	6.68 (1H; d; 8)	121	C1'', C4''
4''	6.47 (1H; t; 8)	115	C3'', C6''
5''	7.06 (1H; t; 8)	133	C2'', C6''
6''	7.55 (1H; d; 8)	128	C2'', C5, C5''

The Synthesis of 3,3'-dihydroxydibenzalacetone (5). The preparation of compound **5** was initiated by the mixing of **3** with sodium hydroxide as catalyst in aquadest as solvent (Figure 1). To this reaction mixture was directly added **2**, followed by stirring at ice bath for 3 hours. After additional stirring, provided yellow crystalline **5** in 78.94% was resulted. The structure of **5** was determined by chromatographic and spectroscopic data: R_f (TLC; methanol: chloroform = 1:9) 0.34; FTIR (KBr) 1/cm: 3379.29; 3248.13; 1620.21; 1581.63; 1450; 1211.30 and 1103.28.

The multiple bond correlation of HMBC supported the structure (Table 2, Figure 1). In the ¹H-NMR spectrum (500 MHz, CD₃OD), one set protons singlet, four set protons doublet and one set protons triplet were observed. Support spectra data were provided by the IR (KBr), which indicate the existence of C=O (1620.21 cm⁻¹), aromatic C=C (1581.63-1450 cm⁻¹) and CO (1103.28 cm⁻¹). Therefore, what can be concluded for the structure of **5** was 3,3'-dihydroxydibenzalacetone.

Table 2: ¹H and ¹³C-NMR data of compound 6 (CD₃OD)

C no.	δ H (Σ H; m) ppm	δ C ppm	HMBC (500 MHz)
1	7.68 (1 H; d; 15,9)	145	C3, C2', C2, C2'
2	7.16 (1H; d; 15,9)	126	C3, C1, C1'
3	-	191	-
4	7.16 (1H; d; 15,9)	126	C3, C1'', C5
5	7.68 (1H; d; 15,9)	145	C3, C4, C1'', C2''
1'	-	137	-
2'	7.1 (1H; s)	115	C1, C3', C6'
3'	-	159	-
4'	6.86 (1H; d; 8)	119	C3', C2', C6'
5'	7.2 (1H; t; 8)	131	C4', C3', C1'
6'	7.15 (1H; d; 8)	121	C1, C1'
1''	-	137	-
2''	7.1 (1H; s)	115	C5, C3'', C6''
3''	-	159	-
4''	6.86 (1H; d; 8)	119	C3'', C2'', C6''
5''	7.2 (1H; t; 8)	131	C4'', C3'', C1''
6''	7.15 (1H; d; 8)	121	C5, C1''

Deoxyribose assay

Activity test as deoxyribose degradation inhibitor was done by fenton reaction. The IC₅₀ value represented the concentration of the compounds, that caused 50% inhibition. All experiment were repeated for five times. Data of IC₅₀ values were showed in Table 3.

Table 3: IC₅₀ datas for compounds 4 dan 5

No	Compound	IC ₅₀ (μg/mL)	activity
1.	4	791.62	Low
2.	5	196.56	active

Conclusions

In conclusion, two dihydroxydibenzalacetones, **4** and **5** were successfully synthesized in 60.15 and 78.94% respectively. Compound **4** and **5** exhibited significant antioxidant activity with the IC₅₀ of 791.62 and 196.56 μg/mL respectively. Compound **5** is more potent than **4** to inhibit deoxyribose degradation.

Acknowledment

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References

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