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## APPENDICES

### Appendix A WAXD patterns of all catalysts

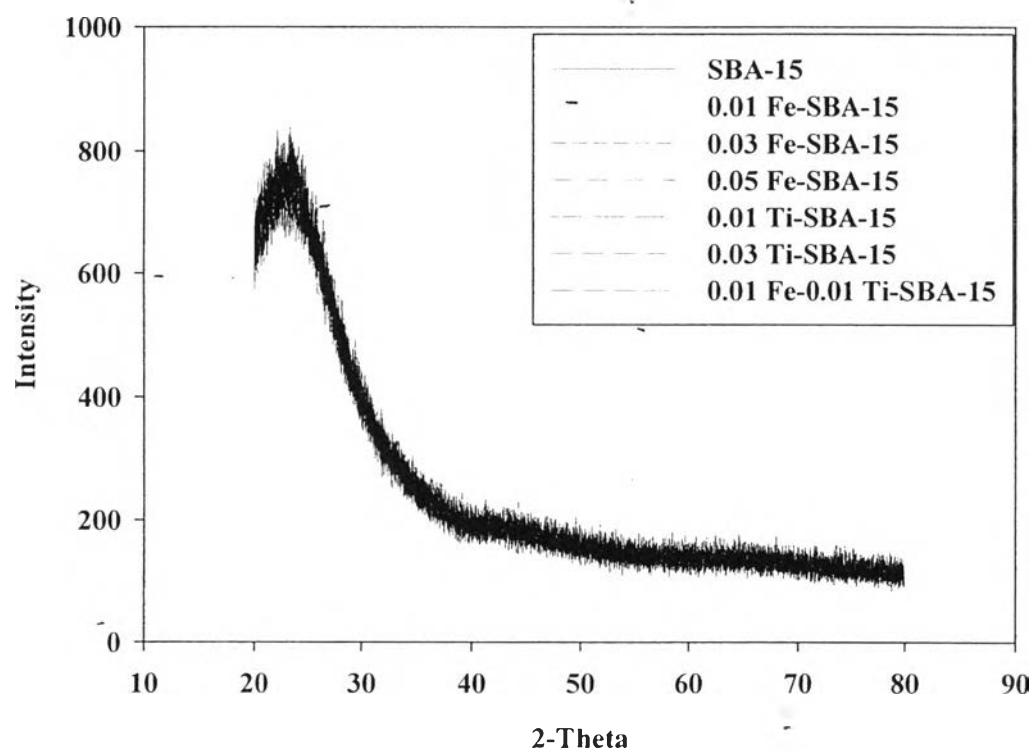


Figure A1 WAXD patterns of all catalysts.

## Appendix B Study on phenol hydroxylation

**Table B1** Effect of temperature and time on phenol hydroxylation (Thermal reaction)

Condition		Conversion (%)	Selectivity		
Temperature (°C)	Time (min)		HQ	CAT	BQ
30	10	34.76±0.87	-	-	100
	20	37.96±3.90	-	-	100
	30	37.14±1.42	-	-	100
	60	34.43±2.91	-	-	100
	120	33.27±4.70	-	-	100
	180	32.98±3.55	-	-	100
	240	31.89±2.94	-	-	100
	300	31.20±1.54	-	-	100
50	10	27.56±8.15	-	-	100
	20	33.38±9.66	-	-	100
	30	32.21±3.29	-	-	100
	60	26.39±9.17	-	-	100
	120	25.91±8.84	-	-	100
	180	24.11±1.76	-	-	100
	240	23.45±7.34	-	-	100
	300	23.43±2.86	-	-	100



**Table B1** Effect of temperature and time on phenol hydroxylation (thermal reaction)  
(Cont.)

Condition		Conversion (%)	Selectivity		
Temperature (°C)	Time (min)		HQ	CAT	BQ
70	10	25.29±4.57	-	-	100
	20	28.99±4.69	-	-	100
	30	25.49±0.42	-	-	100
	60	21.05±5.06	-	-	100
	120	18.03±0.36	-	-	100
	180	16.38±4.59	-	-	100
	240	15.85±1.54	-	-	100
	300	14.81±1.19	-	-	100
90	10	25.02±0.70	-	-	100
	20	26.93±1.26	-	-	100
	30	22.71±3.13	-	-	100
	60	19.99±1.21	-	-	100
	120	16.39±5.92	-	-	100
	180	15.23±4.88	-	-	100
	240	13.43±0.93	-	-	100
	300	13.74±3.00	-	-	100

\*The reaction performed by using 30 mg of 0.01Fe-0.01Ti-SBA-15 and 1:1 phenol: H<sub>2</sub>O<sub>2</sub> ratio.

**Table B2** Effect of catalyst content on phenol hydroxylation (Thermal reaction)

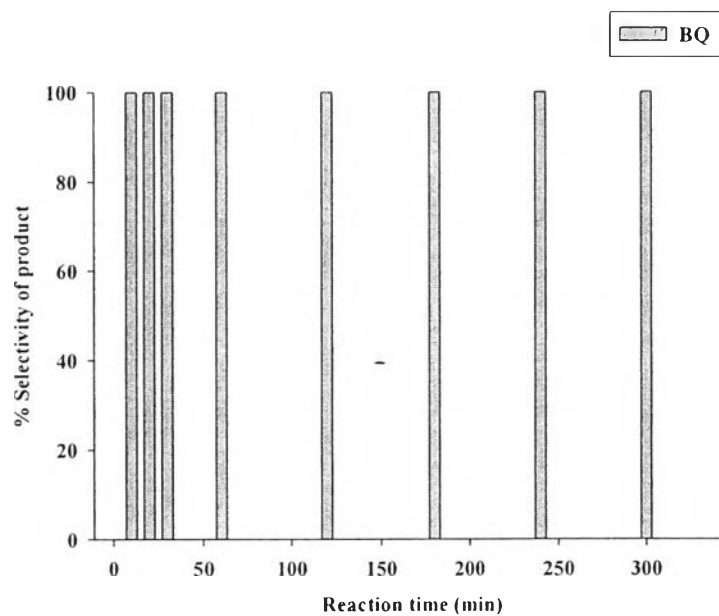
Catalyst content (mg)	Conversion (%)	Selectivity		
		HQ	CAT	BQ
No catalyst	23.37±2.38	-	-	100
30	29.78±2.35	-	-	100
50	37.96±3.90	-	-	100
70	32.36±1.10	-	-	100
90	28.17±3.33	-	-	100

\*The reaction performed at 30 °C for 20 min by using 0.01Fe-0.01Ti-SBA-15 and 1:1 phenol: H<sub>2</sub>O<sub>2</sub> ratio.

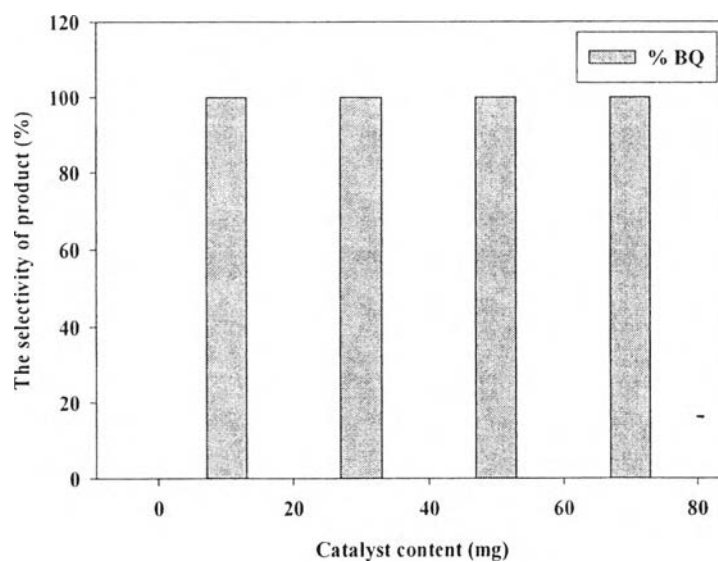
**Table B3** Effect of Molar ratio (phenol: H<sub>2</sub>O<sub>2</sub>) on phenol hydroxylation (Thermal reaction)

Molar ratio (phenol:H <sub>2</sub> O <sub>2</sub> )	Conversion (%)	Selectivity		
		HQ	CAT	BQ
1:1	37.96±3.90	-	-	100
1:2	17.91±1.41	-	-	100
1:3	7.40±2.02	-	-	100
2:1	12.53±1.45	-	-	100

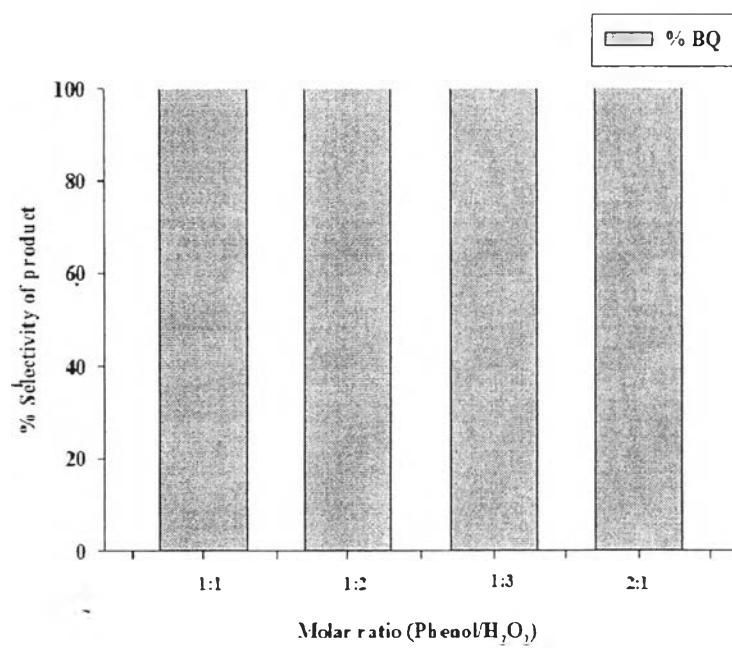
\*The reaction performed at 30 °C for 20 min using 30 mg of 0.01Fe-0.01Ti-SBA-15.



**Figure B1** Effect of the reaction time on the selectivity of product.



**Figure B2** Effect of catalyst content on the selectivity of product.



**Figure B3** Effect of Molar ratio (Phenol/H<sub>2</sub>O<sub>2</sub>) on the selectivity of product.

## CURRICULUM VITAE

**Name:** Ms. Ratchadaporn Kaewmuang

**Date of Birth:** June 6, 1989

**Nationality:** Thai

**University Education:**

2008-2012 Bachelor Degree of Engineering (Second-class Honours) in Petrochemicals and Polymeric Materials, Faculty of Engineering and Industrial Technology, Silpakorn University, Nakhonpathom, Thailand.

**Work Experience:**

2011 Position: Trainee  
Company name: The Siam Cement Group (SCG)

**Proceedings:**

1. Kaewmuang, R; Maneesuwan, H.; Chaisuwan, T.; Wongkasemjit, S. (2014, April 22) Synthesis and Activity of Ti-Fe-SBA-15 from Silatrane. Proceedings of the 5<sup>th</sup> Research Symposium on Petrochemical and Materials Technology and the 20<sup>th</sup> PPC Symposium on Petroleum, Petrochemicals and Polymers, Bangkok, Thailand.

**Presentations:**

1. Kaewmuang, R; Maneesuwan, H.; Chaisuwan, T.; Wongkasemjit, S. (2014, February 27-28) Synthesis of Bimetallic Ti-Fe-SBA-15 using Silatrane. Paper presented at ICCEE 2014: International Conference on Chemical and Environmental Engineering, Barcelona, Spain.
2. Kaewmuang, R; Maneesuwan, H.; Chaisuwan, T.; Wongkasemjit, S. (2014, April 22) Synthesis and Activity of Ti-Fe-SBA-15 from Silatrane. Paper presented at the 5<sup>th</sup> Research Symposium on Petrochemical and Materials Technology and the 20<sup>th</sup> PPC Symposium on Petroleum, Petrochemicals and Polymers, Bangkok, Thailand.