FEASIBILITY OF NATURAL COLOURANT EXTRACTED FROM SAW DUST

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ABSTRACT
A sawmill is a factory that processes raw lumber into finished items including planks, beams, and planks of furniture. Saw dust, wood shavings, wood offcuts, and other similar items are produced as waste during this process. Pterocarpus indicus Willd. and Pterocarpus marsupium Roxb. are two examples of the many forest trees that serve several purposes.

Keywords: Cedrus deodara sawdust; Crystal violet; Adsorption; Isotherms; Kinetics.
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INTRODUCTION

Sawdust (sometimes called wood dust) is a common byproduct of woodworking operations such sawing, sanding, milling, planing, and routing. Its building blocks are wood shavings. These jobs may be accomplished with the help of woodworking equipment, portable power tools, or even just a steady hand. Some animals, including woodpeckers and carpenter ants, create wood dust as a byproduct of their everyday activity while making their nests in wood. It creates a high danger of fire and dust exposure in certain manufacturing settings.

Sawdust forms the bulk of particleboard's composition. While occupational safety and health examines possible threats to worker health, indoor air quality engineering focuses on ventilation. Sawdust is carcinogenic to humans, according the International Agency for Research on Cancer.

The majority of sawdust is used to create particleboard, however fine sawdust may be used to create wood pulp. Sawdust has a wide variety of possible use, such as mulch, an alternative to clay cat litter, and even as a fuel source. Before refrigeration was invented, ice was commonly stored in icehouses over the hot summer months. It has been used decoratively and as a fine point on model railways and other items. It may also be used to soak up liquid spills before they are swept up or otherwise collected. This explains why it used to be so common on bar menus. This is the source of Cutler's resin. When pykrete is mixed with water and frozen, it becomes considerably harder and takes longer to melt than conventional ice.

Wood shavings or sawdust may be used to create charcoal briquettes. Henry Ford first started making charcoal briquettes out of wood scraps and sawdust from his automotive production. These dyes were used on a wide range of materials, including animal and human skins, hair, teeth, bones, textiles derived from a wide range of plants, and even wood, to generate a wide range of colors. Synthetic dye use is now estimated at about 10,000,000 tons per year.

The manufacture of these synthetic hues from petroleum is destructive to the environment, and the disposal of their waste into rivers is detrimental to aquatic life. This has resulted in a fresh interest in employing organic dyes in the textile sector. Natural pigments and colors may be employed in this situation. Some examples are beetroot, henna leaves, eucalyptus bark, tea leaves, and turmeric rhizomes.

Native to India, Nepal, and Sri Lanka, Pterocarpus marsupium Roxb. is also known as the Indian Kino tree, Malabar Tree, Vijayasar, Bija, or Asana in Sanskrit. Pterocarpus marsupium Roxb has several different

pharmacological actions. Pterocarpus indicus Willd., more popularly known as Narra, is widely distributed in nature across South East Asia and the South West Pacific area and is cited in many different types of traditional medicine (Gorle & Gadgoli, 2018). It's a tree whose timber is so superior that it can be utilized for everything from musical instruments to upscale home furniture.

LITERATURE AND REVIEW

Jean-Bosco Saha Tchinda et al (2014) In this study, we sought to dye cotton, wood viscose, and bamboo viscose textiles by extracting pigments from padouk and movingui sawdust with alkaline and aqueous solutions. No mordant was used throughout the dying procedure. The degree of discolouration was measured 15 days after washing with soap using a Datacolor D6510 analyzer. After dying, the depth of color was measured using the color space coordinates L*, a*, and b*. When compared to other cellulosic supports like bamboo or wood viscose, cotton has been demonstrated to take dyestuffs the best.

Maryam Batool et al (2021) The study's objective is to determine how well Cedrus deodara sawdust removes crystal violet from untreated water. The fundamental objectives of this study are to identify the ideal experimental conditions for eliminating hazardous crystal violet dye from Cedrus deodara tree sawdust. Adsorption parameters and isotherms have been studied in addition to the more traditional thermodynamics and kinetics. Pseudo-second-order kinetics characterizes the process, and the Langmuir isotherm provides the best match to the data. The calculated free energy and enthalpy demonstrate the endothermic nature and spontaneous recurrence of the process. Cedrus deodara seems to be an excellent adsorbent for getting rid of crystal violet in water, with a success rate of 92% when applied to tap water using the method developed.

Christopher Fapohunda et al (2018) Lack of regulation and excessive use of nonrenewable natural resources in the manufacturing of structural concrete utilized in the building of her infrastructure raises serious concerns about the long-term viability of our built environment. Numerous studies are revealing new sources of material to help with this problem. Wood shavings are one such item that may be used instead of lumber. The findings of the research suggest that structural concrete may be made with a wood waste replacement of up to 20% by using materials like saw dust ash, wood aggregate, or saw dust in the mix. In addition, (ii) SDA-enhanced concrete shows little to no deterioration throughout the course of its service life, despite being exposed to a wide variety of deterioration mechanisms. Therefore, eco-friendliness in construction may be enhanced by including recycled saw dust into concrete.

Hassan Arida (2020) We used tartaric acid to process two new adsorbents that we gathered in their native Pakistan. These are Citrullus colocynthis (CC) and Holarrhena antidysenterica (HA). A modified form of Herbaspirillum antidysenterica (HA-TA) is used, the following were the best conditions for CV dye removal: Using 0.8 g of adsorbent, the following parameters were utilized instead of those used to get the same results with H. antidysenterica: 6.0 pH, 50°C temperature, 150 rpm agitation speed, and a contact period of 40 minutes. pH = 5.0, temperature = 40 degrees Celsius, contact duration = 35 minutes, and agitation = 150 revolutions per minute. The rate-determining stages were associated with diffusion activities both on the particle's surface and inside its interior. Thermodynamic research confirmed the reaction was spontaneous and generated heat. The adsorbents have promising possibilities for effectively detoxifying water supplies by eliminating toxic pigments.

Virendra Kumar Gupta (2019) Environmentally conscious countries have instituted stringent rules on textiles and clothes, leading to a revival in the use of natural colors. Because synthetic dyes may provoke allergic reactions in certain people, natural dyes are gaining popularity. Natural dyes have a lower environmental impact and may be reused. It may be used to provide color to foods, medications, and arts and crafts in addition to textiles. While natural dyes pose no threat to human health or the environment, they must be mordanted using metallic mordants, some of which are not environmentally friendly, in

order to be fixed on the fibers. As a result, natural tones are now far less prevalent. Creating truly eco-friendly textiles calls for cutting-edge study of natural dyes on a range of natural fibers. Therefore, this review paper explains the basics of natural dyes chemistry and emphasizes the most significant results to date.

EFFECT OF DYE EXTRACTION MEDIUM AND METHODS ON DYE YIELD FROM PTEROCARPUS INDICUS WILLD.

Experiments comparing the efficacy of several media and methods for dye extraction from Pterocarpus indicus Willd are summarized in Table 1.

Table 1. Effect of dye extraction medium and methods on dye yield from Pterocarpus indicus Willd.

Extraction medium	UV-Visible spectrophotometer value (Absorbance at 428 nm)				
	Extraction methods				
	Conventional	Magnetic stirring	Enzyme assisted	Ultrasound assisted	Enzyme-mediated ultrasound assisted
Aqueous	1.877	1.849	1.537	3.565	2.449
Alkali (1% Sodium carbonate)	**3.987**	**4.204**	**3.339**	**5.120**	**4.888**
Acid (1% Acetic acid)	1.588	1.629	1.072	2.233	1.729
Alcohol (50% Ethanol)	3.012	3.216	2.937	4.209	3.514

To determine the most effective method for extracting dye from Pterocarpus indicus Willd. saw dust, we dyed cotton and silk farbics with alkaline extracts obtained by conventional, magnetic stirring, enzyme aided, ultrasound assisted, and enzymemediated ultrasound assisted extraction. The color saturation (K/S) measurements of the various fabrics are shown in Table 2.

Table 2. Colorfastness of Pterocarpus indicus Willd.-dyed cotton and silk.

Extraction methods	Cotton fabric		Silk fabric		% difference in K/S between cotton and silk fabrics
	K/S	Colour produced	K/S	Colour produced	
Conventional	9.230		16.920		45
Magnetic stirring	10.211		19.764		48
Enzyme assisted	9.075		14.783		39
Ultrasound assisted	**14.902**		**26.360**		44
Enzyme-mediated ultrasound assisted	12.561		24.892		50

EFFECT OF DYE EXTRACTION MEDIUM AND METHODS ON DYE YIELD FROM PTEROCARPUS MARSUPIUM ROXB.

The effects of various extraction medium and procedures on dye extraction from Pterocarpus marsupium Roxb are shown in Table 3.

Table 3. Effect of dye extraction medium and methods on dye yield from Pterocarpus marsupium Roxb.

Extraction medium	UV-Visible spectrophotometer value (Absorbance at 430 nm)				
	Extraction methods				
	Conventional	Magnetic stirring	Enzyme assisted	Ultrasound assisted	Enzyme-mediated ultrasound assisted
Aqueous	1.898	2.616	2.547	2.723	2.752
Alkali (1% Sodium carbonate)	**2.758**	**2.830**	**2.782**	**3.078**	**3.288**
Acid (1% Acetic acid)	1.464	1.643	1.511	1.972	2.103
Alcohol (50% Ethanol)	2.221	2.728	2.672	2.801	2.839

OPTIMIZED CONDITIONS FOR DYE EXTRACTION FROM PTEROCARPUS INDICUS WILLD. AND PTEROCARPUS MARSUPIUM ROXB. SAW DUSTS

Dye extraction parameters, such as pH, time, amplitude of ultrasonic pulse, and pulse length, are listed in Table 4 for both Pterocarpus indicus Willd. and Pterocarpus marsupium Roxb.

Table 4. Optimized conditions for dye extraction

Dye source	Parameter				
	Dye source concentration (%)	pH	Time (minutes)	Ultrasound pulse rate (%)	Ultrasound amplitude (%)
Pterocarpus indicus Willd. saw dust	5	10	60	100	65
Pterocarpus marsupium Roxb. saw dust	5	10	60	100	65

Cotton and silk may be colored using Pterocarpus indicus Willd. and Pterocarpus marsupium Roxb. dye extracts, and the optimal dye bath pH, material liquor ratio, dyeing duration, and dyeing temperature are listed in Table 5.

Table 5. Optimized dyeing conditions

Parameters	*Pterocarpus indicus* Willd.		*Pterocarpus marsupium* Roxb.	
	Cotton	Silk	Cotton	Silk
M:L Ratio	1:30	1:30	1:30	1:30
Temperature (°C)	90	80	90	80
Time (min)	60	30	60	60
pH	10	4	10	4

The capacity of fabrics to absorb UV radiation was evaluated both before and after they were colored. Cotton and silk textiles dyed with Pterocarpus indicus Willd. and Pterocarpus marsupium Roxb. are

shown in Tables 4 and 5, together with their respective UPF and protection ratings. Tables 6 and 7 show that the ultraviolet (UV) protection capabilities of undyed cotton and silk textiles are poor, and so fall into the no protection group, with values of 6 and 5, respectively.

Table 6. Fabrics colored with Pterocarpus indicus Willd. provide UV protection.

Mordant	Sample	Cotton				Silk			
		Mean			UV protection category	Mean			UV protection category
		UV-A %	UV-B %	UPF value		UV-A %	UV-B %	UPF value	
Control		83.4	83.3	6	No protection	76.4	87.9	5	No protection
Unmordanted	UT	95.2	97.7	38	Very Good	93.3	96.6	23	Good
	CT	97.9	98.9	76	Excellent	94.6	97.1	29	Very good
	MT	97.3	98.0	45	Excellent	95.0	95.8	23	Good
Stannous chloride	UT	98.3	99.0	85	Excellent	96.1	98.2	43	Excellent
	CT	98.3	99.1	96	Excellent	94.3	97.1	28	Very good
	MT	98.5	99.0	92	Excellent	98.8	99.2	111	Excellent
Copper sulphate	UT	95.1	97.6	35	Very Good	96.9	98.2	46	Excellent
	CT	97.7	98.7	66	Excellent	95.7	97.2	31	Very good
	MT	97.7	98.4	56	Excellent	97.0	97.4	37	Very good
Pomegranate rind	UT	96.2	98.2	45	Excellent	95.8	97.3	33	Very good
	CT	98.1	98.8	73	Excellent	97.0	97.7	38	Very good
	MT	97.3	98.2	48	Excellent	96.3	97.0	32	Very good
Gooseberry	UT	96.7	98.4	53	Excellent	94.6	97.0	29	Very good
	CT	97.3	98.5	55	Excellent	93.9	96.0	23	Good
	MT	96.7	97.9	41	Excellent	96.0	96.8	29	Very good

Table 7. Fabrics coloured with the berries of the Pterocarpus marsupium Roxb.

Mordant	Sample	Cotton				Silk			
		Mean			UV protection category	Mean			UV protection category
		UV-A %	UV-B %	UPF value		UV-A %	UV-B %	UPF value	
Control		83.4	83.3	6	No protection	76.4	87.9	5	No protection
Unmordanted	UT	96.4	97.9	42	Excellent	92.9	95.9	19	Good
	CT	98.2	98.7	70	Excellent	95.0	96.8	27	Very Good
	MT	97.1	97.9	43	Excellent	95.2	95.8	23	Good
Stannous chloride	UT	98.7	99.2	105	Excellent	94.2	96.0	22	Good
	CT	98.8	99.1	106	Excellent	95.2	96.7	27	Very Good
	MT	98.7	99.1	103	Excellent	98.4	98.9	85	Excellent
Copper sulphate	UT	98.5	97.5	51	Excellent	96.4	97.4	35	Very Good
	CT	98.9	99.3	117	Excellent	95.2	96.5	26	Very Good
	MT	97.7	98.4	55	Excellent	96.4	96.8	31	Very Good
Pomegranate rind	UT	97.2	98.4	54	Excellent	97.5	98.3	53	Excellent
	CT	98.6	99.1	94	Excellent	97.2	98.0	47	Excellent
	MT	97.0	97.8	42	Excellent	95.5	97.1	33	Very Good
Gooseberry	UT	97.5	98.6	60	Excellent	95.9	97.4	35	Very Good
	CT	98.7	99.0	90	Excellent	95.6	97.1	32	Very Good
	MT	98.2	98.7	68	Excellent	96.9	97.4	37	Very Good

Because of this, it is safe to say that cotton and silk fabrics dyed with extracts of Pterocarpus marsupium Roxb. greatly increase their UV protection property in comparison to those dyed with conventional mordants and pretreatments.

Compared to silk fabrics dyed with Pterocarpus indicus Willd. and Pterocarpus marsupium Roxb., cotton textiles dyed with these plants had greater UPF values. The UV protection provided by colored materials that had been treated with chitosan or myrobalan was superior to that of similarly colored materials that had not been treated.

CONCLUSION

This article presents empirical evidence that saw dust from the trees Pterocarpus indicus Willd. and Pterocarpus marsupium Roxb. may be used as a substitute for synthetic dyes in specific applications. The natural dyes that have been extracted provide a wide range of colors that hold up well in both cotton and silk. Study results revealed that pretreatment with chitosan and myrobalan significantly improved color saturation, lightfastness, and UV protection.

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