Coloring of Leather using *Piper betel* and tannins - Natural Alternative Material for Dyeing

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Need for Natural Colorants

- Synthetic dyes (acid, basic, metal complex) are widely used in leather industry
- Majority of the ingredients used in the synthesis of synthetic dye are carcinogenic in nature
- Stringent environmental standards have been imposed by many countries in response to the toxic and allergic reactions associated with synthetic dyes
- Banning of azo and aryl amine based dyes is an example

Natural colorants are gaining importance

Natural Dyes – Its Characteristics

- **Colors from nature, mostly from vegetative matter, animal residues and certain naturally occurring minerals**
- **Eco-friendly and non-carcinogenic**
- **Exhibit bio-degradability and hence are compatible with the environment**
- **Fashion trends coupled with eco-sensitivity demand the use of natural colorants**
- **Natural Dye extracted from *Piper betel* leaves is used with vegetable tannin extracts.**

Need for Vegetable Tannins for Dyeing

- **Vegetable Tannins are natural substances that have affinity to interact with both the dye and the material to be dyed bringing about not only change in color but also increase in intensity with increase in concentration o tannins**
- **Enables and enhances the natural colorant to fix to the fibers**
- **Based on the type of tannin used different shade are likely to be produced**
- **Generally used vegetable tannins are Wattle, Myrobalan, *Areca catechu* and Quebracho**

Natural Colorants – Current Scenario

- Dyeing of leathers using natural products from Lac and Lac mud, Indian Madder plant, Pomegrante fruit, Indian gum Arabic, Logwood is reported
- Development of colors using vegetable tannins on iron tanned leathers is reported
- Development of colors using Henna is reported
- Natural dyes are widely used in textile dyeing but not so commercially exploited on leather
- Methodologies to improve fastness, develop range of pastel and moving shades for leather needs to be addressed in the context of eco-benign dyeing

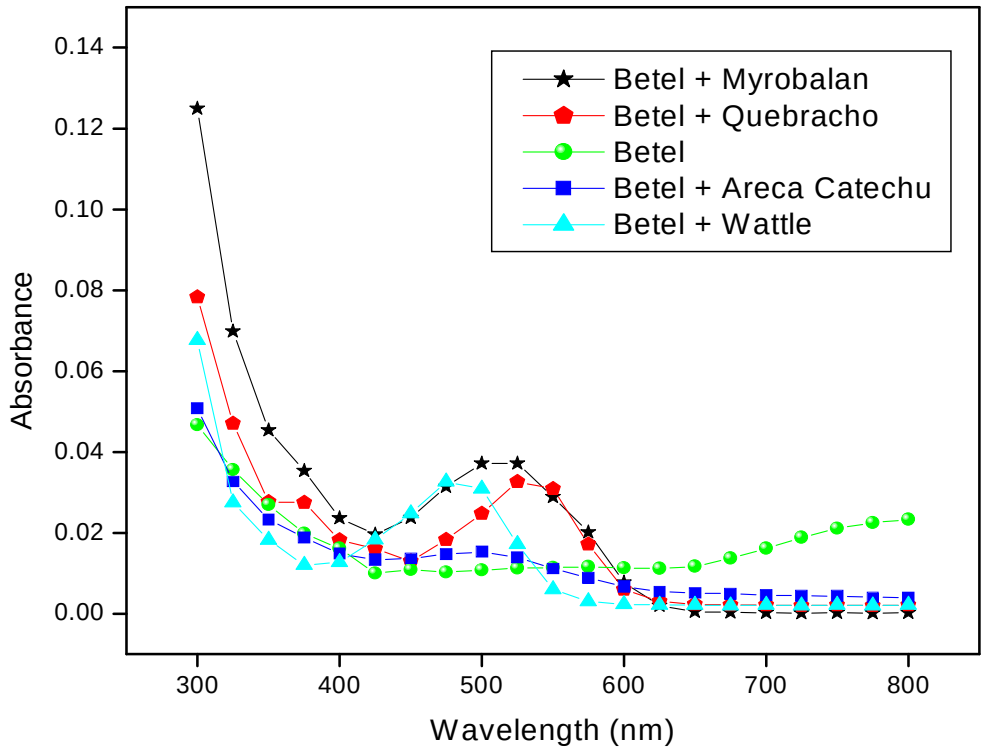
Methodology

- Extraction of dyes using betel leaves and vegetable tannins
- Studies on Spectral characteristics of the extraction
- Bench scale trials on leather
- Instrumental colour assessment of the dyed leathers.
- Studies on fastness characteristics of the dyed leathers

Extraction of dyes from *Piper betel* and Vegetable Tannins

- **Fresh *Piper betel* leaves are ground to fine paste and mixed with the fine vegetable tannin powder**
- **The above mixture was dissolved in distilled water and left undisturbed for 24 h.**
- **After 24 h incubation at room temperature, the mixture was heated at 90^{o} C for two hours.**
- **The mixture was filtered , concentrated and used for leather dyeing process**

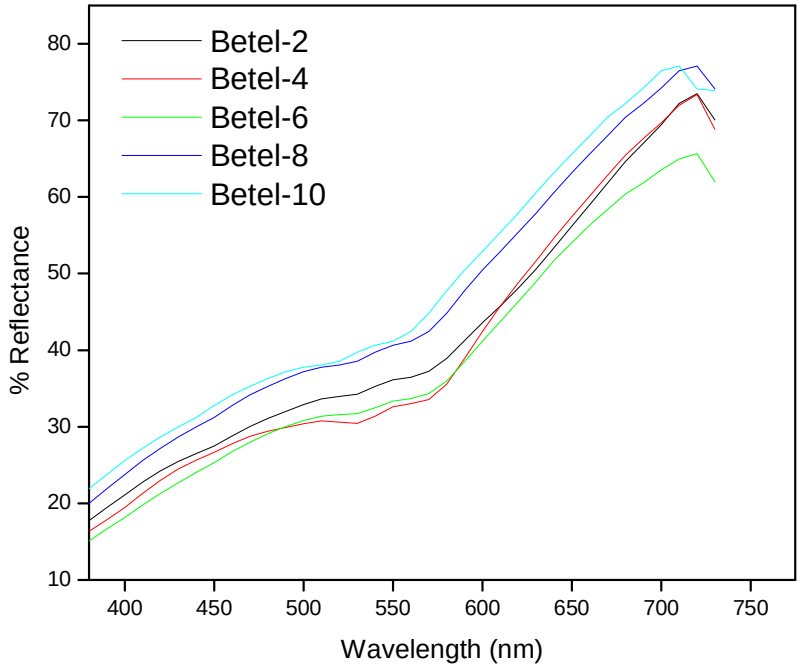
Spectral Characteristics: Effect of Vegetable Tannins



- **Shift in the absorbance maxima of the dye on interaction with vegetable tannins**

Colors from *Piper Betel* alone

Dye	L	a	b
Betle-2	42.84	10.11	2.09
Betle-4	45.16	10.18	2.68
Betle-6	46.16	10.69	2.36
Betle-8	50.39	11.16	2.54
Betle-10	51.84	11.88	2.70

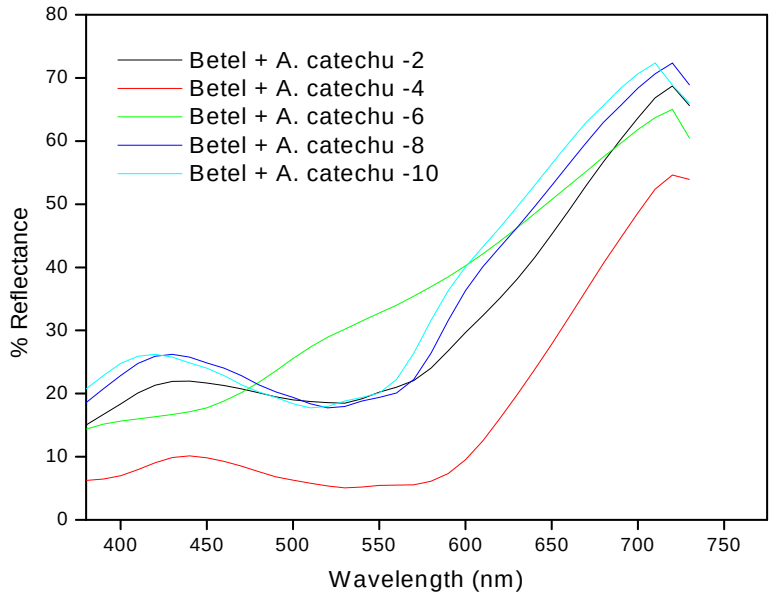


- Change in color on dyeing with *piper betle* at varying concentration
- L, a, b values also shows that there is no significant change in base color
- There is an increase in intensity with increase in concentration

Change in the shade of color

Colors from *Piper Betel* and Areca Catechu

% Betel+ *A. catechu*	L	a	b
2	38.92	25.09	-0.10
4	40.92	25.68	-0.33
6	41.44	26.96	3.76
8	43.49	31.18	6.68
10	47.58	36.77	8.16

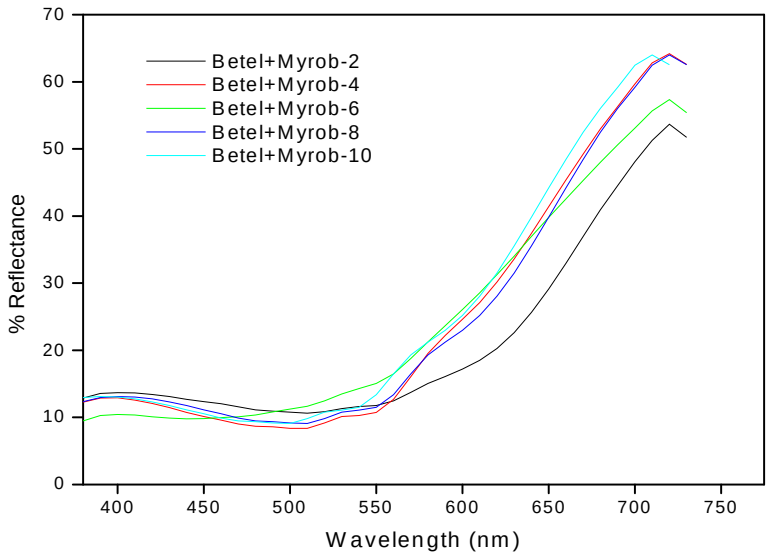


- Shade variation is observed from reflectance spectrum
- Role of Area Catechu in changing the color could be attributed to the interaction
- L, a, b values also show that ‘a’ value is varied as compared to piper betel, which confirms the variation to reddish brownish tone from grayish tone of piper betel

Change in the shade of color

Colors from *Piper Betel* and Myrobalan

% Betel + Myrob	L	a	b
2	58.73	20.73	15.51
4	57.83	22.34	22.19
6	57.21	19.98	19.55
8	54.67	17.14	17.55
10	51.48	16.58	17.12

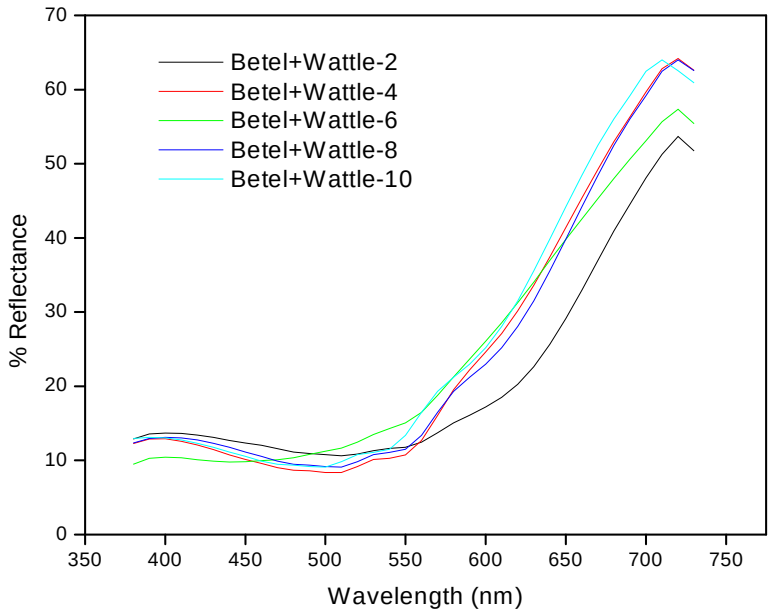


- Shade variation is observed from the reflectance spectrum
- Role of Myrobalan in changing the color could be attributed to the interaction
- L, a, b values also show that 'a' value is varied as compared to piper betel, which confirms the variation to chestnut brownish tone from grayish tone of piper betel

Change in the shade of color

Colors from *Piper Betel* and Wattle

%Betel + Wattle	L	a	b
2	54.67	18.73	22.32
4	53.62	18.34	19.21
6	52.73	17.75	17.76
8	52.12	17.14	15.95
10	51.48	16.73	15.51

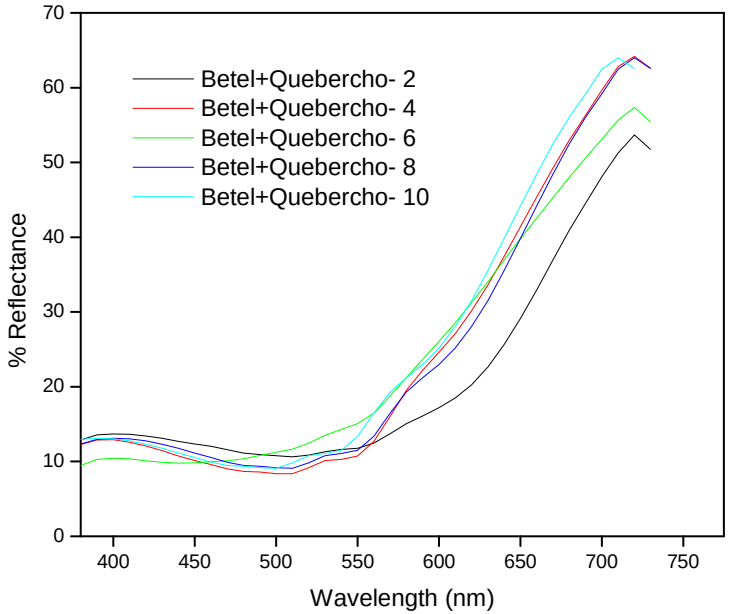


- Light chestnut brown shade is obtained on interaction with cattle
- L, a, b values also shows that there is no significant change in base color but deviates when compared to *piper betel*

Change in the shade of color

Colors from *Piper Betel* and Quebercho

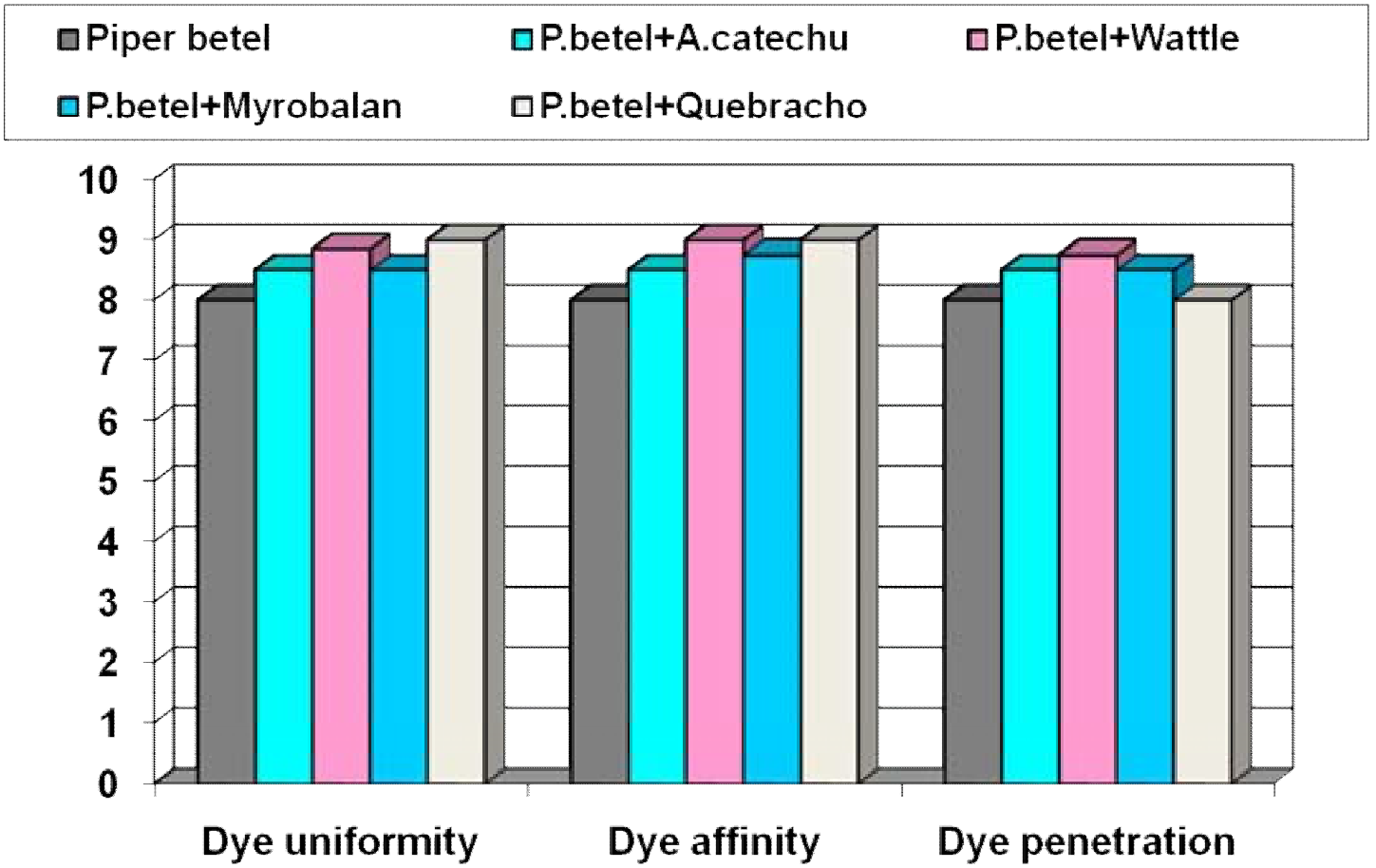
% Betel + Quebercho	L	a	b
2	68.48	23.79	12.16
4	64.12	22.39	10.92
6	63.89	22.12	11.13
8	61.78	21.13	10.55
10	60.21	20.46	9.96



- Brown shades are obtained on interaction with quebracho
- L, a, b values also shows that there is no significant change in base color at different concentrations

Change in the shade of color

Characteristics of Natural Dyed Leathers



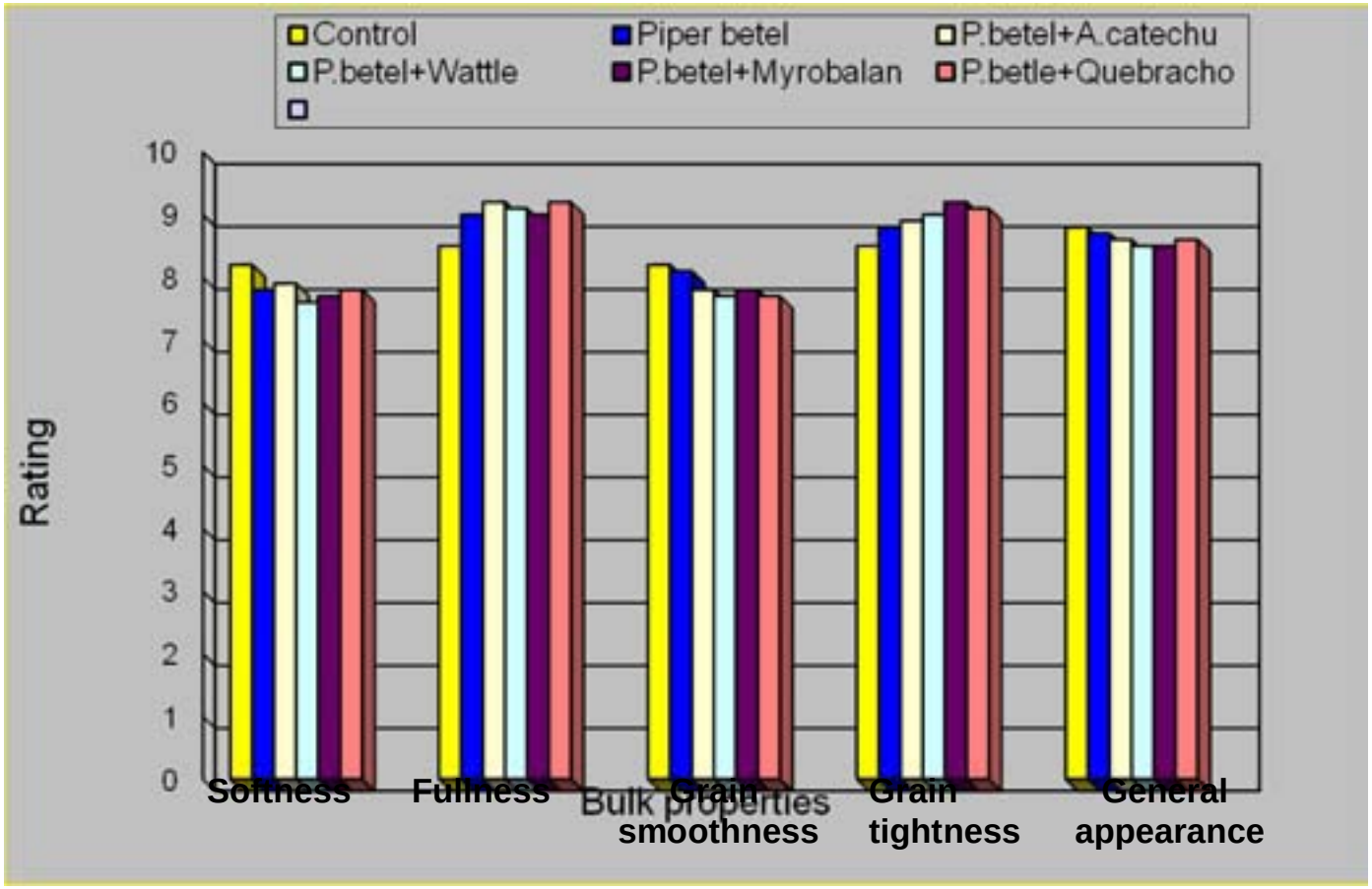
Dyeing characteristics have not been significantly altered by the use of *piper betel* and vegetable tannins

Natural Dyed Leathers: Wet, Dry Rub and Light Fastness

Natural Colorants	Felt		Leather		Blue scale reading
	Dry rubbing	Wet rubbing	Dry rubbing	Wet rubbing	Light Fastness
Piper betel	**4-5**	**4**	**4-5**	**4**	**3-4**
P.betel+A.catechu	**5**	**4-5**	**4-5**	**4-5**	**4-5**
P.betel+Wattle	**5**	**4-5**	**4-5**	**4-5**	**4-5**
P.betel+Myrobalan	**5**	**4**	**4-5**	**4-5**	**4-5**
P.betel+Quebracho	**5**	**4-5**	**4-5**	**4-5**	**4-5**

***Piper betel* and vegetable tannin combination dyed leathers exhibit good wet and dry rub fastness properties**

Natural Dyed Leathers: Wet and Dry Rub Fastness



Leather characteristics are not significantly altered by the use of natural colorants

Salient Features

- **25 natural colors have been developed from combination of piper betel, areca catechu, wattle, myrobalan and quebracho**
- **Vegetable tannins play an important role with natural dyes especially with piper betel**
- ***Piper betel* dyed leathers exhibit good dyeing properties like uniformity in dyeing, dye uptake and dye penetration**
- ***Piper betel* dyed leathers exhibit good light fastness properties**
- **Leather characteristics have not been significantly altered by the use of natural colorants**
- **This study establishes that natural materials can be used for eco-dyeing of leathers in the global leather industry.**

THANK YOU