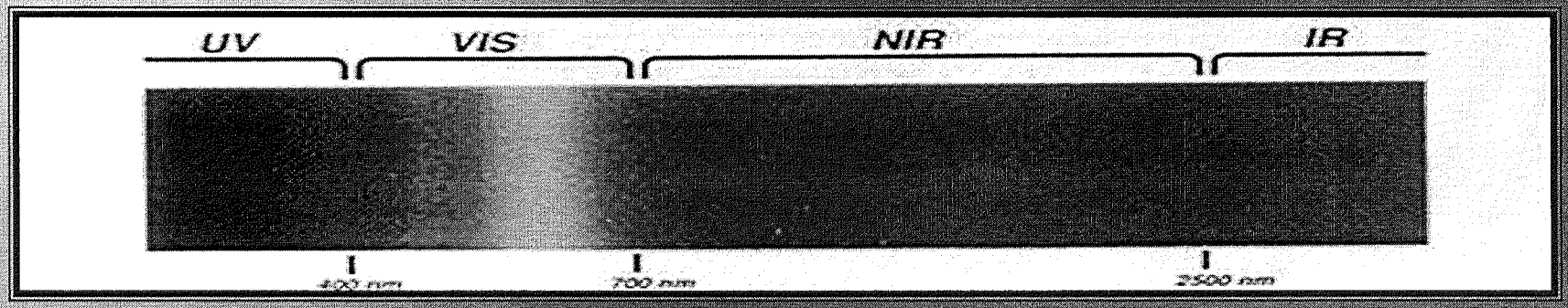
2. Experiment

Disadvantages of the conventional methods:

- Samples destructed;
- Complicated operations;
- Time consuming;
- Difficult measuring large number of samples.

2. Experiment



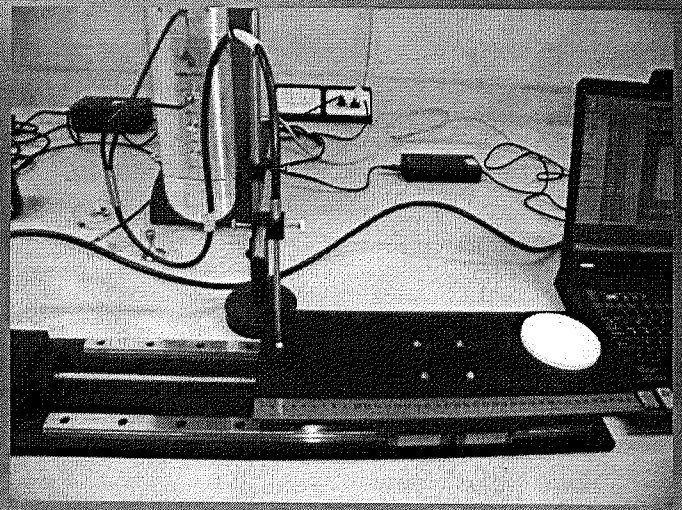
NIR is a new nondestructive technique

NIR: 780～2526 nm electromagnetic wave between visible light and infrared.

Advantage: Nondestructive, simple operations, rapid and accurate, easy measuring large number of samples

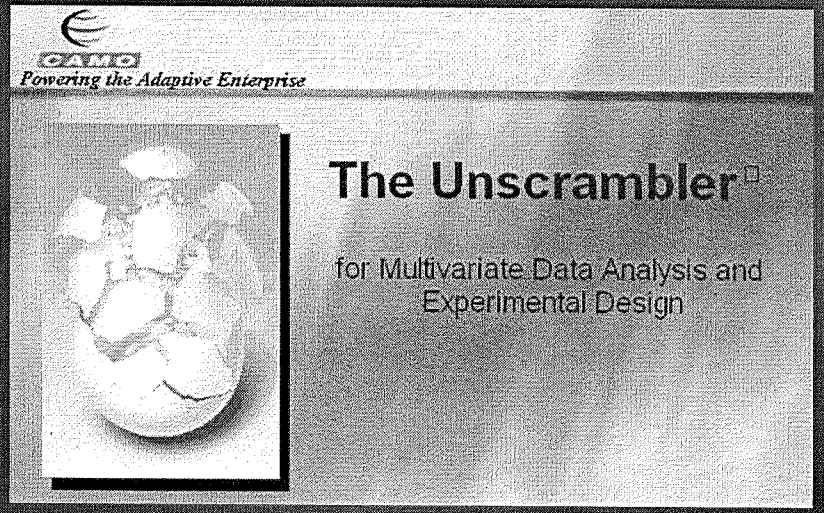
2. Experiment

Collection of spectra of samples



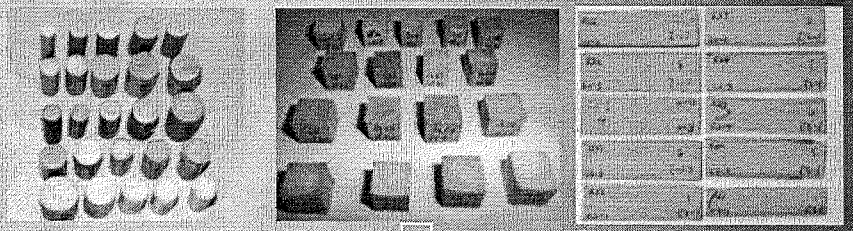
350-2500nm wavelength

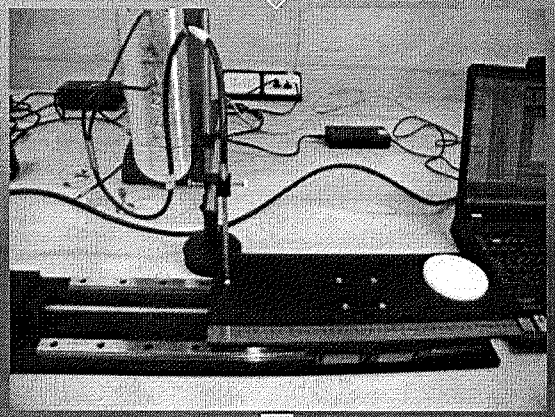
Software used

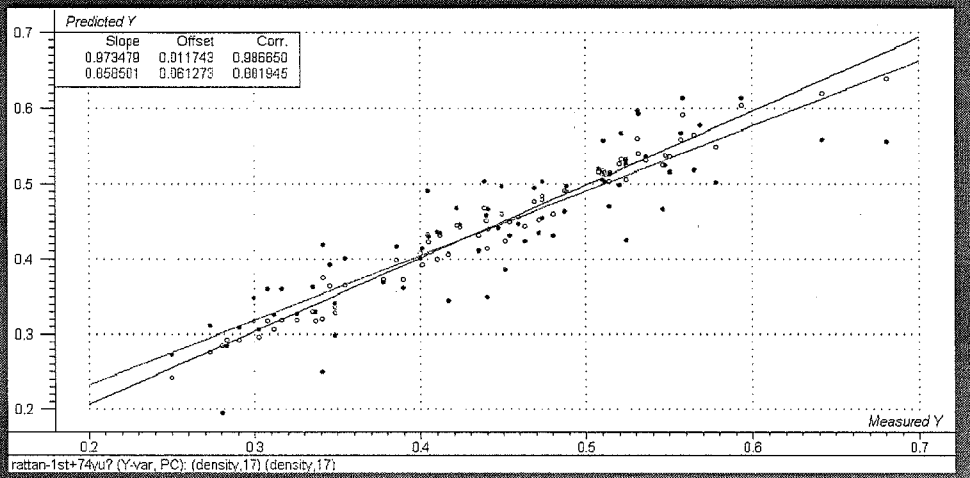


The models were made and analyzed by the partial least square (PLS) and full cross validation of the software.

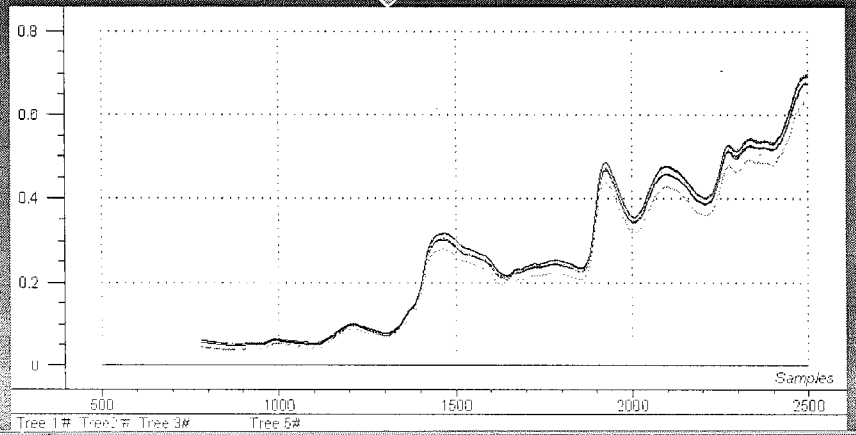
2. Experiment

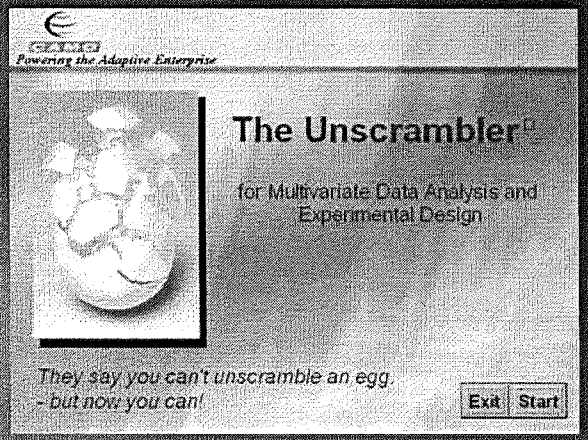






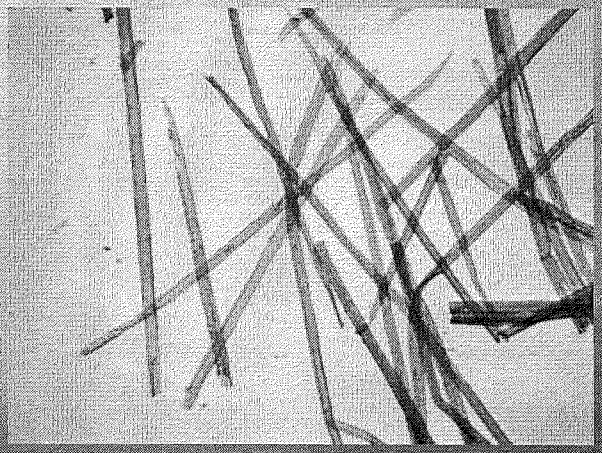
Data collected by conventional methods



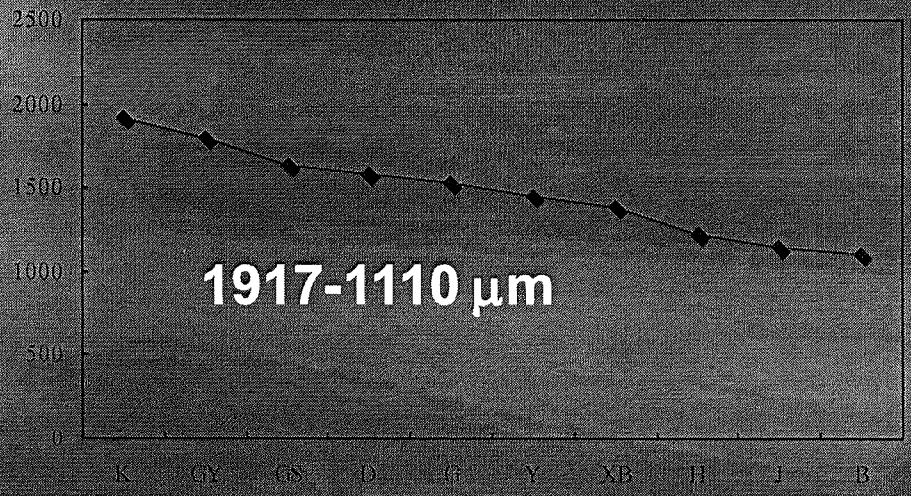


PLS and full cross

3. Results and discussions-fiber length



Fiber form of D. margaritae

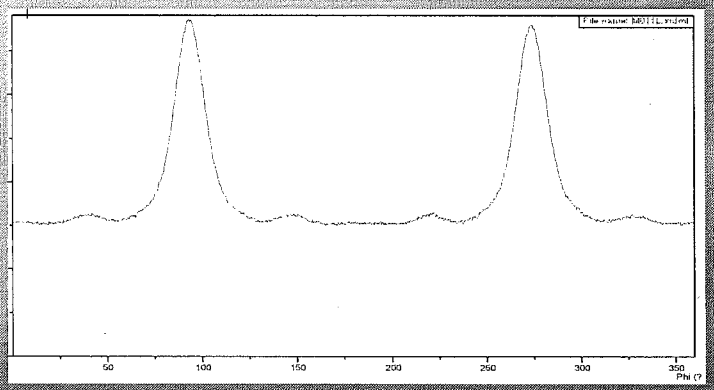


Mean fiber length of ten species rattan canes

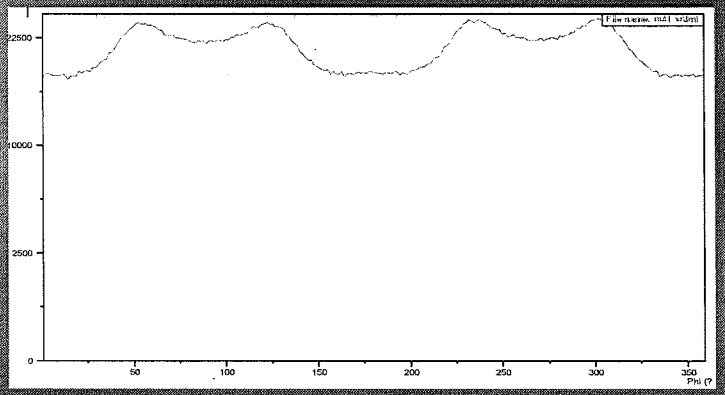
- The fiber length had a positive correlation with the diameter of rattan canes.
- It is almost the same as that of hardwood, but shorter than that of moso bamboo.

3 Results and discussions-MFA

X-ray diffractometry diagrams



Wood and bamboo



rattan

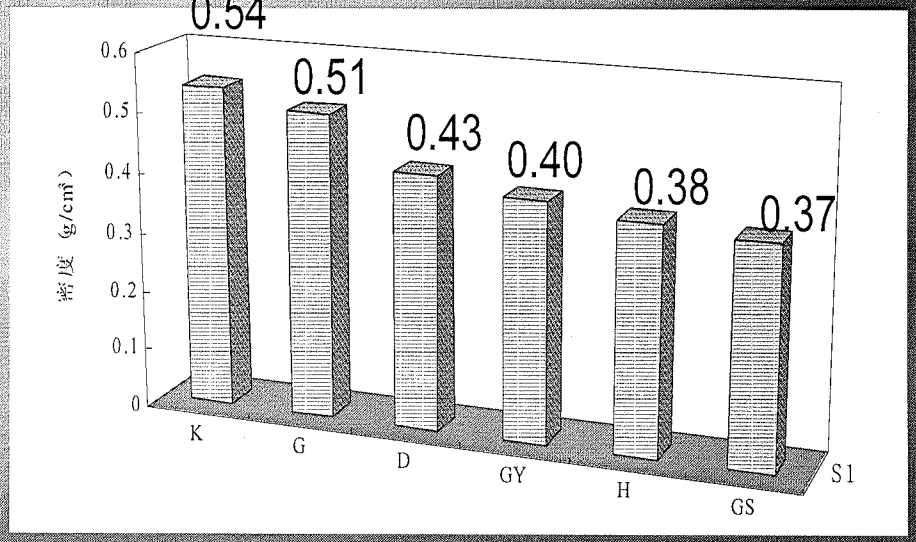
6 species of rattans, mean MFA was 28-36°

Mean MFA of several kinds of wood, bamboo and rattan

Species	Rattan	Chinese fir	Poplar	Slash pine	Moso bamboo
MFA	32	21.5	23.7	16.9	9.5

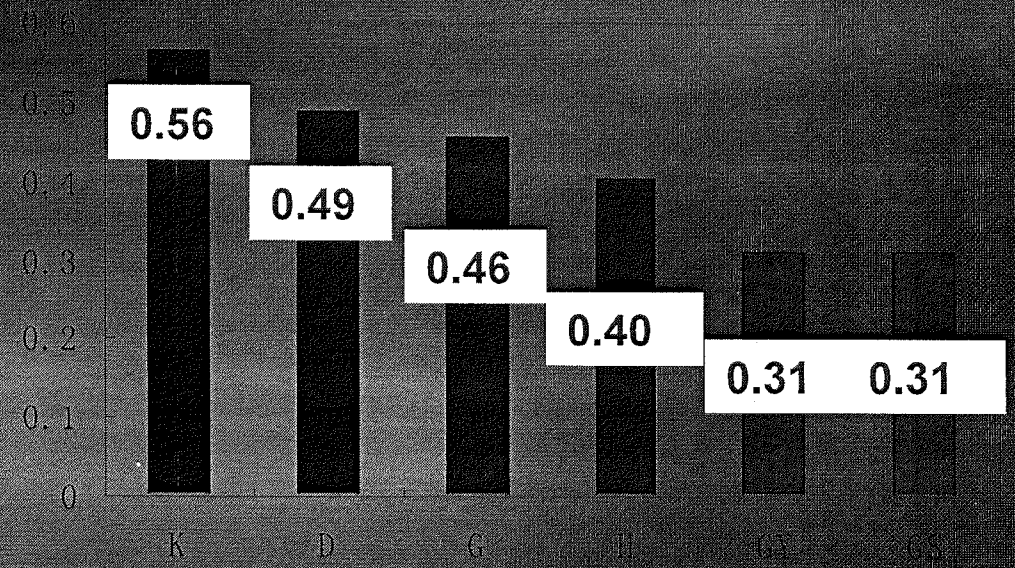
Bigger MFA indicate lower stiffness, so rattan is a very good material for weaving.

3 Results and discussions- density



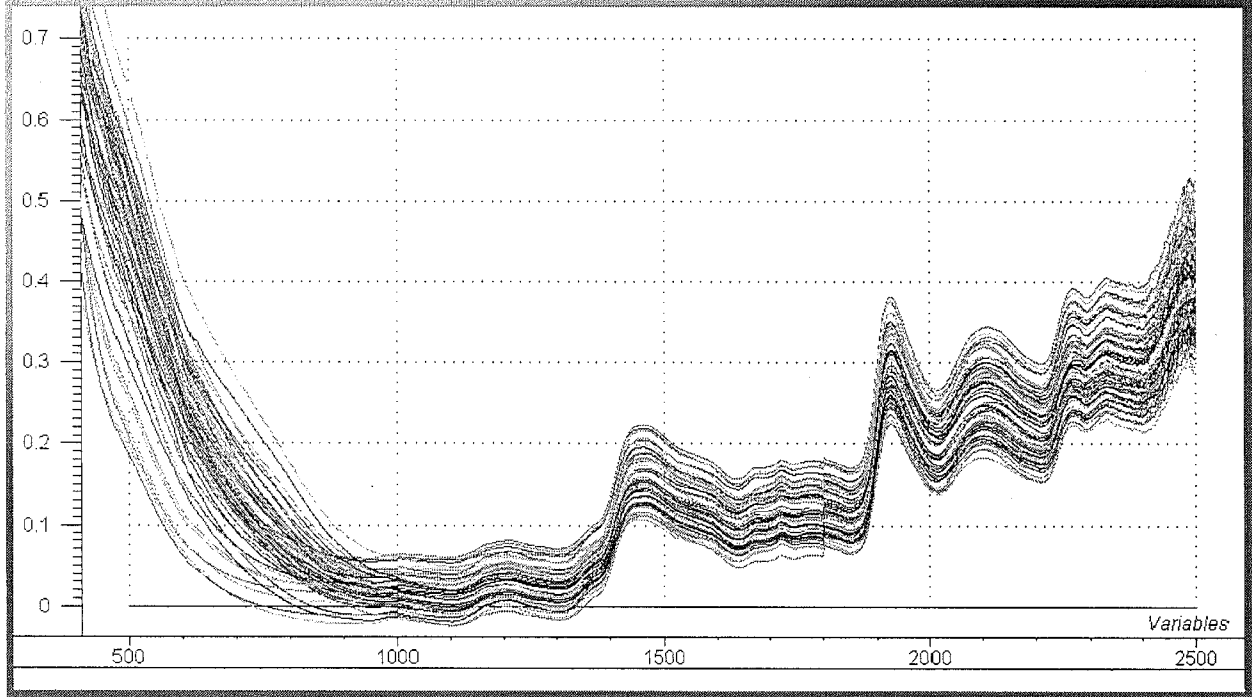
Basic densities of six species rattan canes

Compared with the densities of wood and bamboo, the densities of rattans are middling .

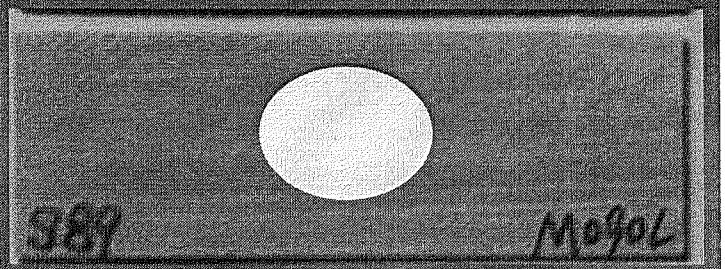


Air- dried densities of [illegible] species rattan canes flayed

3 Results and discussions- Models of fiber length

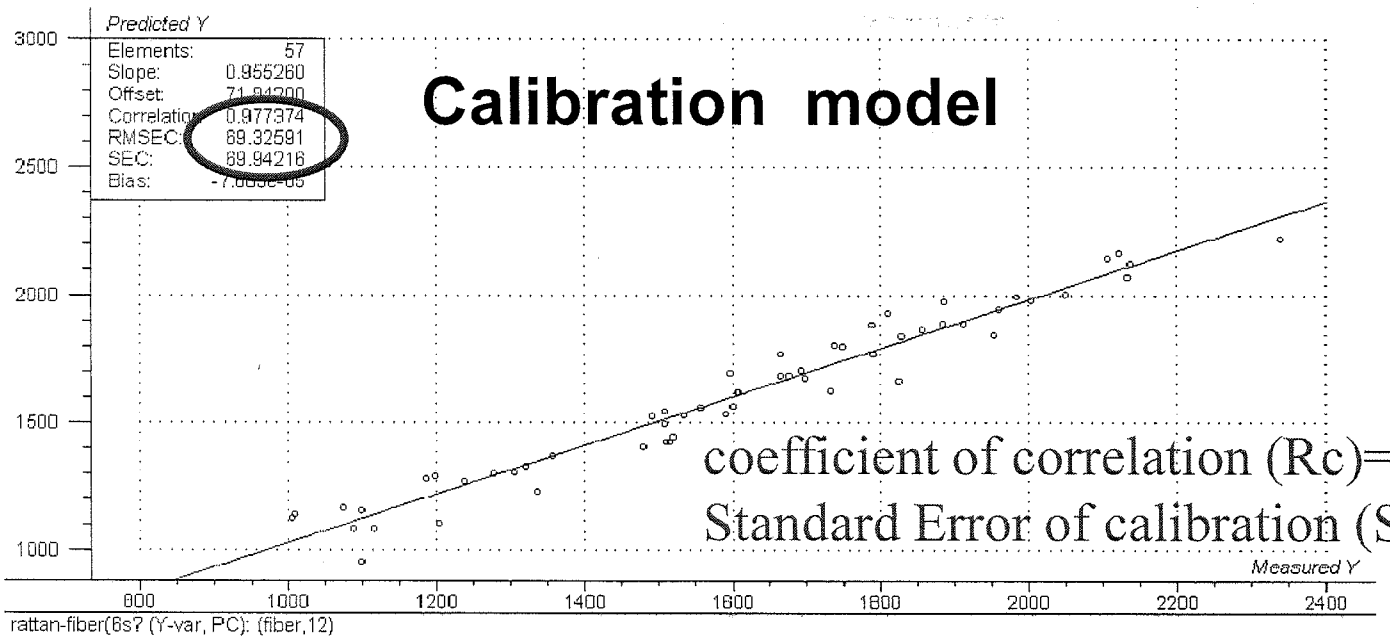


Wavelength /**nm**



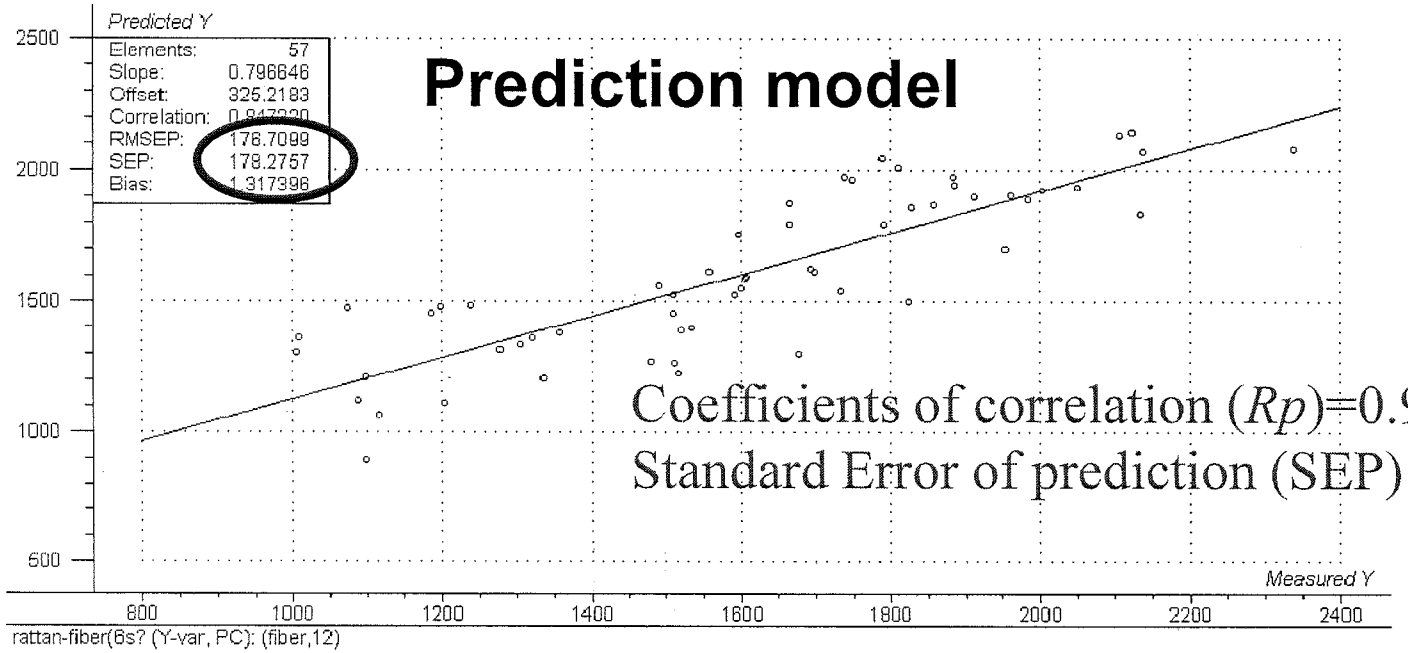
Absorption spectrum of tangential sections in six rattan canes

3 Results and discussions- Models of fiber length



coefficient of correlation (Rc)=0.97

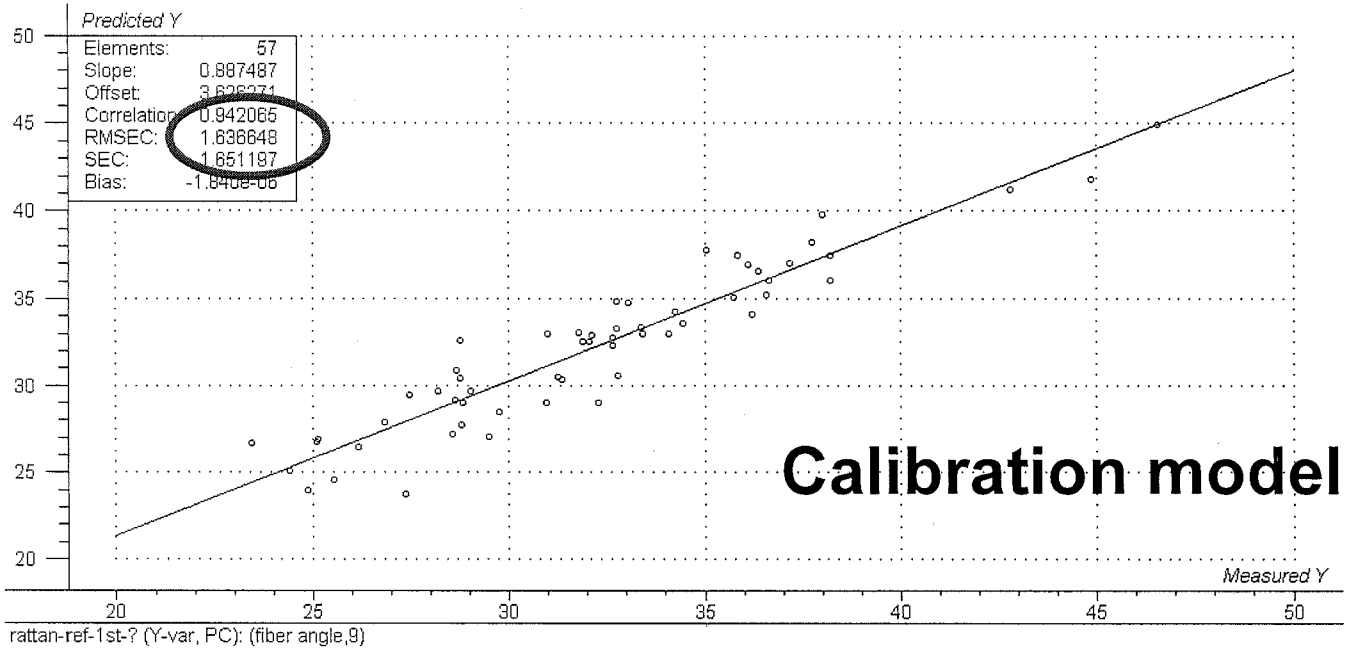
Standard Error of calibration (SEC)=70



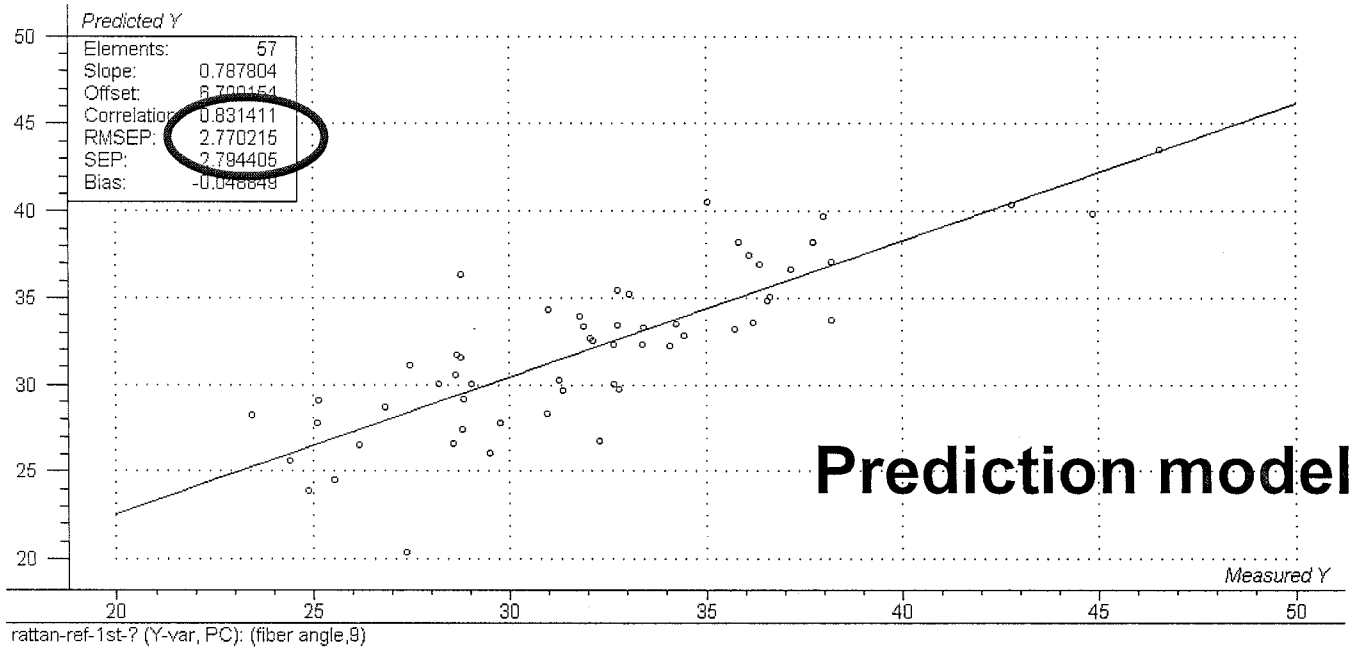
Coefficients of correlation (*Rp*)=0.92

Standard Error of prediction (SEP) =0.04

3. Results and discussions- Models of MFA

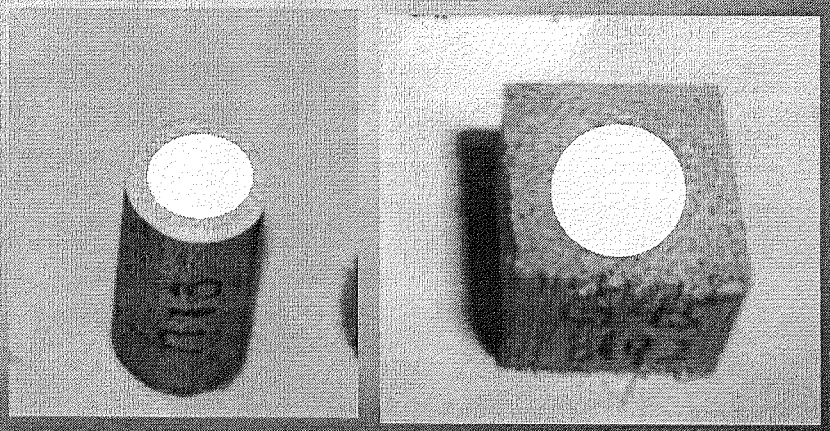


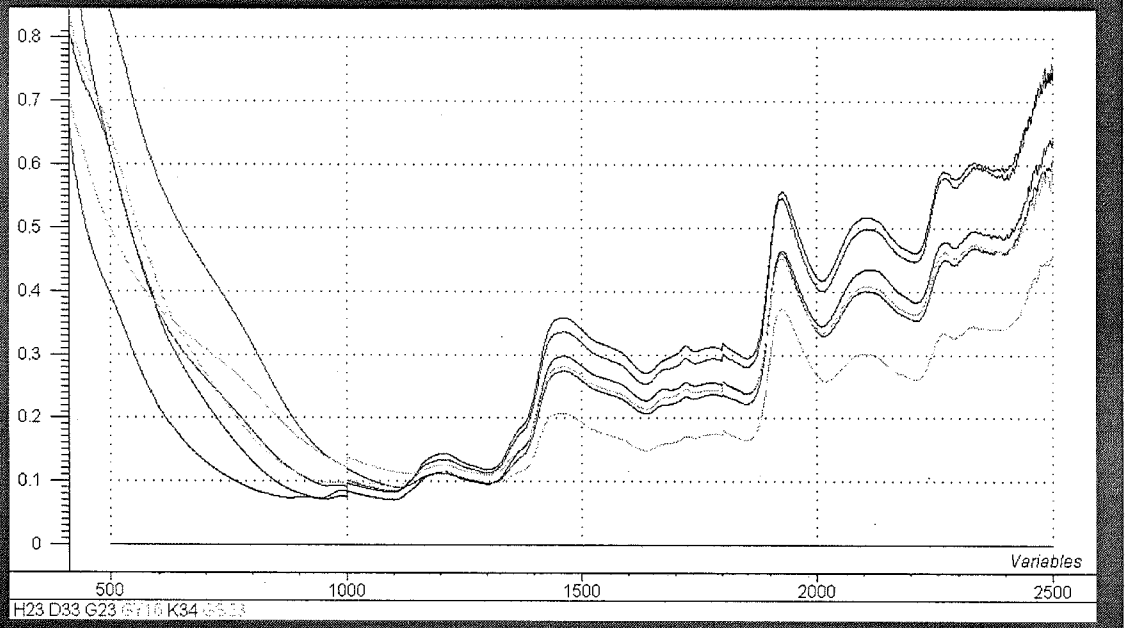
Calibration model



Prediction model

3 Results and discussions- **Models of density**

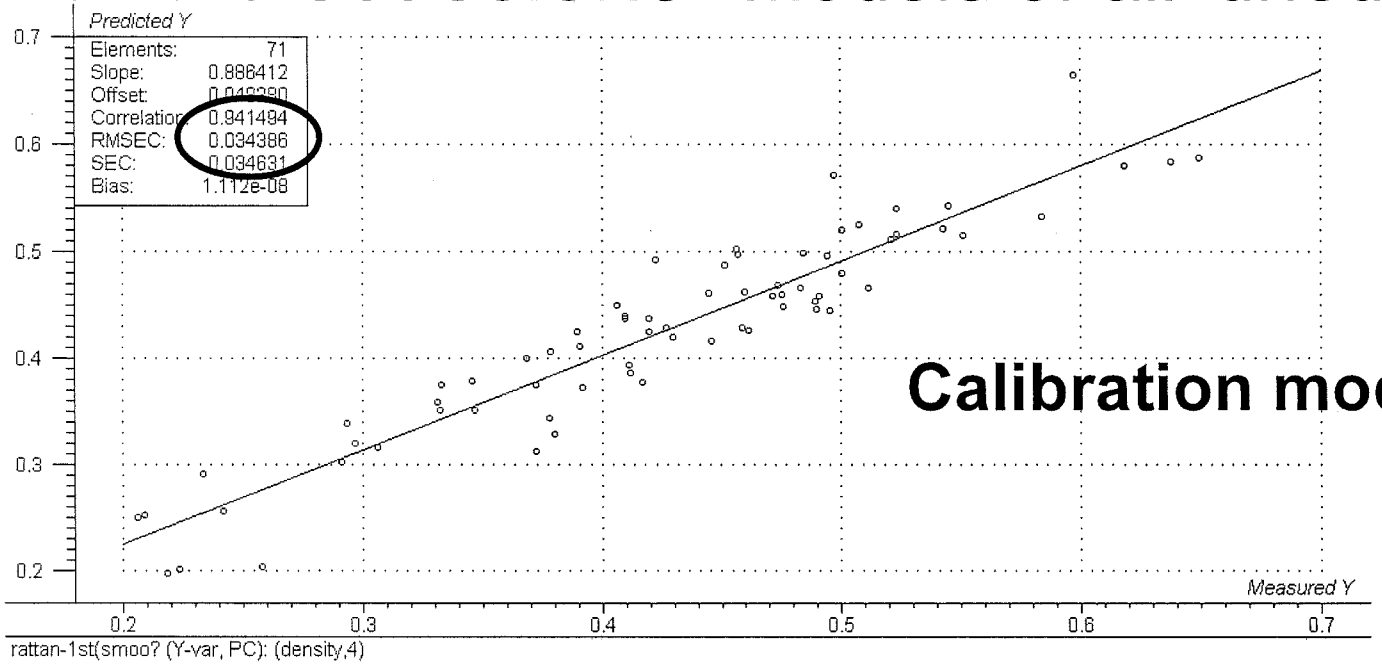




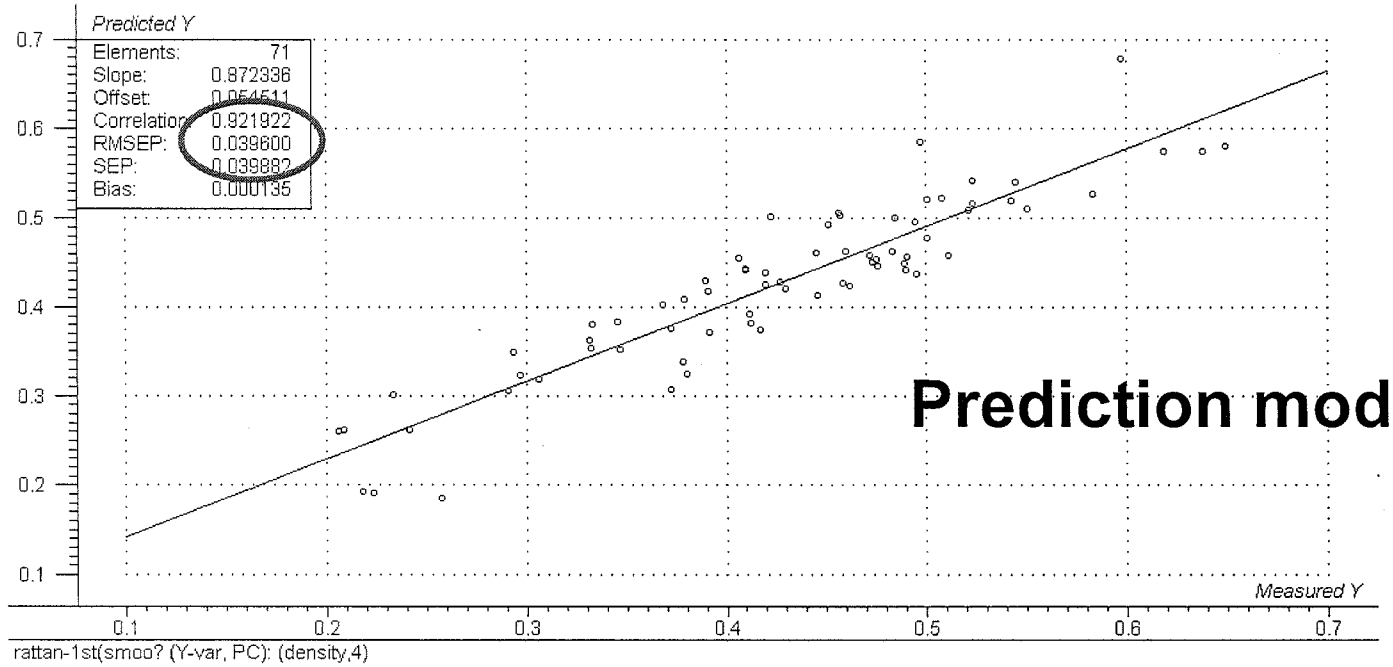
Wavelength **/nm**

Absorption spectrum of [illegible] in six rattan canes

3 Results and discussions- Models of air-dried density

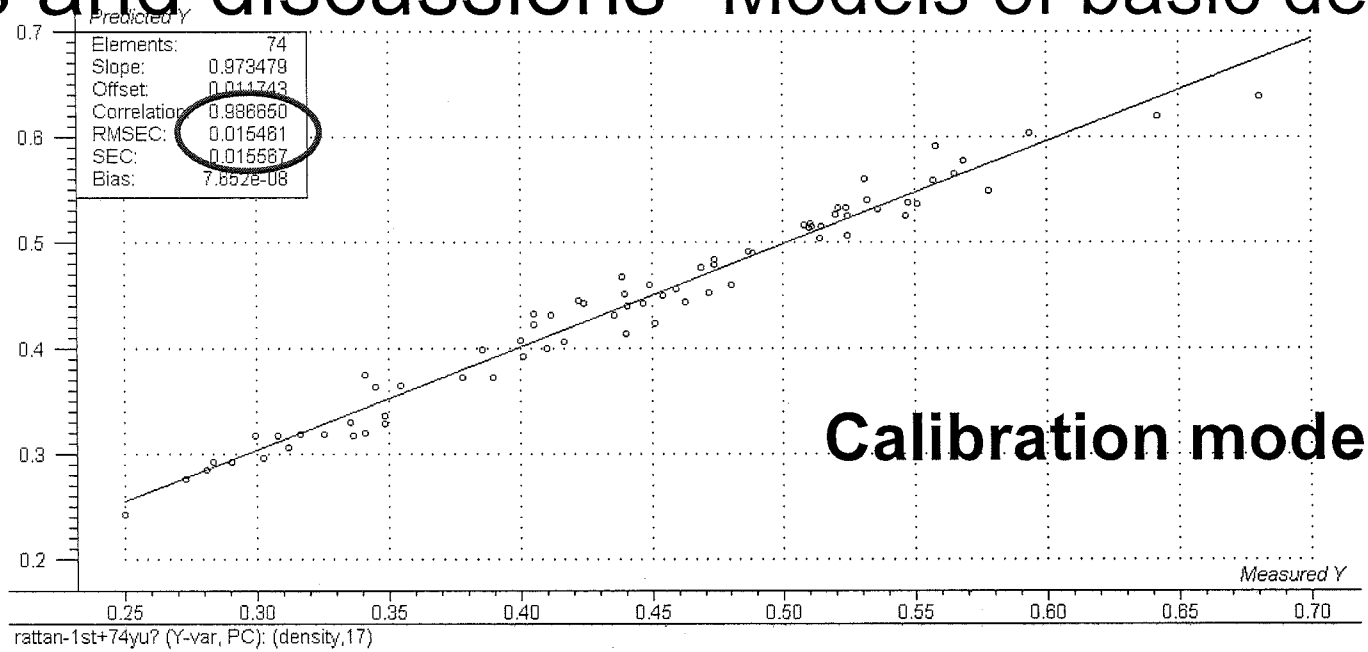


Calibration model

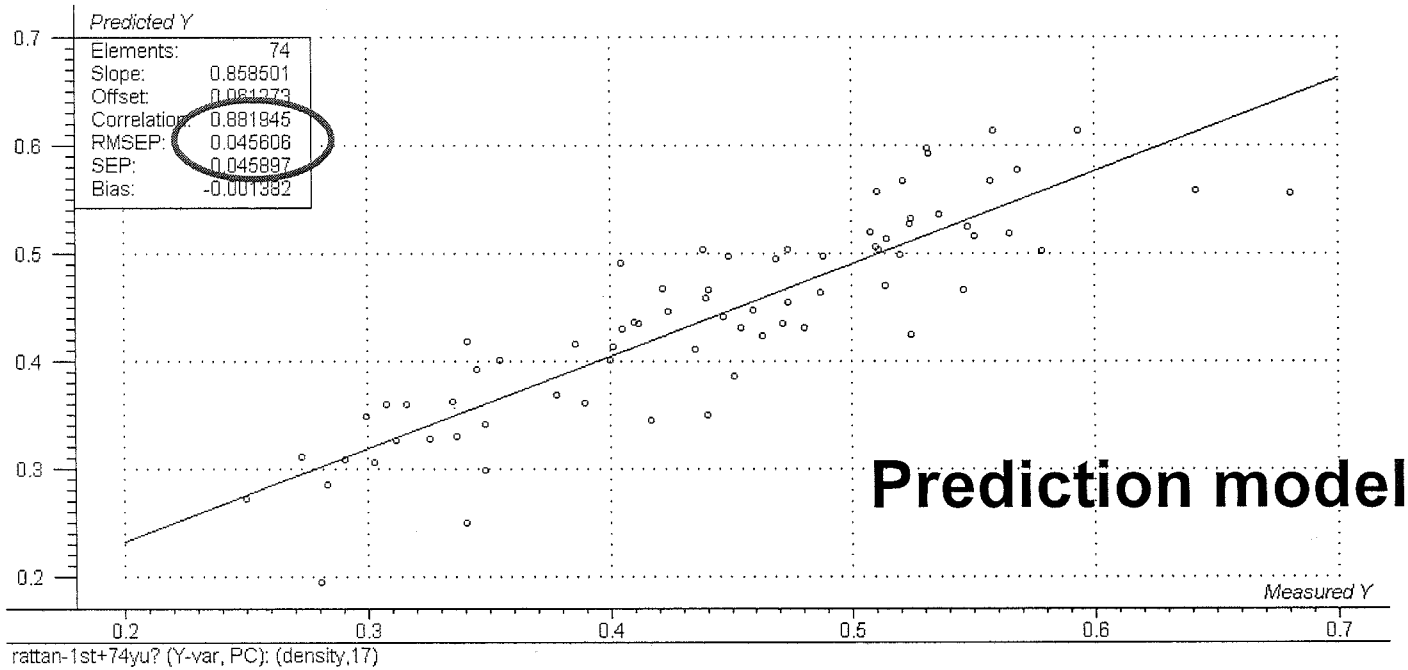


Prediction model

3 Results and discussions- Models of basic density



Calibration model



Prediction model

Parameters of models of rattan properties

Sort	Main factor	Calibration model R	RMSEC	SEC	Prediction model RMSEP	SEP
Fiber length	12	0.98	69.32	69.94	0.85	176.71	178.28
MFA	9	0.94	1.64	1.65	0.83	2.77	2.79
Air-dried density	4	0.94	0.03	0.03	0.92	0.04	0.04
Basic density	17	0.99	0.02	0.02	0.88	0.05	0.05

4. Conclusions

- The average fiber length was 1917-1110 μm in 10 species.
- The fibre length had a positive correlation with the diameter of stem.
- The average micro-fibril angle of 6 large and middle diameter species was 28° -36° .
- The average basic density was 0.54-0.37 g/cm^3
- The air-dried density of cane hearts was 0.56-0.31 g/cm^3

4 conclusions

- The model was established between the laboratory-measured data and the NIR fitted data of rattan samples.
- High coefficients were obtained and the correlation coefficient (Rc) of calibration model is above 0.94. The correlation coefficient (Rp) of prediction model is above 0.83,both standard error of calibration (SEC)and standard error of prediction (SEP) were low.

4 conclusions

- These calibration model can be applied to the analysis of unknown materials to provide an estimate of properties of rattan canes according to our results, and it will reduce the cost and time of rattan property evaluation in tree breeding and resource evaluation.


Thanks for your attention!

Main Causes and Remove of *Daemonorops margaritae* canes' discolorations

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The Global Rattan Workshop: Haikou, 8 - 10, Jan. 2008

Contents :

- Introduction
- Main causes
  - SEM observation
  - Chemical composition analysis
  - Isolation and inoculation of stain fungi
  - Xenon light aging experiment
- Bleaching of the stained canes

1. introduction

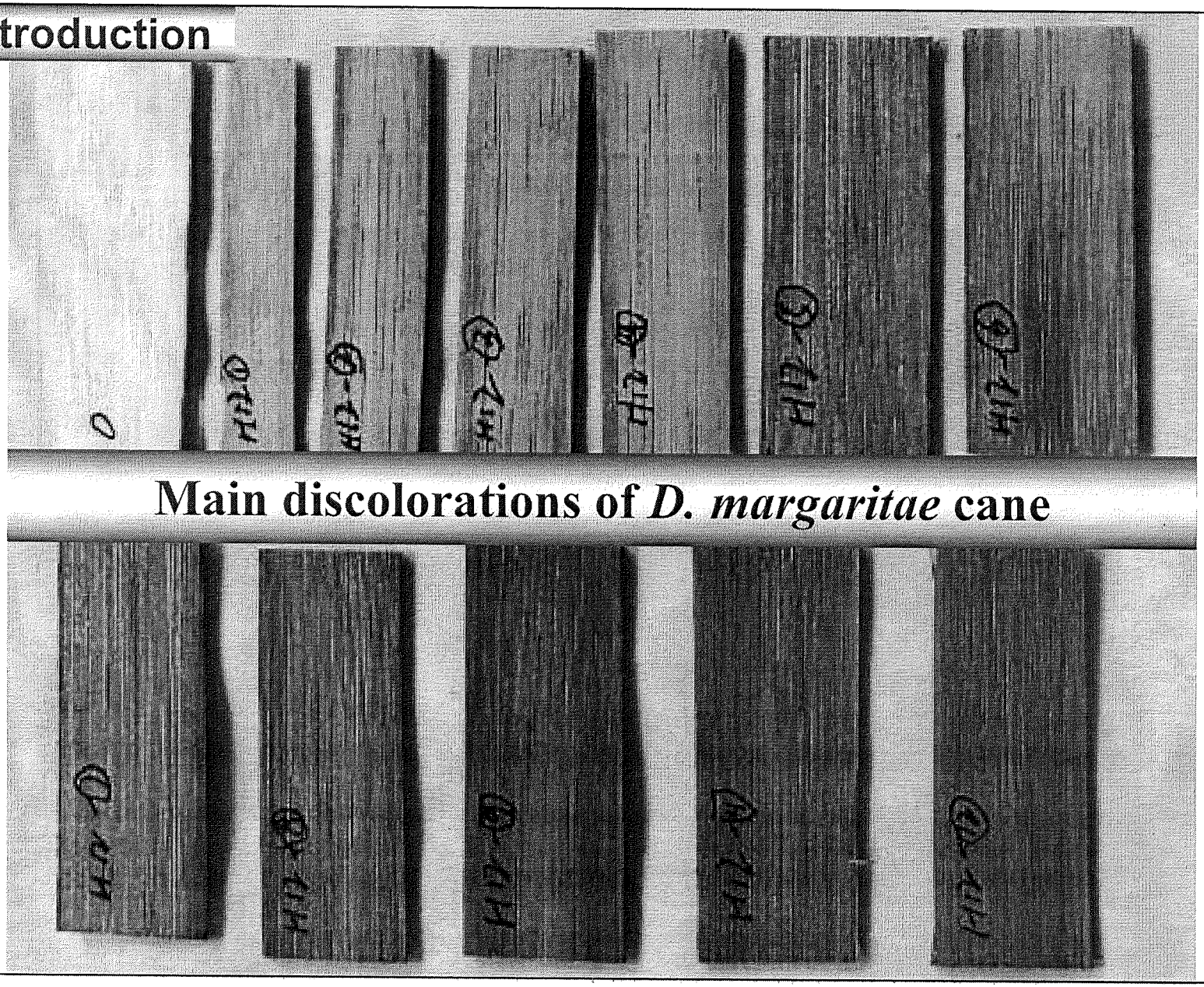
- Cane color is an important factor that strongly affects purchasing power; cane discoloration is a serious problem from the viewpoint of commercial worth.
- *Daemonorops margaritae* (Hance) Becc is an important commercial cane rattan in the South-China region.

1. introduction

- The new felled fresh canes are attractive yellowish white or creamy. But they often change color during the courses of transportation, storage, processing and utilization.

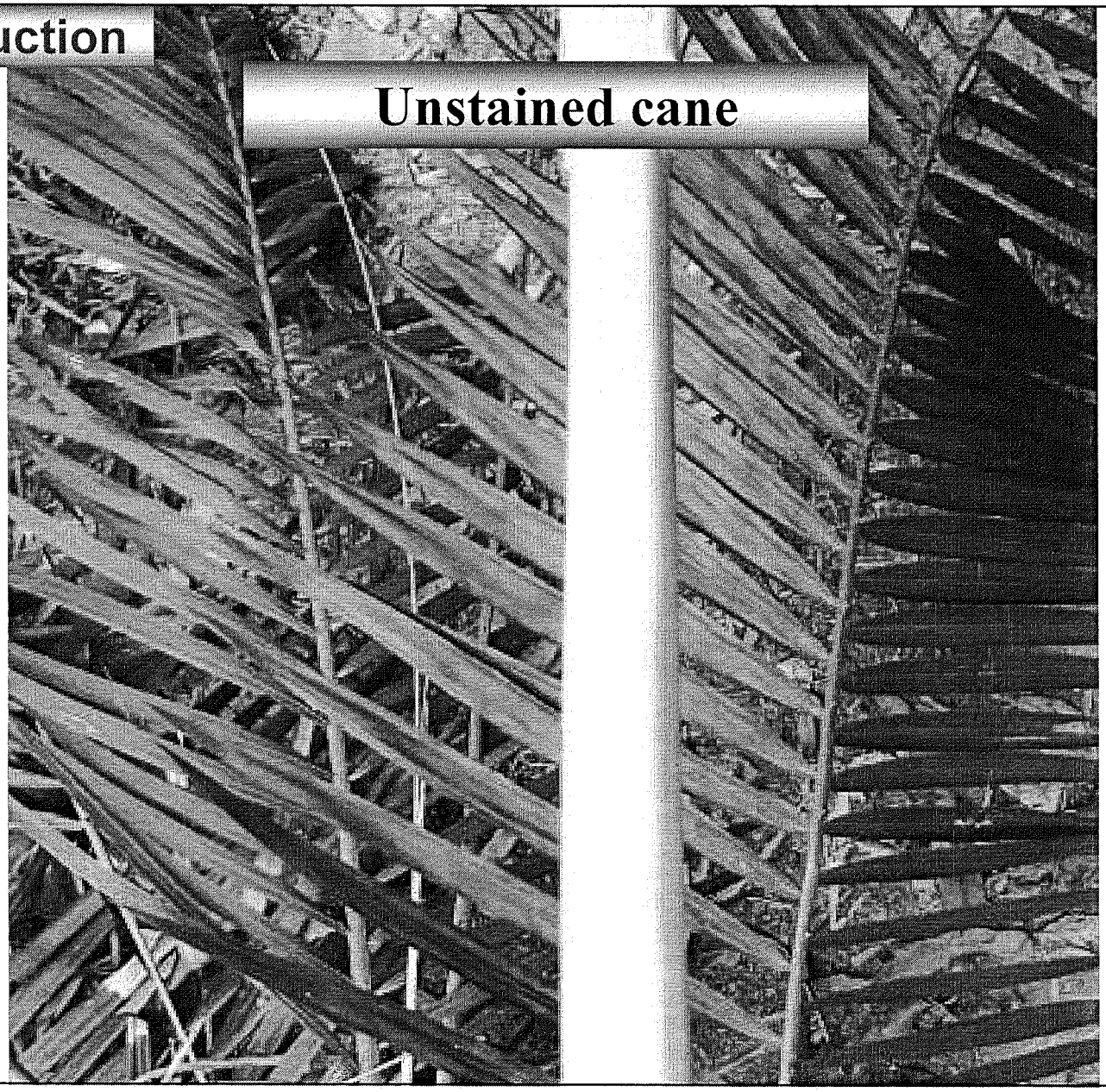
- The prevention and remove of the cane discoloration is an important approach to save the cane and enhance its value.

1. introduction



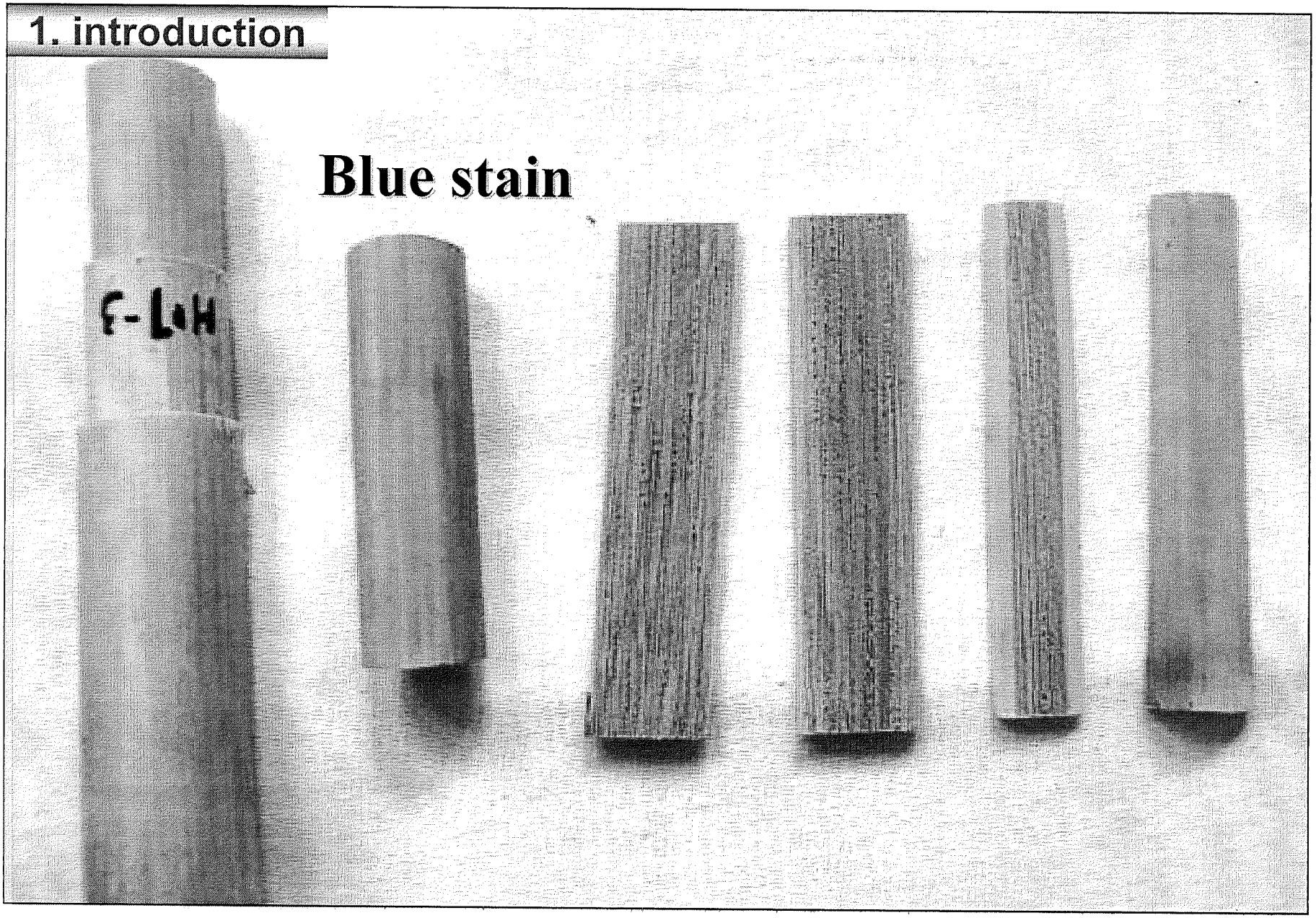
Main discolorations of *D. margaritae* cane

1. introduction

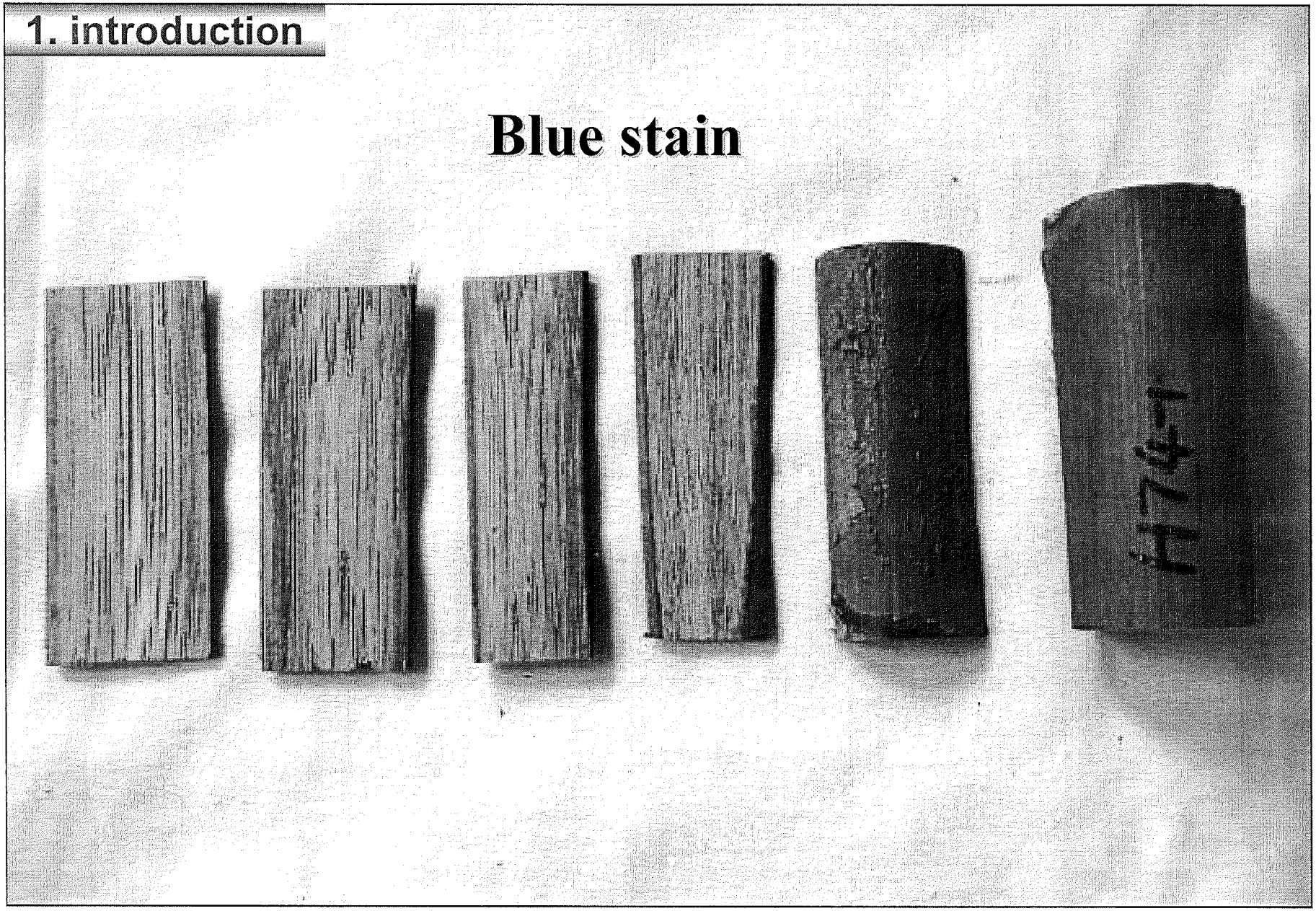


Unstained cane

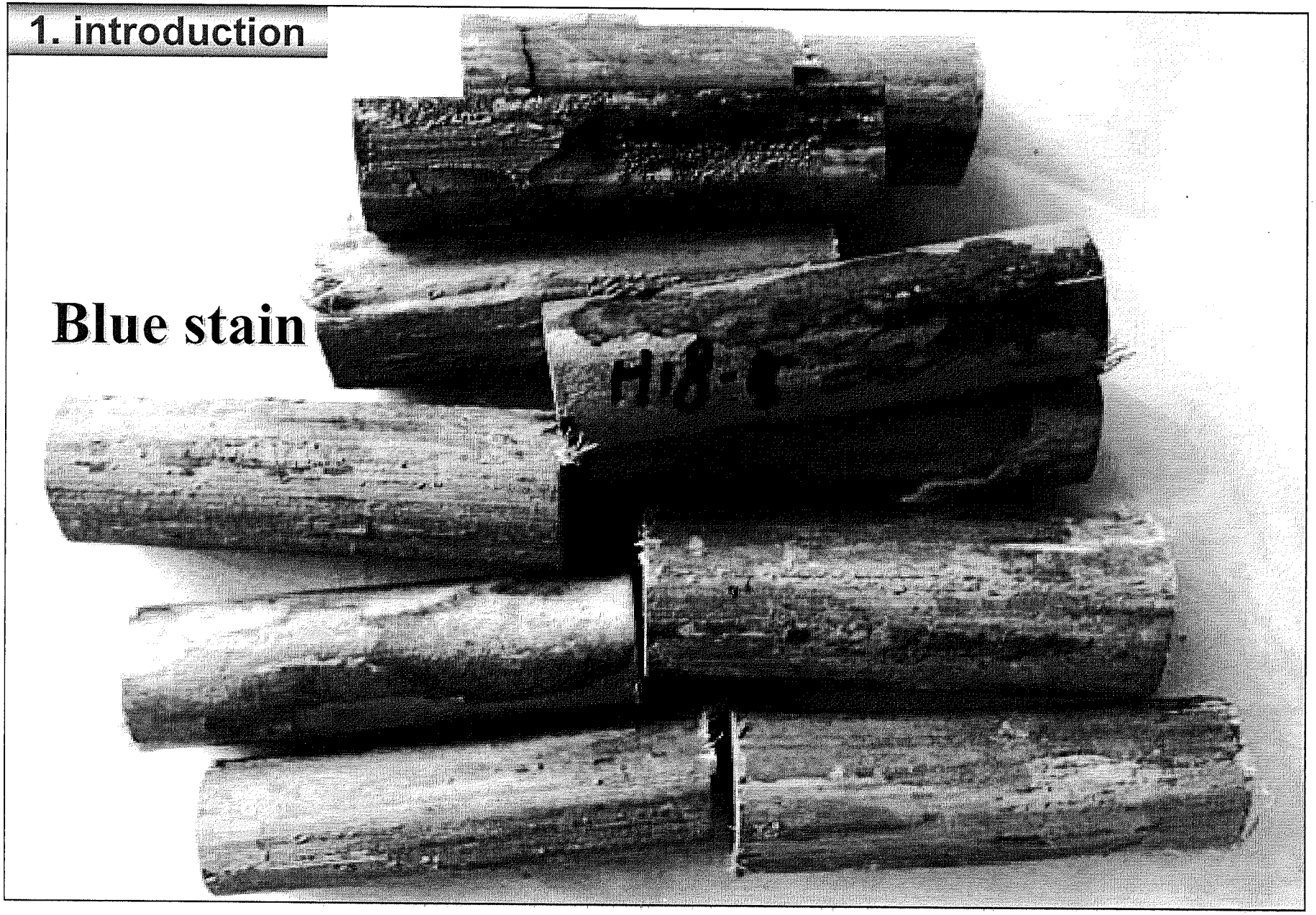
1. introduction



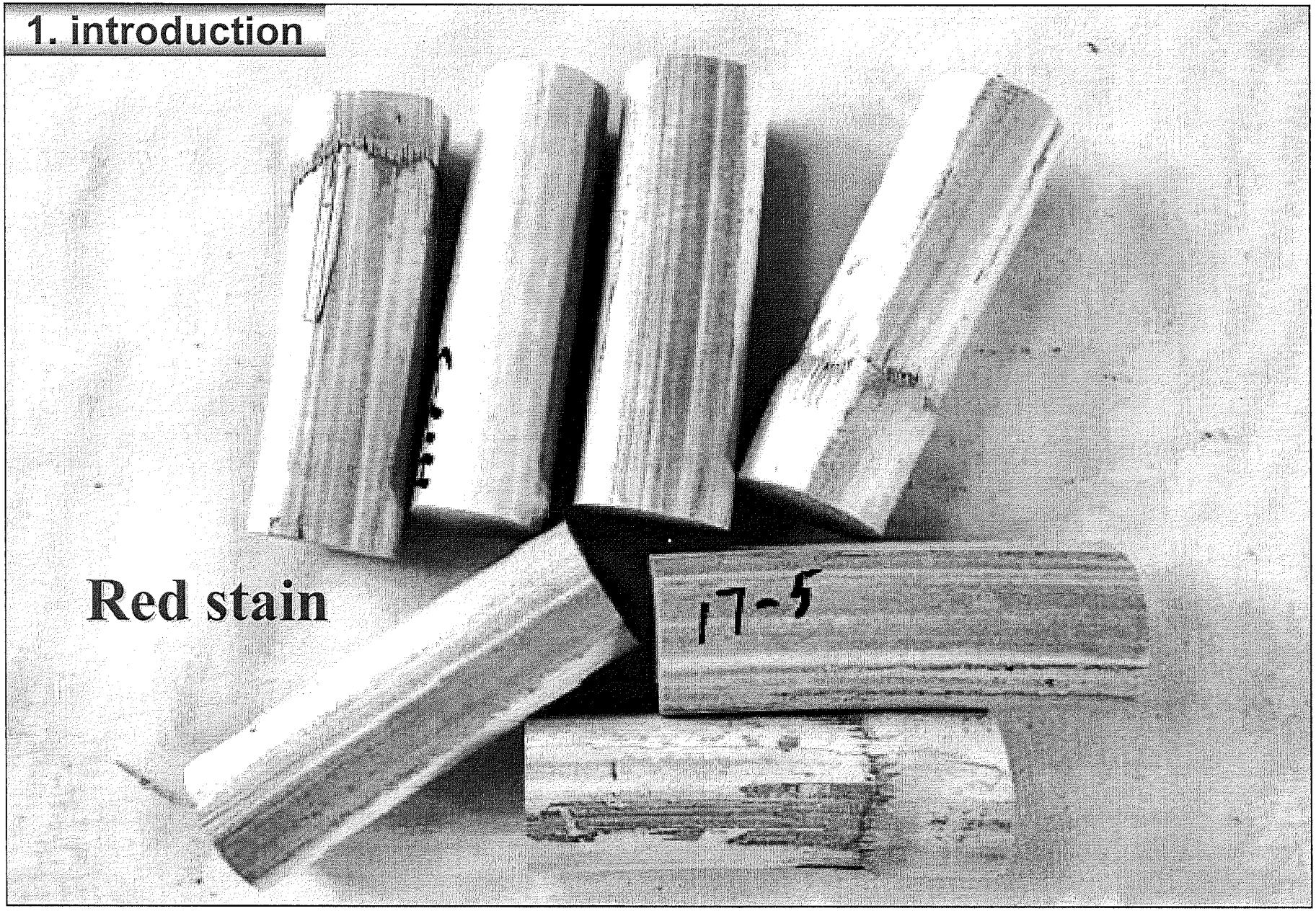
1. introduction



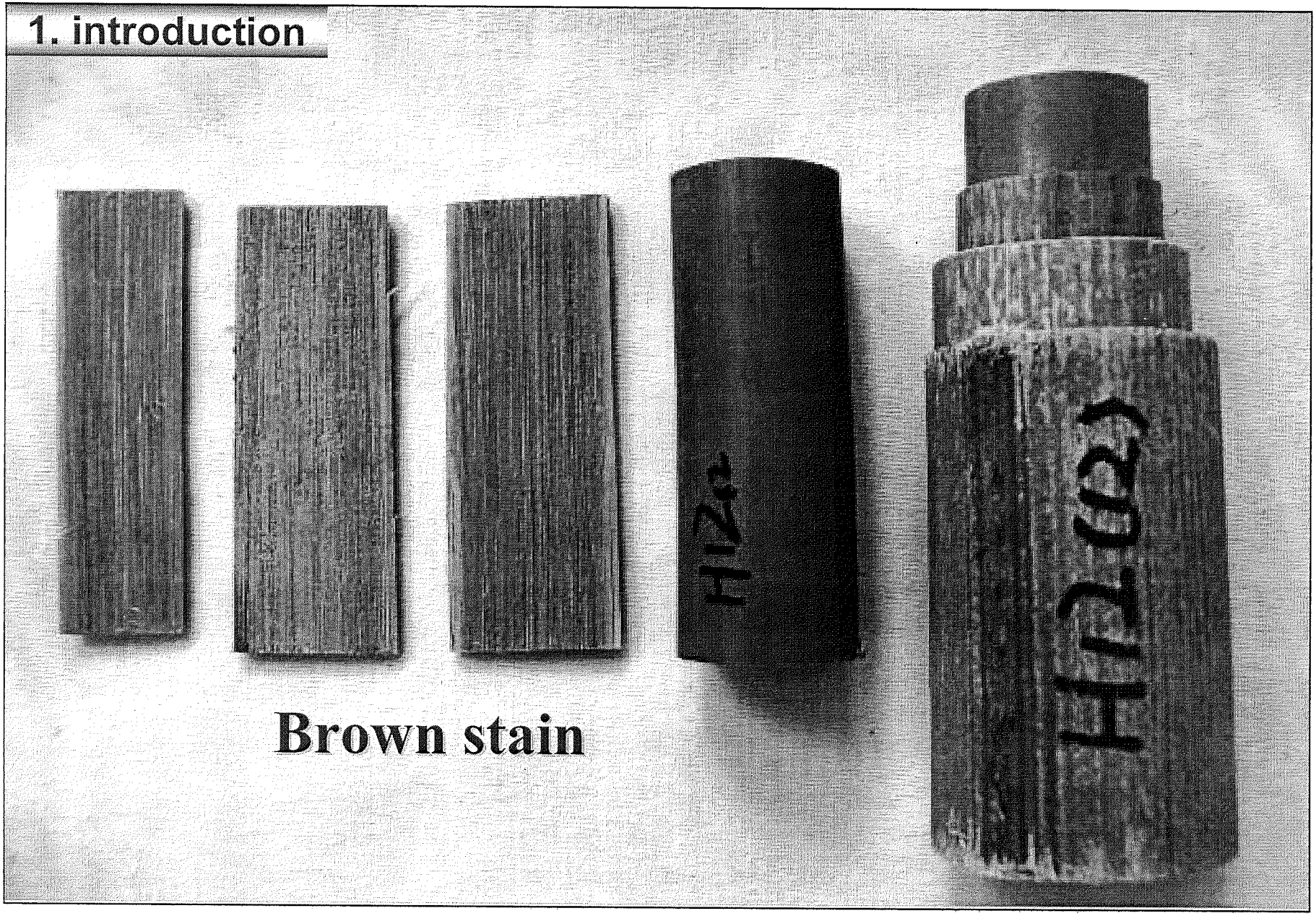
1. introduction



1. introduction



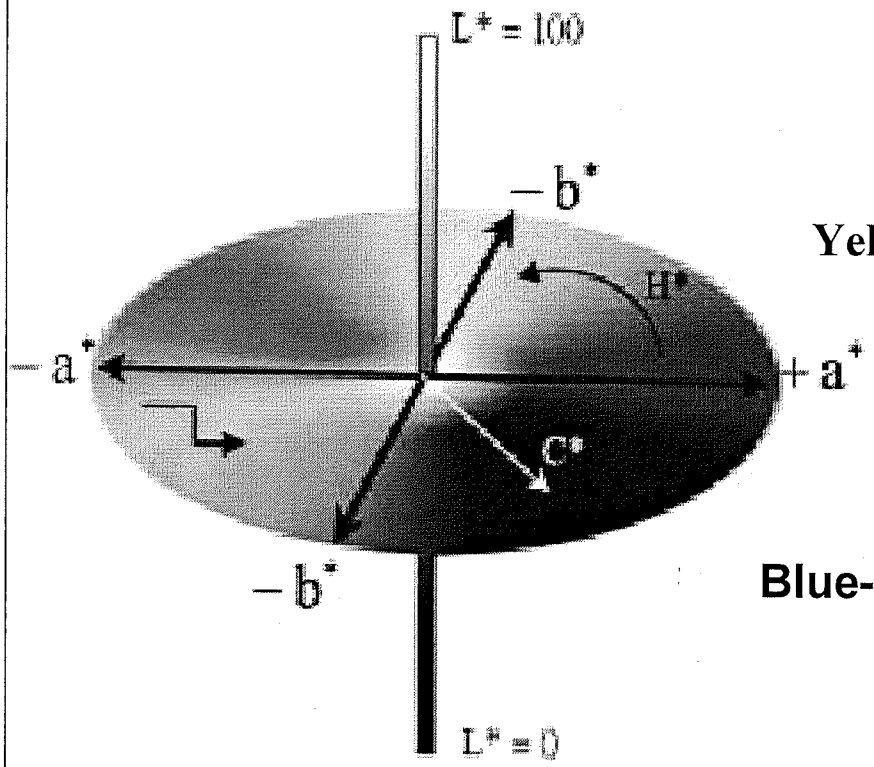
1. introduction

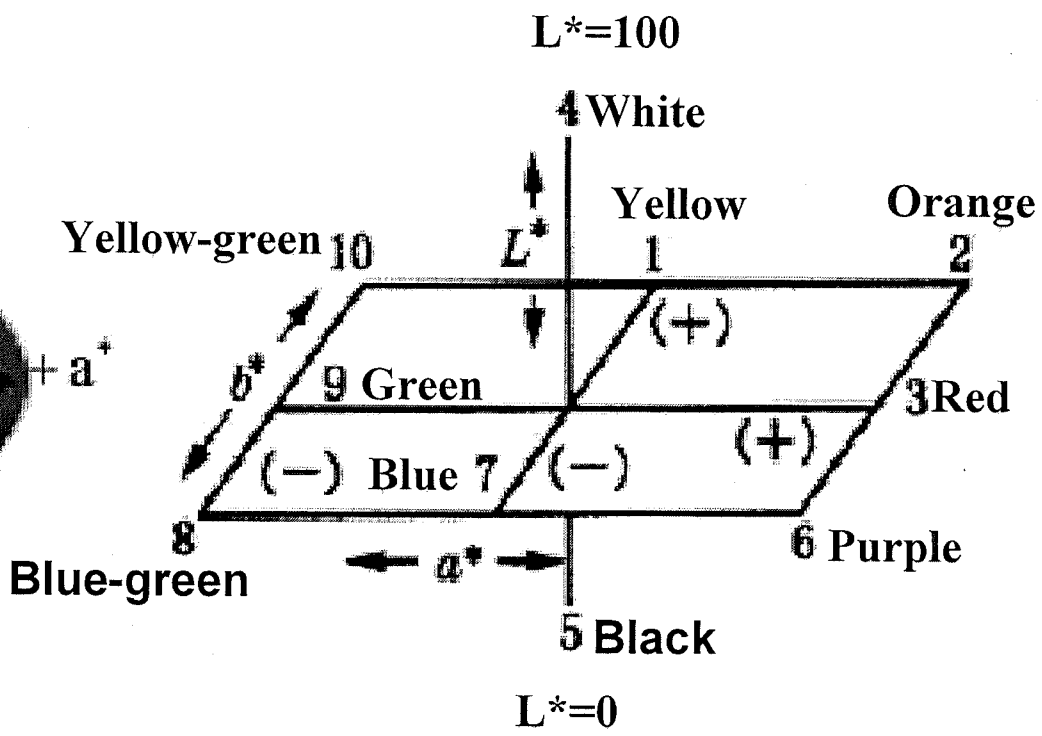


Brown stain

1. introduction

1. introduction





CIELAB Color Space (CIE1976 color system)

1. introduction

Color measurement :

Measrurement:

Chromatic Aberration Meter (CR-300)

D_{65} light source, CIE1976L*a*b*

Calculative formula:

$$Ag^* = \arctan(b^*/a^*)180/\pi$$

$$C^* = [(a^*)^2+(b^*)^2]^{1/2}$$

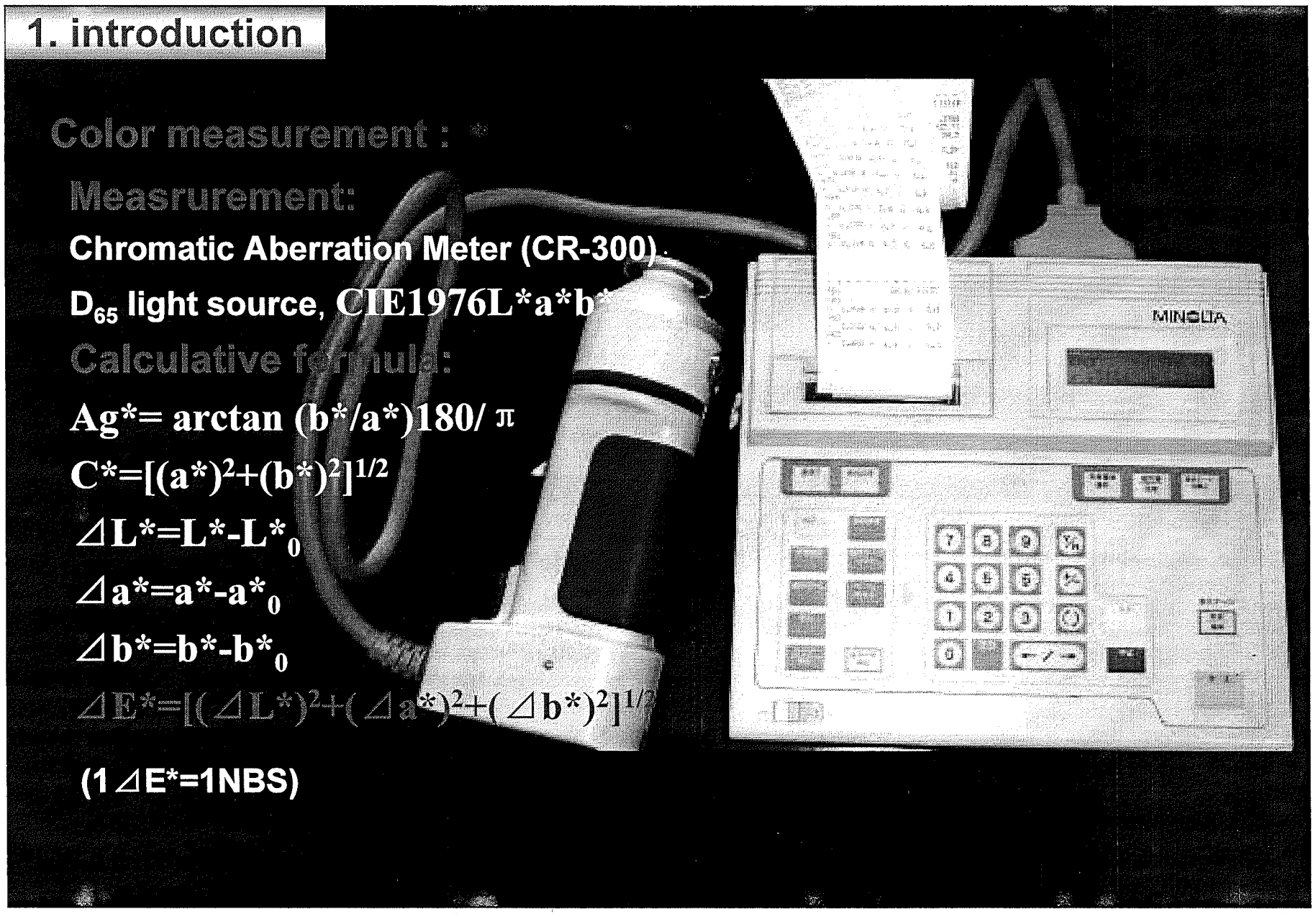
$$\Delta L^* = L^* - L^*_0$$

$$\Delta a^* = a^* - a^*_0$$

$$\Delta b^* = b^* - b^*_0$$

$$\Delta E^* = [(\Delta L^*)^2+(\Delta a^*)^2+(\Delta b^*)^2]^{1/2}$$

(1ΔE*=1NBS)



Tab.1 The relation of color difference and vision

⊿E*(NBS)	Visual sense
0.0～0.5	Trace
0.5～1.5	Slight
1.5～3.0	Noticeable
3.0～6.0	Appreciable
6.0～12.0	Much
> 12.0	Very Much

1. introduction

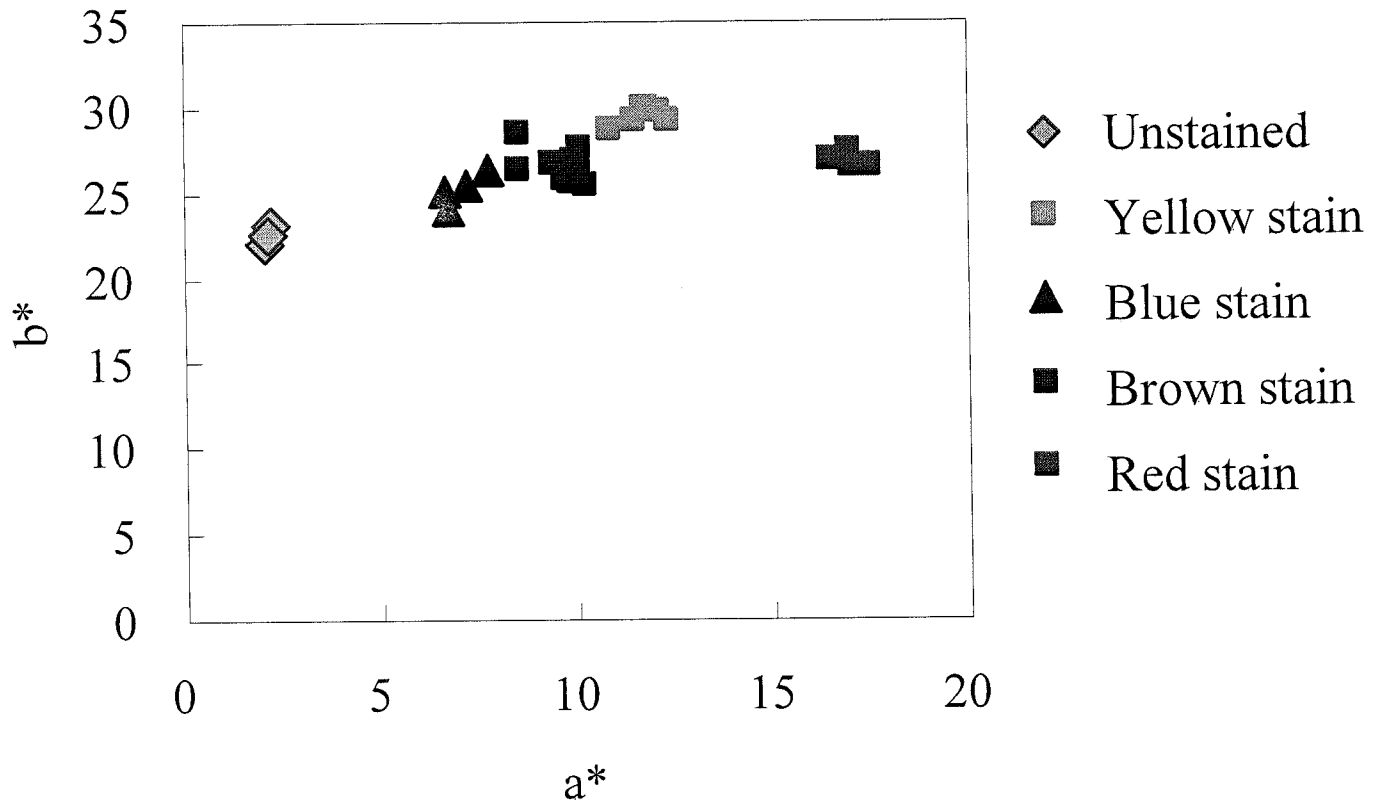
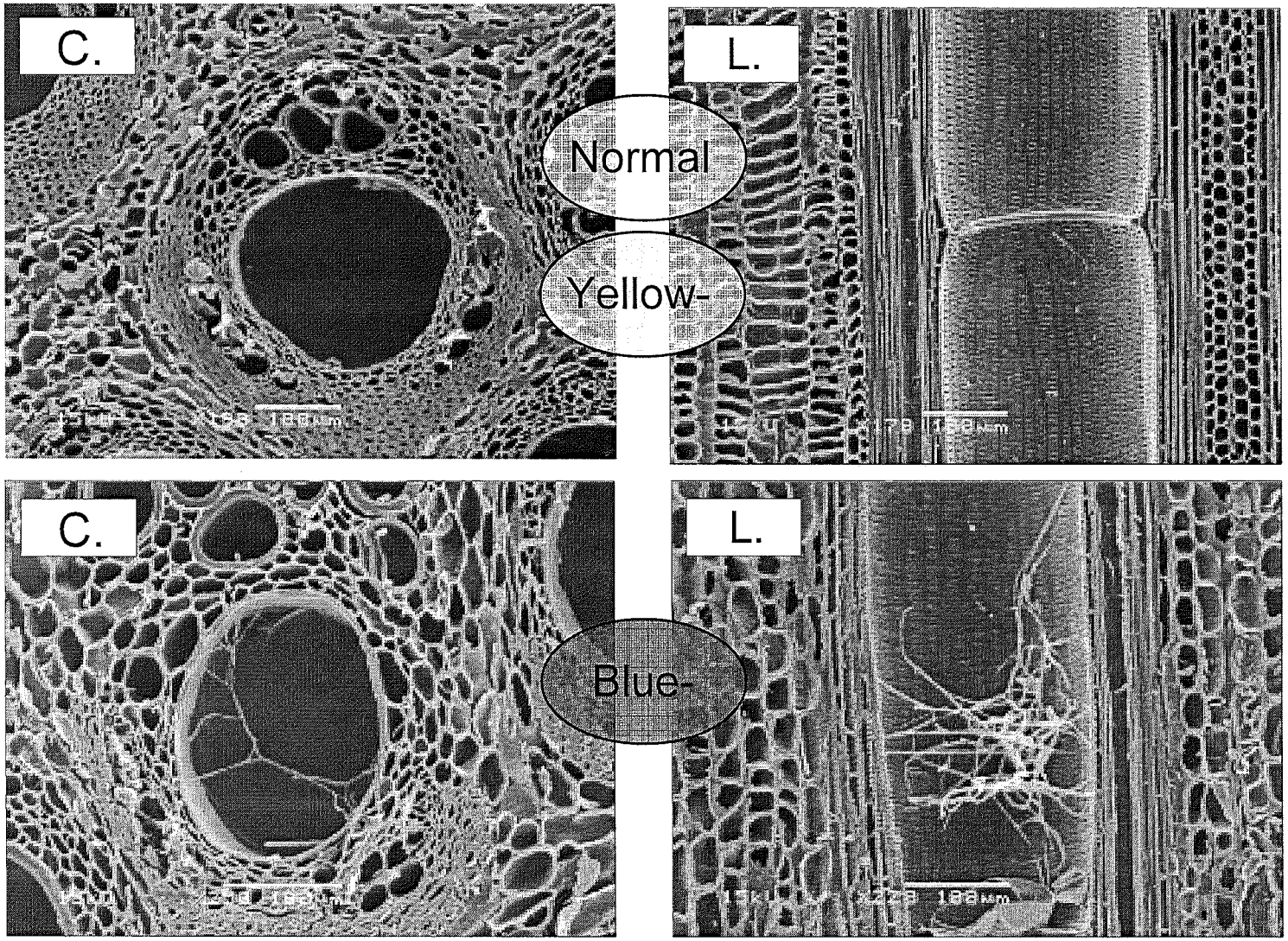


Fig.1 The a *-b* distribution of the cane main discolorations

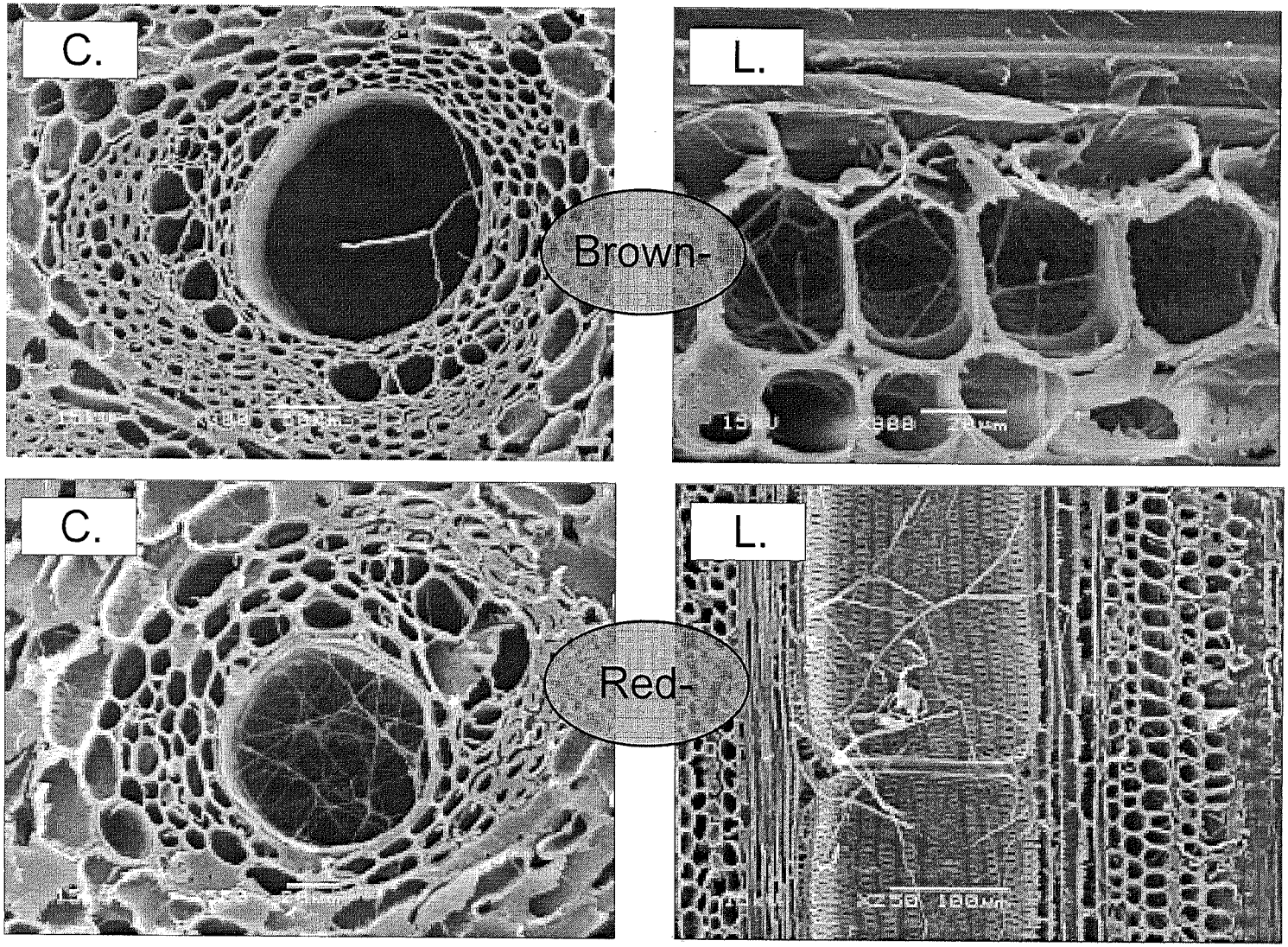
2. Main causes

- 2.1 SEM observation
- 2.2 Chemical composition analysis
- 2.3 Isolation and inoculation of stain fungi
- 2.4 Xenon light aging experiment

2.1 SEM observation



2.1 SEM observation



2.1 SEM observation

- The yellow stain was not caused by fungi.
  → chemical or photoinduced discoloration

- As for the blue, brown and red stained canes, there were always much fungi mycelium in their vessel and basic parenchyma cells.
  → Fungi-satin

2.2 Chemical composition analysis

Tab.2 Chemical compositions of the normal and fungi-stained canes

Location	Cane	MC %	Extractive content (%)				Lignin	Holo-cellulose (%)	Pentosan (%)	Ash (%)	pH value
			Cold water	Hot water	1% NaOH	Alcohol-benzene					
Core	Normal	8.83	19.51	23.77	41.07	8.95	21.62	58.25	22.84	0.92	4.38
	Stained	9.32	8.56	10.25	35.77	4.16	26.10	68.31	24.22	1.83	5.24
	Change	↑	↓	↓	↓	↓	↑	↑	↑	↑	↑
Cortex	Normal	8.82	10.17	13.58	33.91	7.00	24.90	68.28	20.66	2.26	4.49
	Stained	8.93	5.99	8.06	32.74	4.08	25.20	69.91	20.82	2.27	5.27
	Change	↑	↓	↓	↓	↓	↑	↑	↑	↑	↑

2.2 Chemical composition analysis

- The extractive contents in all items of the fungi-stained canes were decreased, and the moisture, pentosan, holocellulose, ash contents and the pH value were all increased.
- The stain-fungi had little effect on the cellulose and lignin. It was chiefly the extractives was consumed by the stain-fungi.
- The stain-fungi had greater influence on the core than on the cortex.

2.3 Isolation and inoculation of stain fungi

- **Fifteen main fungi were isolated and purified from the stained canes. After inoculated with these fungi respectively for 2 weeks, all the canes lost a little weight, but its color changed greatly.**

Tab.3 Color changes and weight loss of the stained canes inoculated with the isolated stain fungi respectively

	Fungi	F_1	F_2	F_3	F_4	F_5	F_6	F_7	F_8	F_9	F_{10}	F_{11}	F_{12}	F_{13}	F_{14}	F_{15}
2W	△E*	4.41	5.56	3.16	5.21	9.58	17.7	10.1	3.9	19.8	4.34	6.36	3.01	4.73	4.45	6.32
	WL%	1.75	1.45	0.62	1.55	0.72	1.71	1.29	1.12	2.2	1.45	1.99	0.88	0.96	1.26	1.44
4W	△E*	5.94	8.83	4.31	8.5	10.6	19.1	11.7	5.58	28.6	4.63	9.95	5.74	4.42	4.68	13.3
	WL%	1.9	1.83	0.84	1.91	0.77	1.88	1.62	1.58	2.47	1.88	2.09	1.32	1.47	1.55	1.99

2.3 Isolation and inoculation of stain fungi

- **The discolorations of the inoculated canes were compatible with the colors of the stained canes from which the inoculating fungi were isolated.**
- **Based on the cultivating characteristics of the stain-fungi, the blue, brown and red stains of *D. margaritae* canes were mainly caused by the mycelia colors of the stain-fungi or the pigments such as melanin secreted by the stain-fungi.**

The blue, brown and red stains are mainly caused by stain-fungi.