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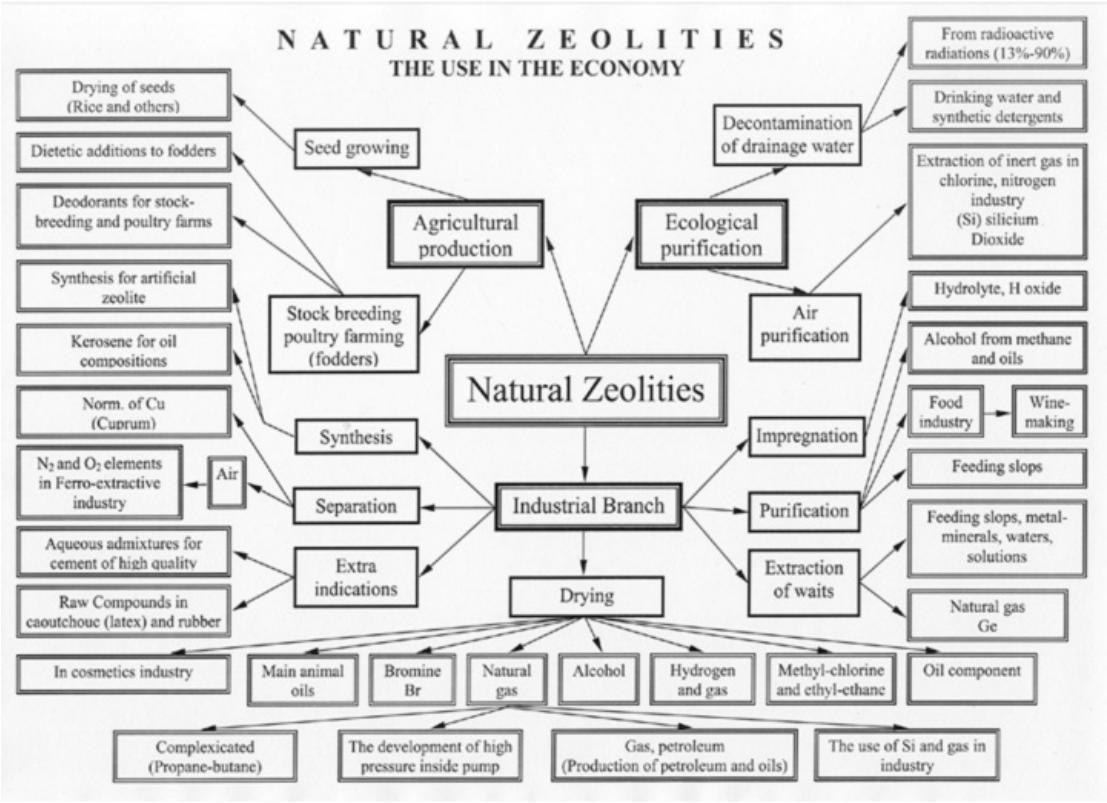
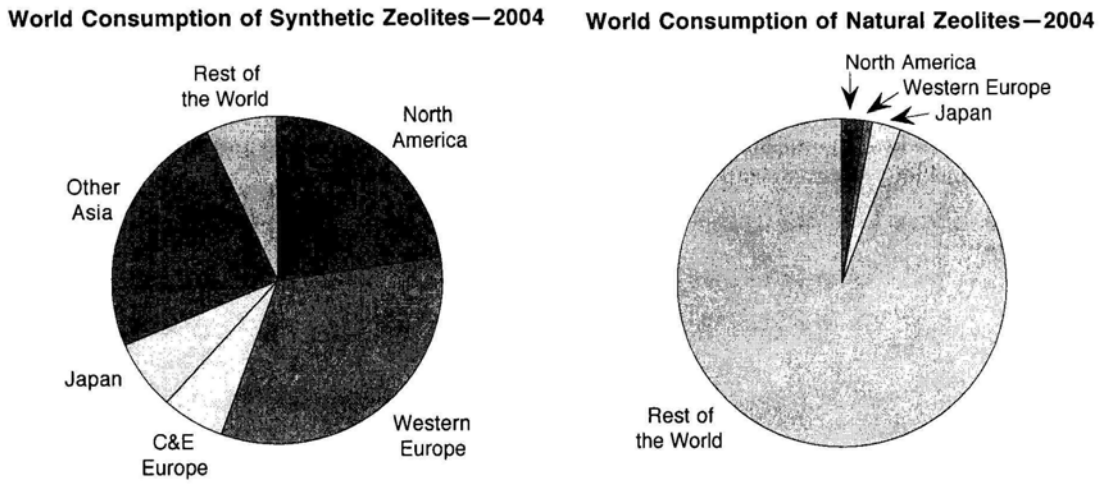
APPENDIX



Appendix Figure 1 Representative utilizations of zeolite



Appendix Figure 2 World Consumption of Synthetic and Natural Zeolites in 2004

Appendix Table 1 Global consumption of zeolites (2000)

Zeolite type	**Consumption in thousands of metric tons per annum**				
	United States	**Western Europe**	**Japan**	**Other Global Regions**	**Total**
Natural zeolites	32	30	120	3800	3982
Synthetic zeolites	470	606	110	176	1362
Detergents	365	555	95	145	1160(85%)
Catalysts	70	26	10	11	117(8%)
Absorbents	35	25	5	20	85(7%)
Total	**502**	**636**	**230**	**3976**	**5344**

TISTR

Request No. 55/49 **MATERIALS TECHNOLOGY DEPARTMENT (MTD)** Lab No. 59/49

Date March 31, 2006 Page 1 of 14

REPORT ON TESTING AND ANALYSIS

FOR

KASETSART UNIVERSITY

Testing/analysis of :– Zeolite, $CaCO_3$, RHA (30) and RHA (AA)

Method of testing/analysis :– Surface Area Analysis (BET); Model: Autosorb 1 and Particle Size Analysis (Wet Sieve)

Result of testing/analysis :–

The results of Particle size by wet sieving of the samples are shown in the table on page 2. The results of surface area of the samples are shown in the table below. The details are shown on pages 3-14.

Sample	Single point BET (m^2/g)	Multipoint BET (m^2/g)	Remark
Zeolite	14.30	14.59	Pages 3-5
$CaCO_3$	2.99	3.07	Pages 6-8
RHA (30)	78.54	79.92	Pages 9-11
RHA (AA)	76.58	77.04	Pages 12-14

Tested/analysed by

Panida Thaveethavorn.

(Ms. Panida Thaveethavorn)

Approved by

Siriporn Larpkiattaworn

(Siriporn Larpkiattaworn, Ph.D.)
Acting Director
Materials Technology Department
TISTR

Examined by

Siriporn Larpkiattaworn

(Siriporn Larpkiattaworn, Ph.D.)

FM-MTD-GEN 02-02 Rev.0

Remark : The above results are valid exclusively for tested/analysis sample as mentioned in the report
Publicity of the results on testing and analysis is prohibited unless written permission is obtained from the governor of TISTR

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Appendix Figure 3 Report on Surface area of various fillers

The amount of residue on sieve.

	% Residue on sieve			
	+150μm	+75μm	+45μm	-45μm
Zeolite	8.13	16.76	10.54	64.57
$CaCO_3$	0.51	0.41	0.33	98.75
RHA (30)	70.25	15.32	6.38	8.05
RHA (AA)	68.07	17.72	6.91	7.30

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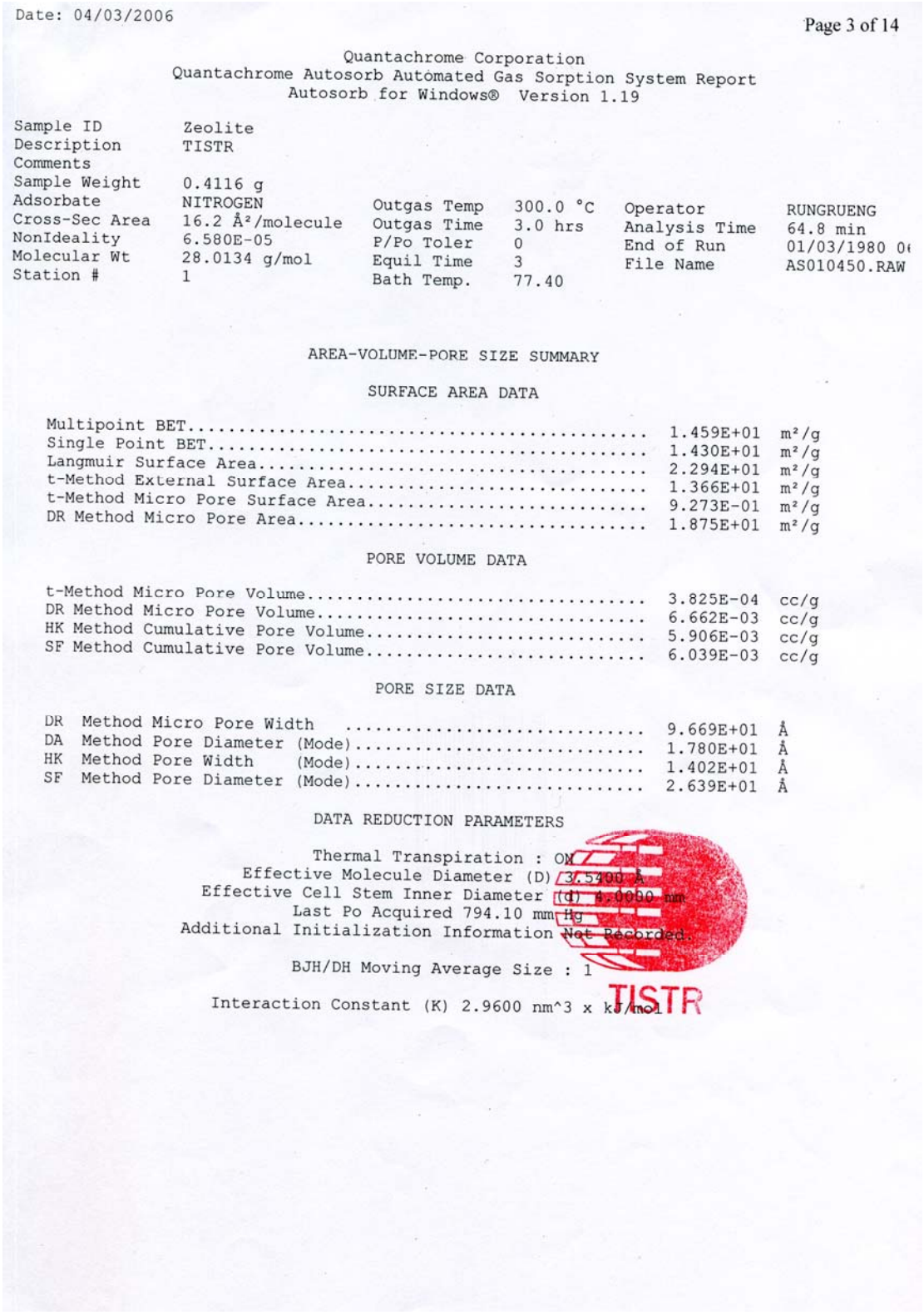
Appendix Figure 4 Report on Particle size of various fillers



Date: 04/03/2006 Page 3 of 14

Quantachrome Corporation
Quantachrome Autosorb Automated Gas Sorption System Report
Autosorb for Windows® Version 1.19

Sample ID	Zeolite				
Description	TISTR				
Comments					
Sample Weight	0.4116 g				
Adsorbate	NITROGEN	Outgas Temp	300.0 °C	Operator	RUNGRUENG
Cross-Sec Area	16.2 Å²/molecule	Outgas Time	3.0 hrs	Analysis Time	64.8 min
NonIdeality	6.580E-05	P/Po Toler	0	End of Run	01/03/1980 0(
Molecular Wt	28.0134 g/mol	Equil Time	3	File Name	AS010450.RAW
Station #	1	Bath Temp.	77.40		

AREA-VOLUME-PORE SIZE SUMMARY

SURFACE AREA DATA

Multipoint BET	1.459E+01	m²/g
Single Point BET	1.430E+01	m²/g
Langmuir Surface Area	2.294E+01	m²/g
t-Method External Surface Area	1.366E+01	m²/g
t-Method Micro Pore Surface Area	9.273E-01	m²/g
DR Method Micro Pore Area	1.875E+01	m²/g

PORE VOLUME DATA

t-Method Micro Pore Volume	3.825E-04	cc/g
DR Method Micro Pore Volume	6.662E-03	cc/g
HK Method Cumulative Pore Volume	5.906E-03	cc/g
SF Method Cumulative Pore Volume	6.039E-03	cc/g

PORE SIZE DATA

DR Method Micro Pore Width	9.669E+01	Å
DA Method Pore Diameter (Mode)	1.780E+01	Å
HK Method Pore Width (Mode)	1.402E+01	Å
SF Method Pore Diameter (Mode)	2.639E+01	Å

DATA REDUCTION PARAMETERS

Thermal Transpiration : ON
Effective Molecule Diameter (D) 3.5400 Å
Effective Cell Stem Inner Diameter (d) 4.0000 mm
Last Po Acquired 794.10 mm Hg
Additional Initialization Information Not Recorded.

BJH/DH Moving Average Size : 1

Interaction Constant (K) 2.9600 nm^3 x kJ/mol

TISTR

Appendix Figure 5 Report on Pore volume of natural zeolite

Date: 04/03/2006

Quantachrome Corporation
Quantachrome Autosorb Automated Gas Sorption System Report
Autosorb for Windows® Version 1.19

Sample ID	CaCO3				
Description	TISTR				
Comments					
Sample Weight	0.2364 g				
Adsorbate	NITROGEN	Outgas Temp	300.0 °C	Operator	RUNGRUENG
Cross-Sec Area	16.2 Å²/molecule	Outgas Time	3.0 hrs	Analysis Time	60.6 min
NonIdeality	6.580E-05	P/Po Toler	0	End of Run	03/20/2006 1
Molecular Wt	28.0134 g/mol	Equil Time	3	File Name	AS010449.RAW
Station #	1	Bath Temp.	77.40		

AREA-VOLUME-PORE SIZE SUMMARY

SURFACE AREA DATA

Multipoint BET	3.078E+00	m²/g
Single Point BET	2.994E+00	m²/g
Langmuir Surface Area	4.792E+00	m²/g
t-Method External Surface Area	2.582E+00	m²/g
t-Method Micro Pore Surface Area	4.963E-01	m²/g
DR Method Micro Pore Area	4.045E+00	m²/g

PORE VOLUME DATA

t-Method Micro Pore Volume	2.541E-04	cc/g
DR Method Micro Pore Volume	1.437E-03	cc/g
HK Method Cumulative Pore Volume	1.308E-03	cc/g
SF Method Cumulative Pore Volume	1.338E-03	cc/g

PORE SIZE DATA

DR Method Micro Pore Width	8.998E+01	Å
DA Method Pore Diameter (Mode)	1.780E+01	Å
HK Method Pore Width (Mode)	1.773E+01	Å
SF Method Pore Diameter (Mode)	3.368E+01	Å

DATA REDUCTION PARAMETERS

Thermal Transpiration : ON
Effective Molecule Diameter (D) 3.5400 Å
Effective Cell Stem Inner Diameter (d) 4.0000 mm
Last Po Acquired 798.09 mm Hg
Additional Initialization Information Not Recorded

BJH/DH Moving Average Size : 1

Interaction Constant (K) 2.9600 nm^3 x kJ/mol

TISTR

Appendix Figure 6 Report on Pore volume of $CaCO_3$

Date: 04/03/2006

Quantachrome Corporation
Quantachrome Autosorb Automated Gas Sorption System Report
Autosorb for Windows® Version 1.19

Sample ID	RHA(30)				
Description	TISTR				
Comments					
Sample Weight	0.1361 g				
Adsorbate	NITROGEN	Outgas Temp	300.0 °C	Operator	RUNGRUENG
Cross-Sec Area	16.2 Å²/molecule	Outgas Time	3.0 hrs	Analysis Time	94.2 min
NonIdeality	6.580E-05	P/Po Toler	0	End of Run	03/29/2006 1
Molecular Wt	28.0134 g/mol	Equil Time	3	File Name	AS010452.RAW
Station #	1	Bath Temp.	77.40		

AREA-VOLUME-PORE SIZE SUMMARY

SURFACE AREA DATA

Multipoint BET	7.992E+01	m²/g
Single Point BET	7.854E+01	m²/g
Langmuir Surface Area	1.237E+02	m²/g
t-Method External Surface Area	6.630E+01	m²/g
t-Method Micro Pore Surface Area	1.361E+01	m²/g
DR Method Micro Pore Area	1.067E+02	m²/g

PORE VOLUME DATA

t-Method Micro Pore Volume	6.870E-03	cc/g
DR Method Micro Pore Volume	3.793E-02	cc/g
HK Method Cumulative Pore Volume	3.388E-02	cc/g
SF Method Cumulative Pore Volume	3.453E-02	cc/g

PORE SIZE DATA

DR Method Micro Pore Width	9.311E+01	Å
DA Method Pore Diameter (Mode)	1.800E+01	Å
HK Method Pore Width (Mode)	1.412E+01	Å
SF Method Pore Diameter (Mode)	2.648E+01	Å

DATA REDUCTION PARAMETERS

Thermal Transpiration : ON
Effective Molecule Diameter (D) 3.5400 Å
Effective Cell Stem Inner Diameter (d) 4.0000 mm
Last Po Acquired 788.57 mm Hg
Additional Initialization Information Not Recorded

BJH/DH Moving Average Size : 1

TISTR

Interaction Constant (K) 2.9600 nm^3 x kJ/mol

Appendix Figure 7 Report on Pore volume of RHA

CURRICULUM VITAE

NAME : Miss Thiranan Thuechart

BIRTH DATE : October 7, 1981

BIRTH PLACE : Samut Songkhram, Thailand

EDUCATION :

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SCHOLARSHIP : Thai Research Fund (TRF) 2005-2006