

# Development of Talc for Paper Coating

종이코팅용 탈크의 개발

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# Development of Talc for Paper Coating

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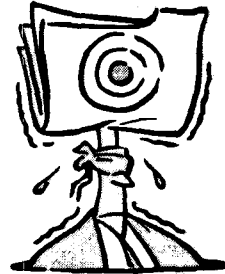
## 목 차

- 개발목적
- 탈크란 무엇인가?
- COTALC-90의 특징
- Talc for Paper Coating
- Pigments 비교 실험
- Binder 감량 실험
- Mill Trial

2

## 개발목적

- 도공지의 품질개선
- A1 도공지 및 신제품개발
- Clay 대체로 원가절감
- 중국내의 무한한 자원활용
- Silky Matte 생산, 유럽과 품질경쟁



3



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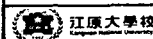
## What is Talc ?

- Hydrated Magnesium Silicate
- $3\text{MgO} \cdot 4\text{SiO}_2 \cdot \text{H}_2\text{O}$
- Trioctahedral, 3층 구조형 층상구조광물
- The Softest Mineral in the World
- More Platelike Shape (Higher Aspect Ratio)
- Hydrophobic & Water-Repellent
- Non Chemical reactivity



Book 11, Pigment Coating and Surface Sizing of Paper 2000

4



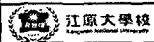
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# Pigments of Coating

	Talc	Clay	GCC	PCC
화학식	$Mg_3Si_4O_{10}(OH)_2$	$Al_2Si_4O_{10}(OH)_2$	$CaCO_3$	$CaCO_3$
성분	MgO, $SiO_2$ , $H_2O$	$SiO_2$ , $Al_2O_3$ , $H_2O$	CaO, $CO_2$ , $MgCO_3$	CaO, $CO_2$ , $MgCO_3$
비중	2.7 ~ 2.8	2.50 ~ 2.65	2.93	2.65
경도	1.0	2.4	2.7	2.7
백색도	86 ~ 93	84 ~ 90	90 ~ 97	90 ~ 97

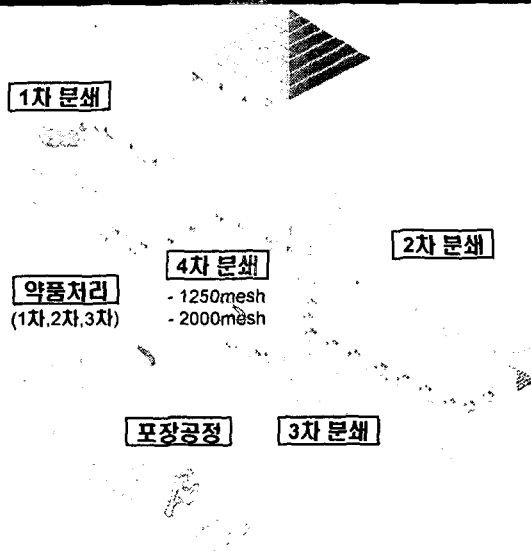
5



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# Proceeding

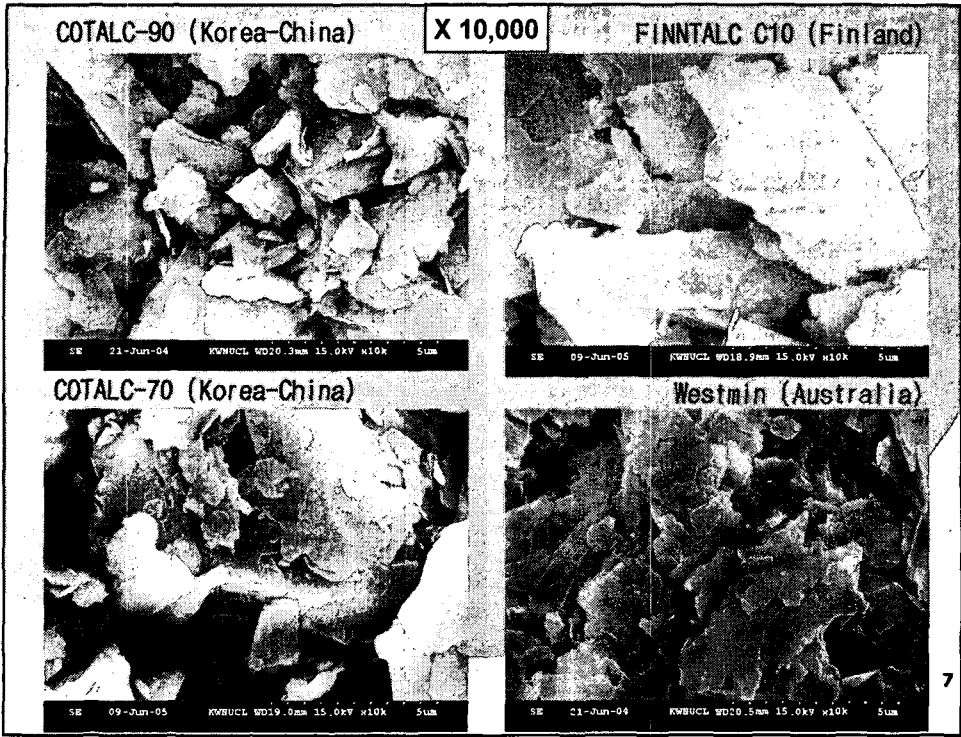


6

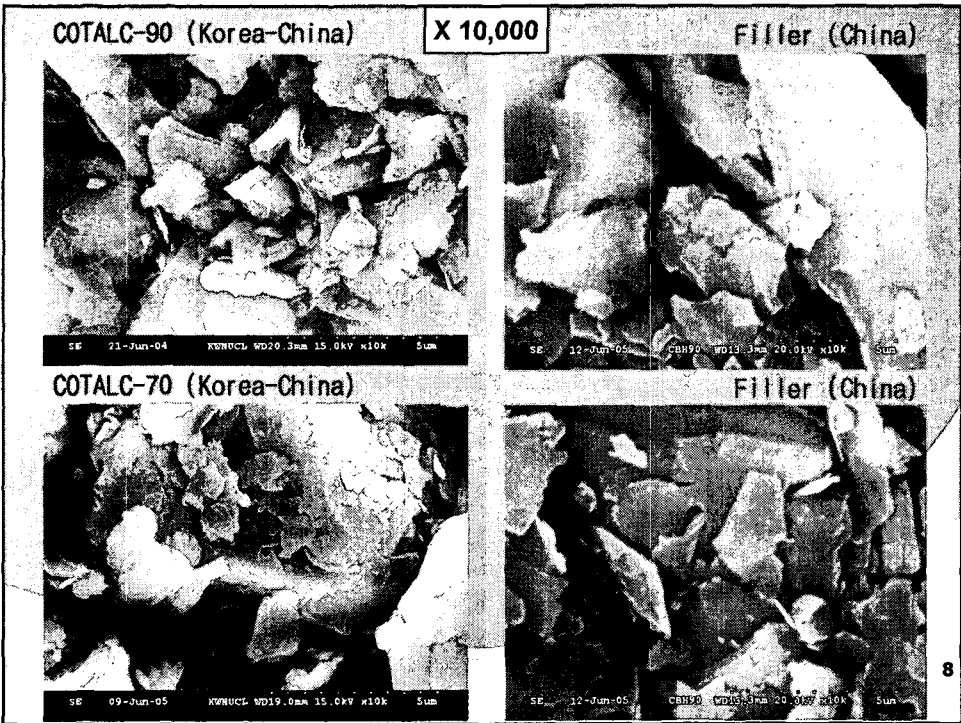


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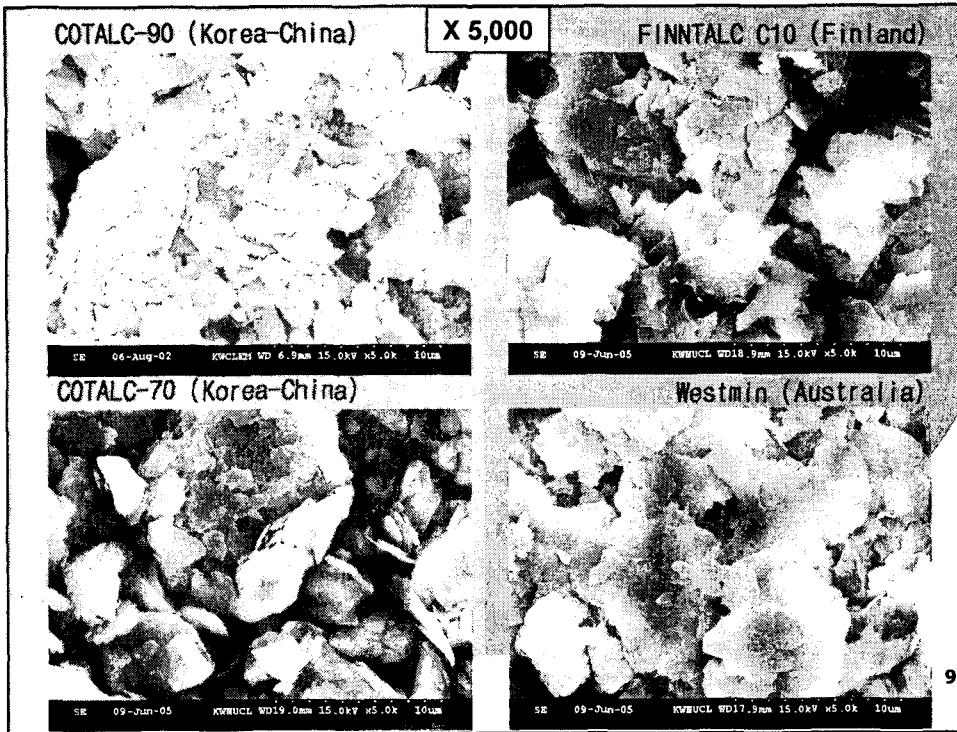
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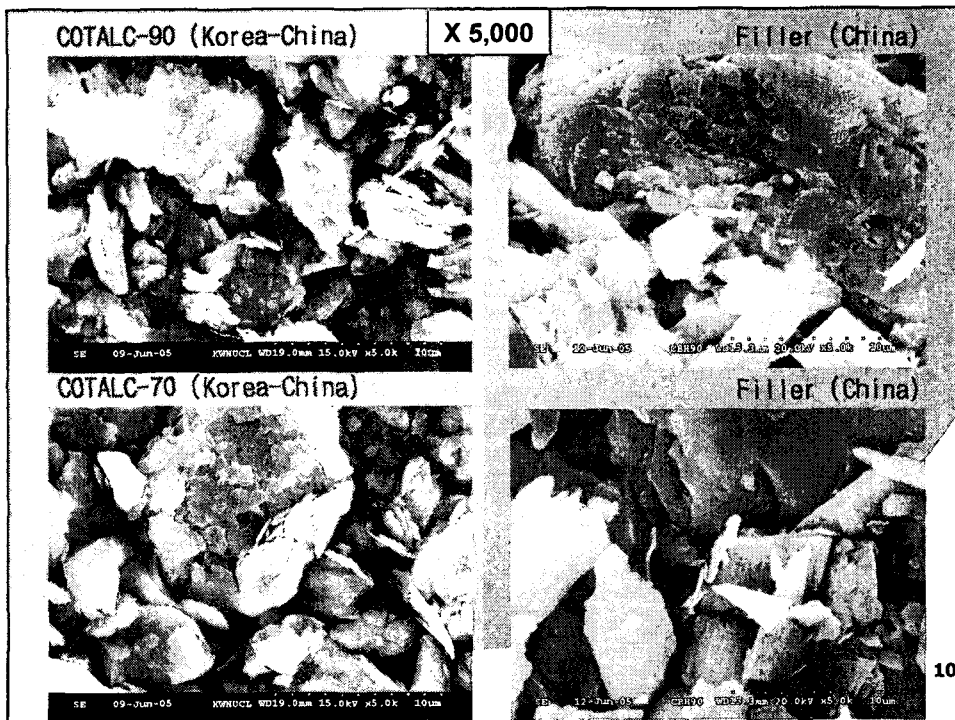
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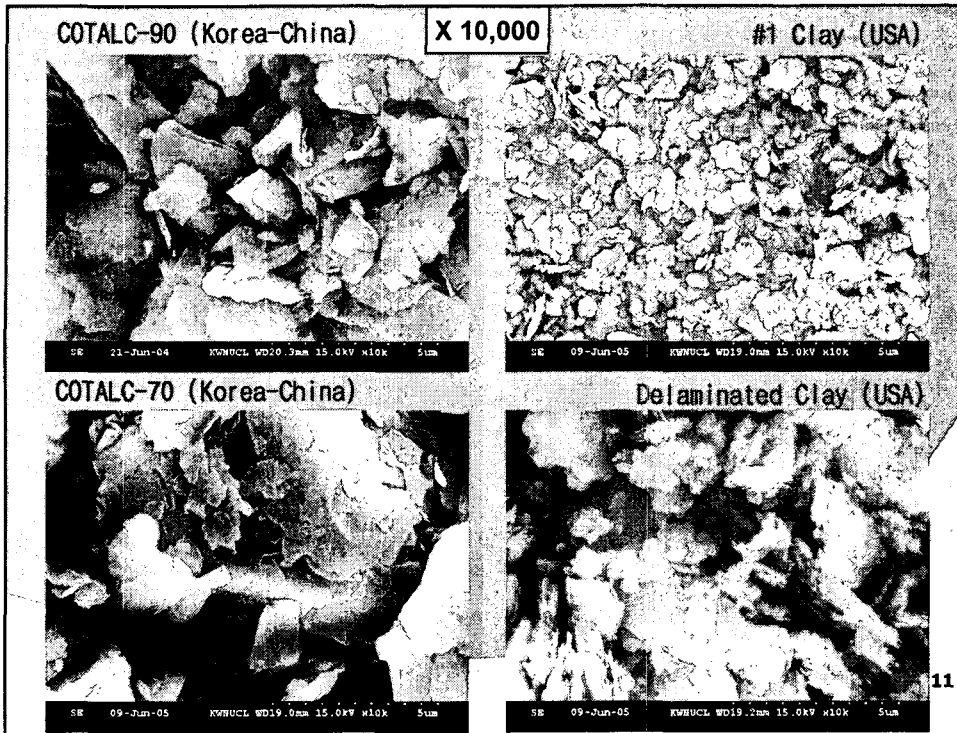
8



9



10



11

## Talc & Chlorite

### Talc

- Si
- O
- OH
- Mg

### Chlorite

- Si
- O
- OH
- Mg/Al

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12

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# Talc Deposit

- **Magnesium Carbonate derivative**

- 50-70%
- Pure, White
- China, Far East, North American, Australia

- **Serpentine derivative**

- 20-40%
- Dark Gray, Upgrade Whiteness through flotation
- Europe, North American

- **Silica Aluminous Rock derivative**

- 10%, Mixed Magnesium Carbonate derivative
- Gray, Chlorite
- China, Far East, Europe

- **Magnesium Sedimentary deposit derivative**

- A Little
- Mixture talc, quartz, mica, clay, iron oxide

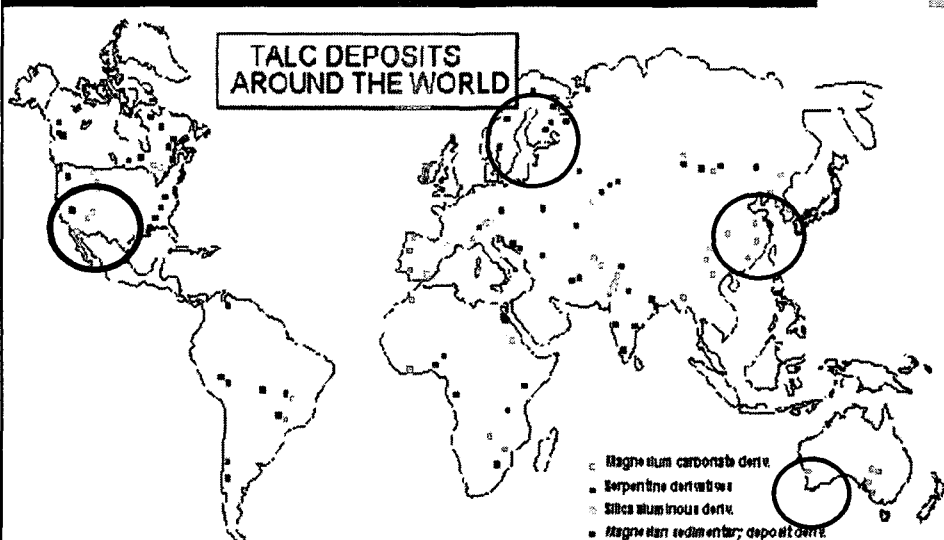
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# Talc Deposits



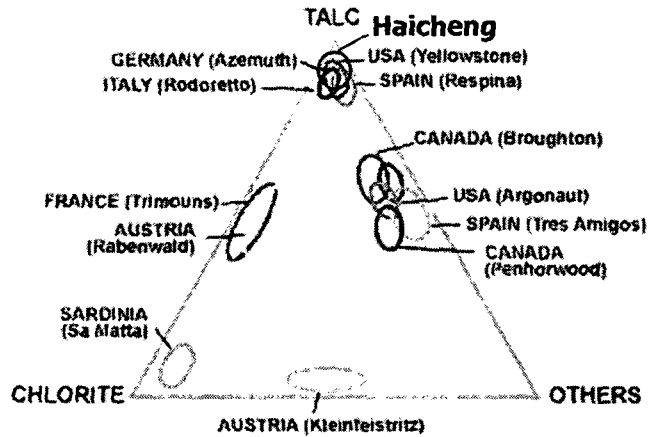
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# Geology



<http://www.luzenac.com/>

15

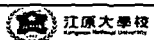


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# Talc Company

회사명	생산량 (ton/yr)	매출액(천\$)	생산기지	제품명
Mondo Minerals	650,000	160,000	Finland, Netherlands, Norway, Portugal, Turkey	Fintalc C10®
Luzenac	300,000	72,000	France, Benelux, Austria, U.K., Italy, Spain	Helicote®

16



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# Talc Consumption

Year	Europe			East Asia	North American
	86	90	2004	89	89
Filler	450,000	300,000	-	850,000	5,000
Pitch Control	145,000	165,000	-	100,000	140,000
Coating	60,000	90,000	1,050,000	0	0

www.hitalc.com

17



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## FINNTALC C10

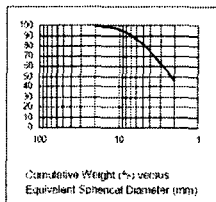
### MINERALOGY

Talc (Mg-Silicate) (XRD) 96 %  
Residue magnesite and chlorite

### OPTICAL PROPERTIES

ISO-Brightness (R457) 85 %  
Refractive index 1.57

### PHYSICAL PROPERTIES



Particle size distribution (Sedigraph 5100)  
- Particles < 10 µm 96 %  
- < 5 µm 82 %  
- < 2 µm 46 %  
Abrasion (Einiehrer AT 1000) 8 mg  
Hardness (Mohs) 1  
Specific gravity 2750 kg/m<sup>3</sup>  
Density  
- moist pellets 1000 kg/m<sup>3</sup>  
- slurry 1680 kg/m<sup>3</sup>  
Moisture  
- moist pellets 11 %  
- solids content of slurry 65.5 %

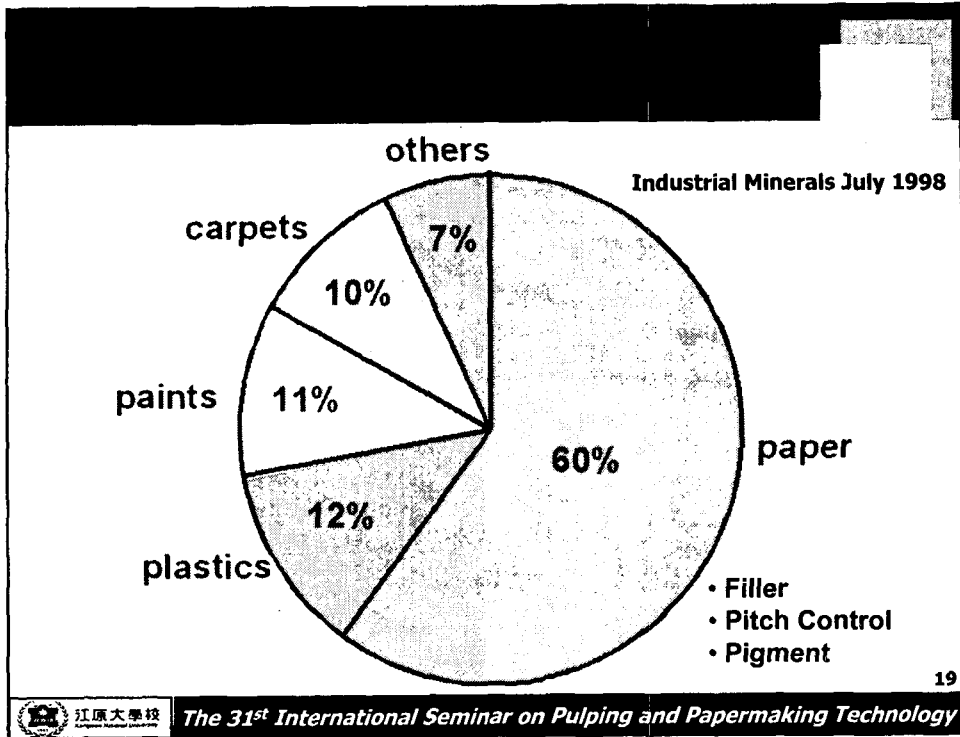
### CHEMICAL ANALYSIS

MgO 31 %  
SiO<sub>2</sub> 60 %  
Al<sub>2</sub>O<sub>3</sub> 0.5 %  
CaO 0.1 %  
FeO 2.1 %  
Fe acid soluble (1M HCl, 100°C) 0.2 %  
Loss on ignition 5.8 %  
Water solubles 0.1 %  
pH value  
- pellets 9  
- slurry 10


### DELIVERY FORMS

moist pellets (without chemicals) in bulk and in big bags, slurry

18



## COTALC-90의 특징



- Higher Brightness than FINNTALC C10
  - Different Deposit
- Lower Moisture Content
  - COTALC-90 0.5%, FINNTALC C10 10%
- Lower Cost than Other talc
  - Fintalc C10, Westmin 240-280\$
- Good Dispersability

20

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## Talc for Paper Coating

- **Soft – Silky Feel, Low Abrasion**
- **Plate – Printability, Smoothness**
- **Low Friction – Touch Feel, Reel Tension**
- **Large Particle Size - Low Binder Demand**
- **Excellent Calendering**
- **Good Printability**
  - : Ink Holdout, Ink Scuff, SNAP, Ink Gloss
- **Excellent Press Runnability**

21

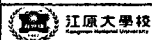


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## Talc for Paper Coating

- **Matte, Silk Matte, Gravure, Web Offset**
- **유럽은 20년 전부터 사용(Mondo Mineral)**
- **북미는 10년 전부터 사용(Luzenac)**
- **아시아에서는 처음으로 개발 생산함**
- **유럽에서는 전체 코팅안료 시장의 15% 점유**

22

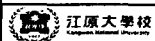


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## Properties of Pigments

Pigments	Mean Particle Size D(0.5), $\mu\text{m}$	Brightness %	% < 2 $\mu\text{m}$	Remark
COTALC-90	3.79	91.3	10	Talc
COTALC-70	5.43	91.3	8	Talc
Fintalc C10	5.95	83.1	7	Talc
Westmin Talc	6.74	82.5	6	Talc
#1 Clay	0.58	87.5	92	US Clay
Delaminated Clay	0.58	86.6	67	US Clay
GCC 90	0.52	92.8	90	GCC

23



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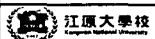
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## COTALC-90 vs. No.1 CLAY

Pigments	Shape	Max. Surry Solid, %	Disadvantages
COTALC-90	Monoclinic Lamellar	67.5	Dispersability
Hydrogloss-90	Hexagonal Plate form	73.0	Opacity
GCC 95	Rhombohedral	77.5	Ink Gloss Ink Scuff
Amazon SD90	Hexagonal Plate form	74.0	Brightness Opacity

- 분산성은 좋지만 최대농도는 Clay에 비해 낮음

24



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# Pigments 비교 실험

25

**Paper is Art  
and  
You are Artist**

26

# Pigment 비교

## 실험 목적

- 매트지의 면감개선 (Gloss Mottle, Feeling Silky)
- 원가절감
- 원지의 피복성 개선 (Platelike)
- 매트지의 인쇄적성 개선 (SNAP, Ink Gloss)

## 실험 내용

- 기존의 #2 Clay, 두 종류의 판상클레이와 비교
- 각각의 안료물 12 part 혼합, 기타 조건은 동일함
- 무광택 도공지(Matte Paper)에 적용
- Pilot Blade Coater (MLC) 사용

27



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# Color Formulation

## Pigments 비교실험

	Control	Clay - I		Cotalc-90		Clay - II		비 고
GCC-90	88	88	82	88	82	88	82	
#2 Clay	12	0	0	0	0	0	0	US Clay
De. Clay -I	0	12	18	0	0	0	0	Delaminated Clay
COTALC-90	0	0	0	12	18	0	0	Talc
De. Clay -II	0	0	0	0	0	12	18	Delaminated Clay
Latex	11.05							
Lubricant	0.7							
Insolubilizer	0.5							
Thickener	0.2							
Solid	68.86	68.93	68.85	68.93	68.86	68.89	68.88	

28



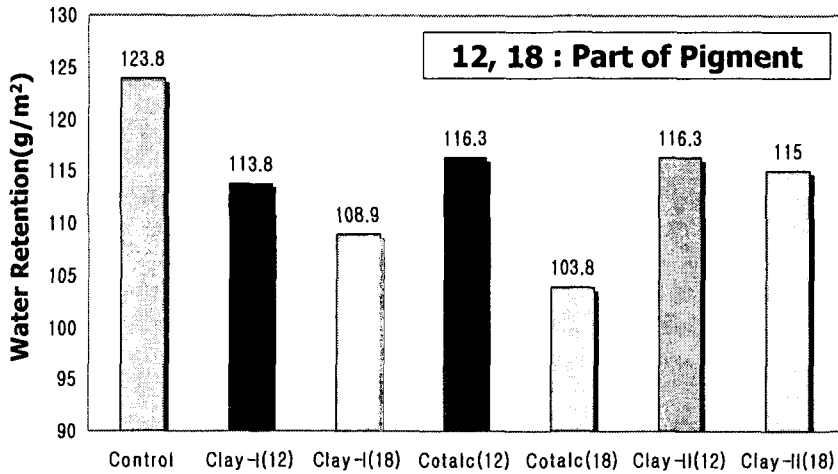
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# Water Retention

Pigments 비교실험



Pigments

29



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# Water Retention

Pigments 비교실험

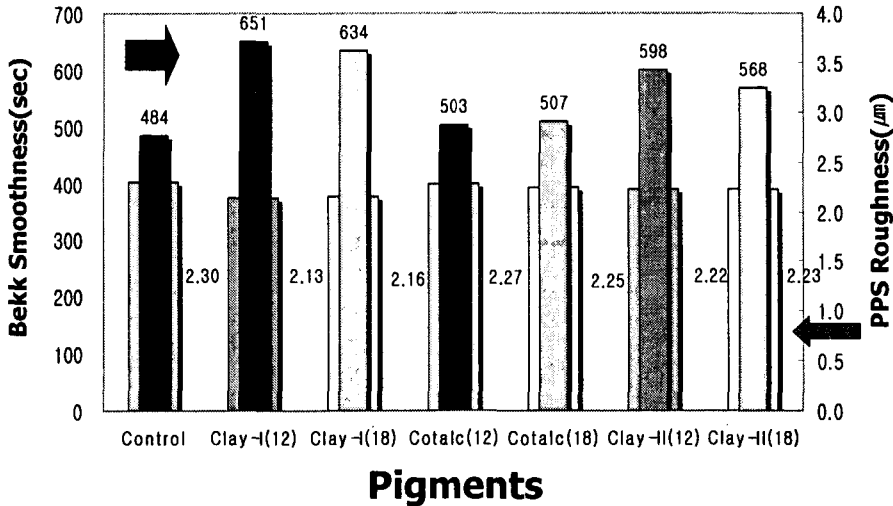
- 도공액의 보수성 측정
- 측정값이 낮을수록 좋은 것임
- Cotalc-90의 Aspect Ratio가 매우 커서 보수성이 향상됨
- 도공액의 Binder Migration 억제
- 탈크가 기존의 2급 클레이, 판상클레이 보다 좋거나 유사함
- Thickener 절감

30



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## Bekk Smoothness & PPS Roughness Pigments 비교실험



31



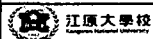
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## Bekk Smoothness & PPS Roughness Pigments 비교실험

- Bekk 평활도는 판상클레이보다 다소 떨어짐
- Cotalc-90의 입자가 크기 때문, 미세한 차이
- PPS Roughness는 동일
- 탈크가 기존의 클레이보다 입도가 매우 큼
- 그러나 평활도가 유사
- Calendering 적성이 매우 우수

32

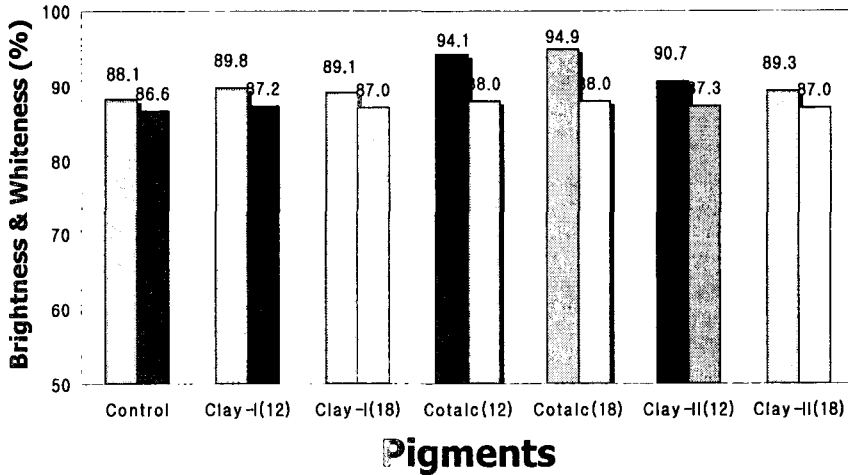


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# Brightness & Whiteness

Pigments 비교실험



33



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# Brightness & Whiteness

Pigments 비교실험

- 탈크(91%)의 백색도가 클레이(87%)보다 매우 높기 때문에 백색도와 백감도 모두 높음
- 형광염료 90%이상 절감가능
- 무형광, 무염료 도공지 제조가 가능
- 기타 유색 염료도 절감이 가능
- 인체 무해한 식품포장용지 제조가능
- 원가절감

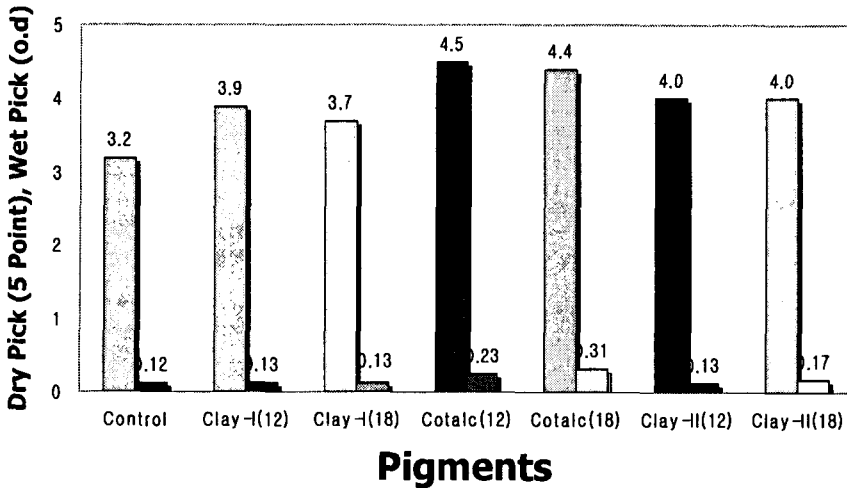
34



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# Wet pick & Dry pick

Pigments 비교실험



35



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# Wet pick & Dry pick

Pigments 비교실험

- 두종류의 판상 클레이보다 Dry Pick과 Wet Pick 모두 우수한 결과를 보임
- 바인더 함량을 약 1 part 이상 낮추는 것이 가능함
- 탈크입자의 비표면적이 적기 때문임
- 탈크의 소수성으로 Wet Pick도 우수
- 바인더 감량으로 원가절감

36

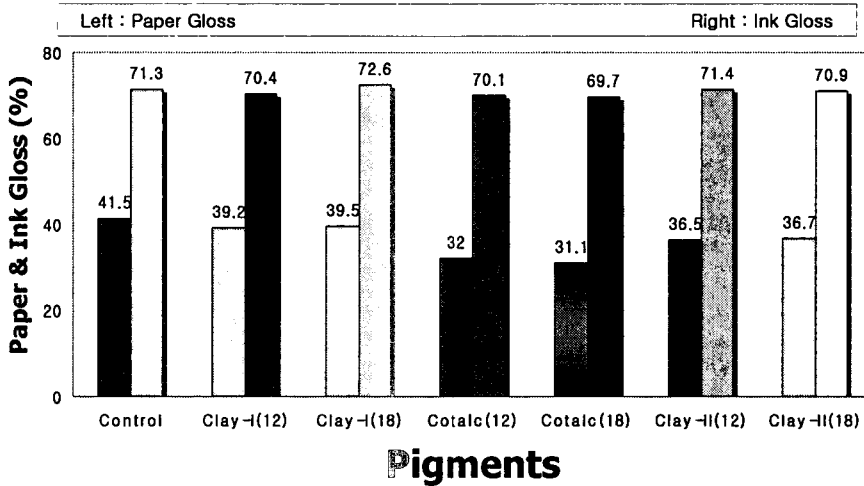


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# Paper Gloss & Ink Gloss

Pigments 비교실험



37



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# Paper Gloss & Ink Gloss

Pigments 비교실험

- 도공지 자체의 광택도는 떨어짐
- 매트지에 적용시 매우 우수함 (광택저하)
- 인쇄후 잉크광택도는 큰차이가 없음
- 인쇄면의 Contrast 매우 향상(SNAP)
- 잉크의 Hold-Out이 매우 우수
- 바인더 감량이 가능

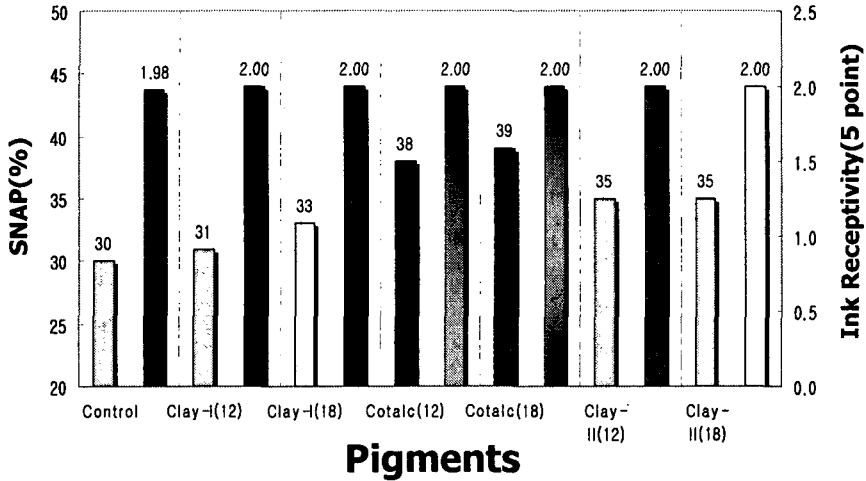
38



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# Ink Receptivity & SNAP

Pigments 비교실험



39



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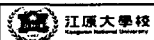
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# Ink Receptivity & SNAP

Pigments 비교실험

- 잉크 색농도계로 측정한 잉크수리성은 유사함
- 백지광택도와 인쇄후 잉크광택도의 차를 나타내는 SNAP은 탈크를 적용한 것이 가장 좋음
- 전반적으로 인쇄적성이 우수함
- High Contrast

40



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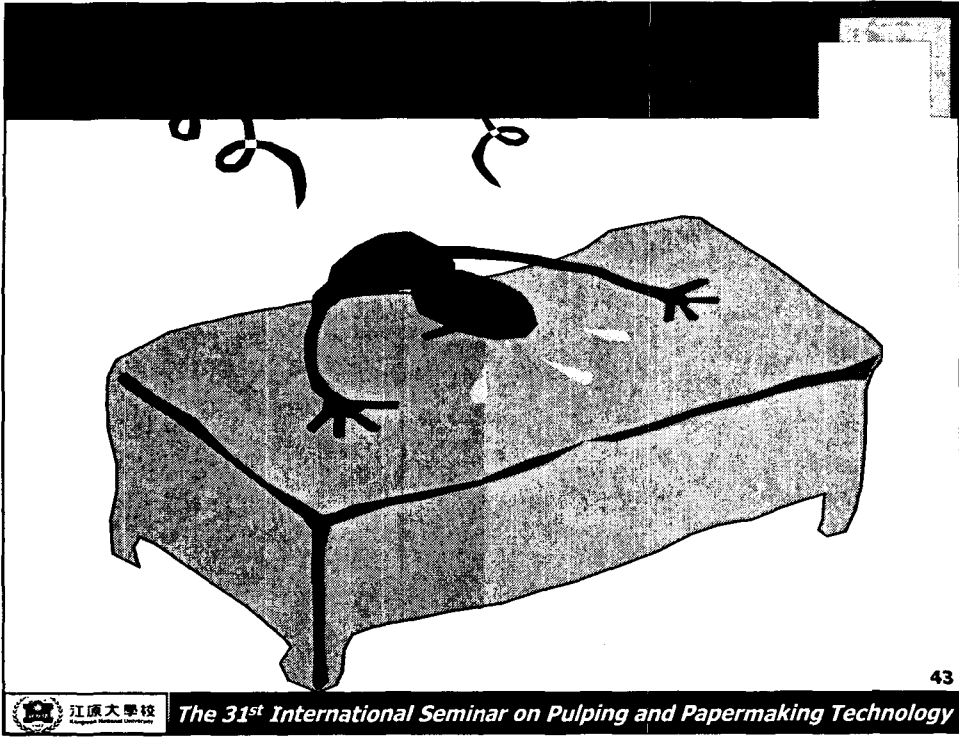
## Pigments 변경 실험 결과 및 고찰

- Matte Paper에 적용중인 Clay는 COTALC-90으로 대체 가능
- Matte지에 적용시 매우 우수함
- 평활도는 유사함
- Paprt Gloss 낮으나 인쇄후 Ink Gloss 큰 차이가 없음
- 백지광택과 인쇄광택의 차(SNAP)가 매우 높음
- 인쇄면의 Contrast 매우 향상
- 잉크의 Hold-Out이 매우 우수
- 바인더 감량이 가능
- 원가절감

41

## Binder 감량 실험

42



43



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## Binder 감량 실험

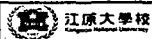
### 실험 목적

- 적절한 바인더 (Latex) 함량 결정
- 기존 Matte Paper의 물성 및 인쇄적성 향상
- 원가절감

### 실험 내용

- 예비실험과 1차 안료비교 실험 결과를 바탕으로 함
- 2급 클레이 대신 탈크를 동일량(12 part) 적용
- 무광택 도공지(매트지)에 적용
- 탈크 사용량이 증가하면 바인더는 더욱 줄어듦
- 1차 실험 결과 최대 1.5part까지 Latex 절감 가능
- Pilot Blade Coater (MLC) 사용

44



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# Color Formulation

Binder 감량 실험

	Control	L-1	L-2	L-3	L-4	Remark
GCC 90	87	87	87	87	87	GCC
# 2 Clay	13	0	0	0	0	Clay
Cotalc-90	0	13	13	13	13	Talc
Latex	11.05	11.05	10.55	10.05	9.55	↓ - 0.5
Lubricant						0.7
Insolubilizer						0.5
Thickener						0.2
Solid Content	68.33	68.29	68.37	68.33	68.40	

\*\* 위 배합비는 한국기준, 중국은 2.5-3.0 part 절감이 가능 \*\*

45

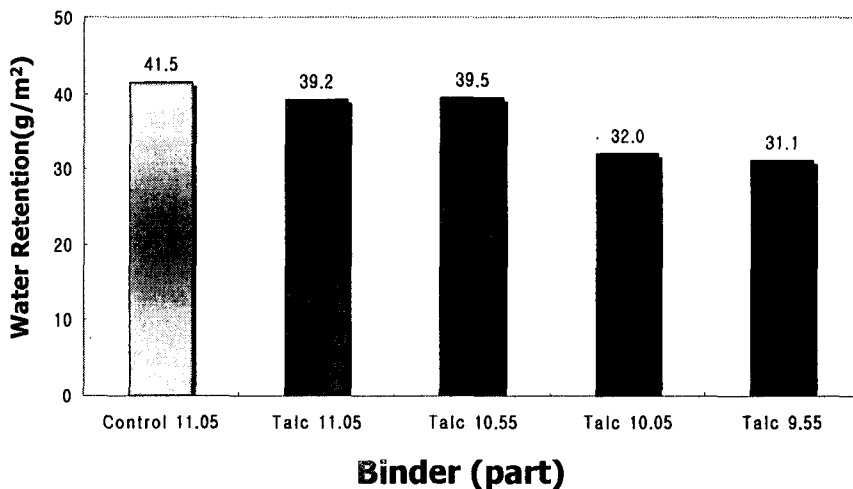


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# Water Retention

Binder 감량 실험



46



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# Water Retention

Binder 감량 실험

- Latex 함량이 줄어들수록 보수성이 향상
- Latex와 같은 수용성 성분이 안료보다 상대적으로 감소하였기 때문임
- 증점제 감량이 가능
- 작업성이 안정
- 원가절감

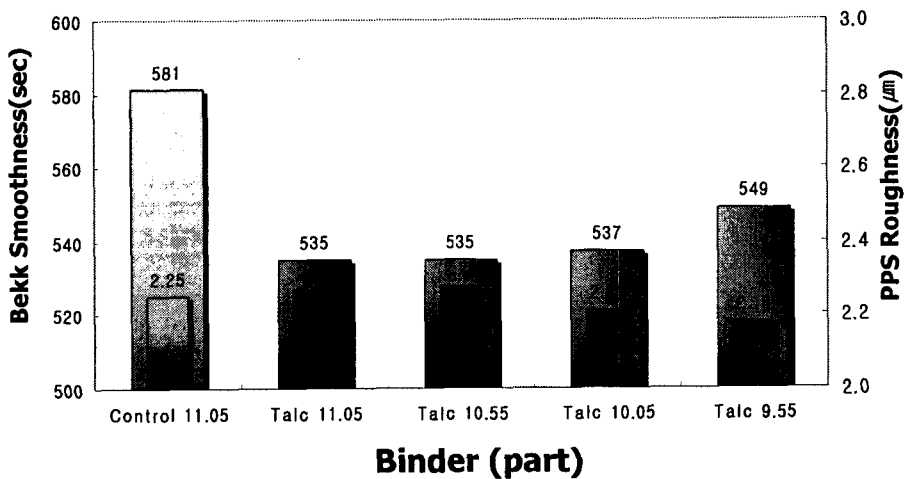
47



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# Bekk Smoothness & PPS Roughness

Binder 감량 실험



48

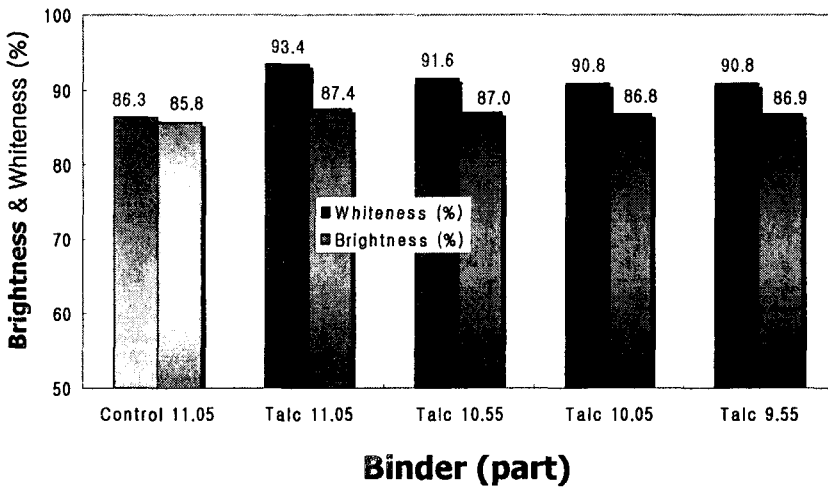


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# Bekk Smoothness & PPS Roughness Binder 감량 실험

- Latex를 줄일 경우 Bekk Smoothness는 다소 떨어지나 큰 차이는 아님
- PPS Roughness는 Latex 함량이 적을수록 향상
- 도공층 표면이 Micro Roughness가 향상된 것임
- 고급 인쇄물에 적합

# Brightness & Whiteness Binder 감량 실험



# Brightness & Whiteness

Binder 감량 실험

- COTALC-900이 Clay보다 전체적으로 우수
- 특히 백감도가 매우 뛰어나
- 형광염료를 90%이상 절감 가능
- 무형광 도공지 제조 가능
- 기타 유색 염료 절감 가능
- 원가절감

51

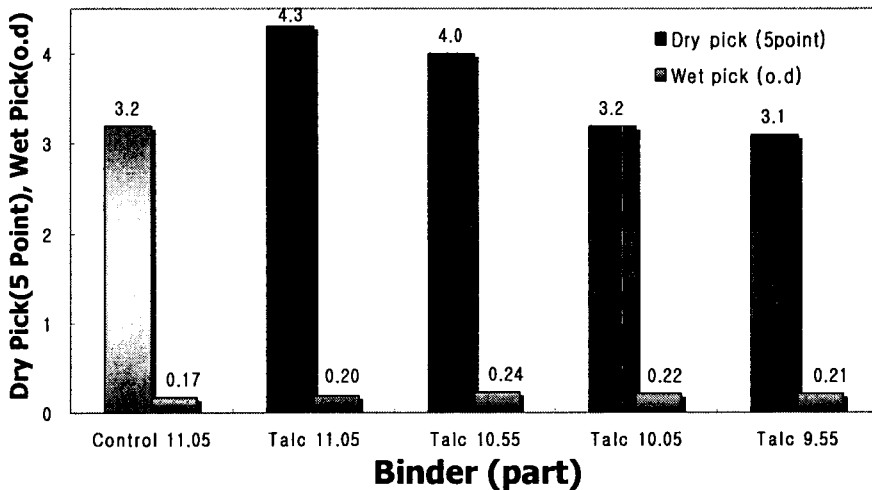


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# Wet pick & Dry pick

Binder 감량 실험



52



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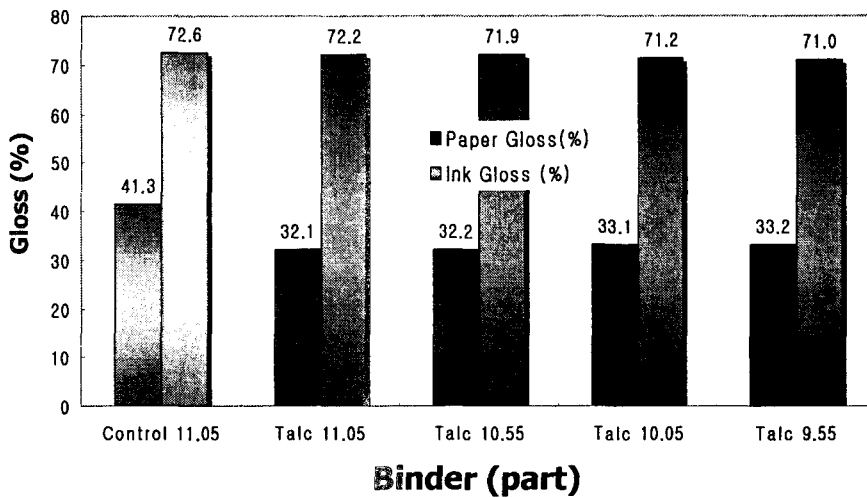
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# Wet pick & Dry pick

- 실험결과 Latex 1.0-1.5 part 감량 가능
- COTALC-90을 30 part 사용  
Latex 3 part 감량 가능
- ✓ 내수화제도 절감이 가능

53

# Paper Gloss & Ink Gloss



54

# Paper Gloss & Ink Gloss

Binder 감량 실험

- Latex를 줄여도 백지광택도와 인쇄후 잉크광택도 모두 큰 차이를 나타내지 않음
- Latex를 줄여도 인쇄 품질은 같음
- 인쇄후 인쇄면 종이면의 광택도 차가 클 것으로 예상
- 인쇄면 Contrast가 뛰어나

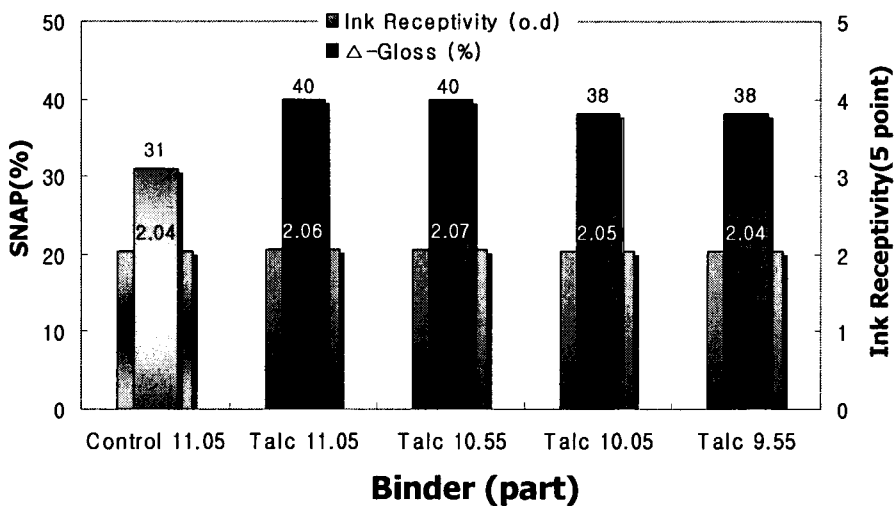
55



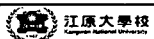
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# Ink Receptivity & SNAP

Binder 감량 실험



56



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## Ink Receptivity & SNAP

- Latex를 줄여도 백지광택도, 인쇄후 잉크광택도 모두 큰 차이가 없음
- 바인더를 줄여도 인쇄 품질에 문제가 없음
- 원가절감

57

## Latex 감량 실험 결과 및 고찰

- COTALC-90이 Clay보다 전체적으로 우수
- Latex는 1.5part 감량이 가능 (15% 절감)
- COTALC-90을 30part 사용하면 Latex 3part감량 가능
- 내수화제도 50% 절감
- 백색도 차이로 형광염료 90% 절감

58

## Homepage of Talc company

**[www.luzenac.com](http://www.luzenac.com)**  
**[www.mondominerals.com](http://www.mondominerals.com)**  
**[www.hitalc.com](http://www.hitalc.com)**  
**[www.kimb.or.kr/imb.php](http://www.kimb.or.kr/imb.php)**  
**[www.riotinto.com](http://www.riotinto.com)**  
**[www.ima-eu.org/en/talcindex.html](http://www.ima-eu.org/en/talcindex.html)**

59



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## Using Talc

- **Decrease Gloss, Increase Ink Gloss**
- **Decrease Roughness, Increase Smoothness**
- **Decrease Latex, Increase Brightness**
- **Decrease Cost, Increase Quality**
- **In matt and/or silk paper production**
- **Reader comfort and quality feel**

60

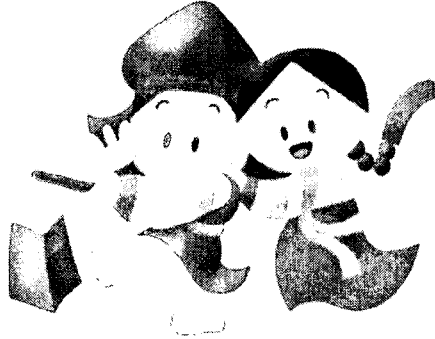


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***Thank you very much  
For your Attention***



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**61**



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