A STUDY ON INVESTIGATION OF THE CHEMICAL CONSTITUENTS & MILLED WOOD LIGNIN ANALYSIS OF LANTANA CAMARA & PROSOPIS CHINNSIS

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ABSTRACT: Investigation was carried out on Lantana Camara & Prosopis Chinensis, the plants of verbenacea (vervain) & leguminosae (Mimosaceae) family for studying their chemical constituents by isolation of milled wood lignin of Lantana Camara & Prosopis Chinensis through different isolation techniques such as hydrolysis & solvent extractions.This has indicated that the lignin prepared from wood species Lantana Camara contains carbon 56. 2%, hydrogen 5.80% ,oxygen 36.00% and methoxy groups 19.70%. Prosopis Chinensis contains carbon 60.70%, hydrogen 6.30%, oxygen 33.00% and methoxy groups 19.78%. The C_9 formula weight for Prosopis Chinensis & Lantana Camara is 204.82 & 212.99 respectively. The other reactive groups of lignin of Lantana Camara & Prosopis Chinensis investigated were also comparable with the other non wood species.

Key Words: Lantana Camara, Prosopis Chinensis and milled wood lignin

INTRODUCTION

Indian pulp & paper industry is passing through the crisis due to shortage of raw materials, high cost of energy, huge consumption of water , power and generation of large amount of pollutants. Among all these the raw material shortage is one of the major problems. Pulp & paper industries are always in search for possible woody & non woody renewable raw material that can replace traditional forest based species like wood and bamboo. Lantana Camara & Prosopis Chinensis can be a good raw material source for pulp making. In this work the potential of Lantana Camara &Prosopis Chinensis & their physico chemical properties were evaluated through milled wood lignin analysis. Lignin is an aromatic amorphous material which forms a part of the cell wall and the middle lamella in wood. It is characterized by considerable amount of methoxy groups and by the presence of hydroxyl groups, parts of which are phenolic in nature. The amount of lignin varies from wood to wood and non wood to non wood. The main function of lignin is to act as cementing material between fiber networks. Lignin is an essentially a three dimensional network containing certain groups. These raw materials are however renewable, now as far as availability of correlations are concerned to evaluate the results of lignin content through statistical experimental design.

In the present investigation Lantana Camara, a plant of verbenaceae/ vervain family , woody shrubs, aromatic, branched, up to10 ft tall, stems prickly, 4angled leaves stiff, margins serrated. 2.5 inches long by 2inches wide florets usually multi colored, yellow, orange, pink, violet, in hemisphere is cal heads, 1 inch diameter, fruits dark blue to blacked maturity. Even after repeated cuttings leaf ovate or ovate-oblong, acute or sub acute, crenate-serrate, rogues above, scab rid on both sides, a different plant with similar inflorescence and was applied to this genus Camara. Latin or West Indian or arch, possibly for shape of corolla tubes. An escaped ornamental originally from the West Indies, where it infests over 400,000 acres, and on midway, it is a major pest of leeward and some windward pastures.

The Prosopis Chinensis belongs to the family leguminosae (Mimosaceae). About 43 species of this genus are known. Some of these are rarely found in India. The commonly used term "mesquite" includes all leguminous trees of genus Prosopis. In Indian subcontinent Prosopis Chinensis (P.Chinensis) is called 'vilayati kikkar', 'kibuli kikkar', 'vilayati babul', vilayati khejra. The plant is evergreen spiny tree or shrub, with drooping branches. The leaflets are usually about one cm long, pinnate are smaller with crowded leaflets. The leaves are bi pinnate and flowers are small, yellowish in dense spikes. The bark is grayish and the pods are yellow, 10-25 cm long and 8-15 mm broad, straight or falcate, flat or cylindrical often with transverse depression between the seeds, 10-30 seeds are present in a pod and are ovoid flattened, 7 mm x 3 mm hard, yellowish brown and shiny.[1, 2, 3.]

The Chemical Constituents of Lantana Camara

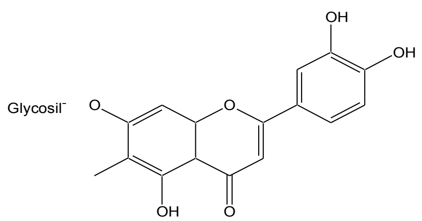
Lantana Camara has hepatotoxins are pentacyclic triterpenoids called lantadenes. Molecular structure of lantadenes has been determined. Green unripe fruits of the plant are toxic to humans. The allelochemicals have been identified as phenolics, with umbelliferone, methylcoumarin, and salicylic acid being the most phytotoxic. In addition to phenolics, a recent report indicates lantadene A and B as more potent allelochemicals in supportive therapy. Recent reports on the bilirubin clearance effect of Chinese herbal tea Yin Zhi Huang (decoction of the plant Yin Chin, Artemisia capillaries, and three other herbs) or its active ingredient 6,7dimethylesculetin, in jaundice are very exciting and warrant investigations on its possible ameliorative effects in lantana intoxicated animals. Research is being conducted on new drug discovery based on natural products in different parts of the lantana plant. [4]

The chemical composition of essential oil samples of the aerial parts of two flower color types of Lantana Camara, have been characterized by GC and GCMS. The main components changed within the two flower color types. The pink-violet flower type contained mainly davanone (23.5%), β-caryophyllene (11.7%), sabinene (10.4%), linalool (5.9%) and α-humulene (4.7%), while the main components of the yellow-orange type were β-caryophyllene (29.8%), β-bisabolene (15.3%), sabinene (13.3%), γ-cadinene (3.7%) and α-humulene (3.1%).[5 ,6] A new ursane was isolated from the leaves of Lantana Camara and its structure elucidated as 3,24-dioxo-urs-12-en-28-oic acid by means of spectral analysis[7] **.**Seven pentacyclic triterpeonoids, camarinic acid, camaric acid, oleanolic acid, pomolic acid, lantanolic acid, lantanilic acid and lantic acid, have been isolated from the aerial parts of Lantana Camara. The two new constituents, camarinic acid and camaric acid, have been characterized as 22β-acetoxy-3,25-epoxy-3α-hydroxy-12-ursen-28-oic acid and 3,25-epoxy-3α-hydroxy-22β(2-methyl-2Z-butenoyloxy)-12-oleanen-28-oic acid[8] **.**The structure of lantanilic acid, a new triterpene isolated from the leaves of Lantana Camara, has been determined as the β,β-di methylacryloyl ester of lantaninilic acid.[9]

The Chemical Constituents of Prosopis Chinensis

In 1964 R.C. Sharma et al[10] reported the isolation of a flavoneglycoside patulitr(1) 3,5,6,3,4-pent amethoxy-7-hydroxy flavone from flowers of prosopis Spicigera. The fruits of Prosopis Chinensis D.C. (Leguminosae) were found to contain the same compound. Iches and co-workers[11] in 1973 found that patulitrin showed significant activity against the Lewis lung carinoma in vivo.

The presence in leaves of Prosopis Chinensis was first reported by Ahmad and co-workers 12in 1978. They had isolated three new alkaloids, Juliflorine, Julifloricine and Julifloridine. The structure of Julifloridine(2) was confirmed through spectral data. In 1979 same group also published the partial structure of Juliflorine. After wards published the complete structure of Juliprosopine (3) from the leaves of this plant. By comparing the published data of Juliflorine with that of Juliprosopine ,it was R Vajpeyi, N Shukla & K Misra 1981 reported the isolation of hexacosan-25-on-l –ol, a new keto alcohol alongwith ombuin and a triterpenoid glycoside from the bark of P. Chinensis.[13] In continuation of their work D.K. Bhardwaj and co-workers isolated[14] in 1980, another new flavone from the seeds of the same plant, prosogerin- D, (6,3',4',5,-tetra methoxy-7-hydroxyflavone (4). In 1981 Hesse et al, isolated[15]another alkaloid Juliprosine (5) from the leaves and proved the structure. From the roots of Prosopis Chinensis a new glycoside, 3,3'-di-O-methyl-ellagic acid4-O-a-L-rhamnopyranoside(6) S. Malhotra and K. Misra16in 1983[16], identified a new glycosidie, ellagic acid 4-0-rutinoside from the pods of P. Chinensis. Two polystyrenes were isolated from seeds of P. Chinensis in 1982 by I.S. Thakur and co-workers[17]which yielded of 37.6 and 48.3 mg/100 g seed powder. Respective molecular weights were determined as 5725 and 12580.3 .P.L.Soni [18] in 1988 identified some monosaccharides, disaccharides and natural gums from P. julif.'ora.42 di phenic acid 1,3-glucose ester.



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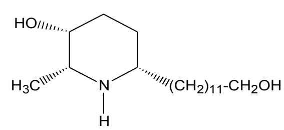

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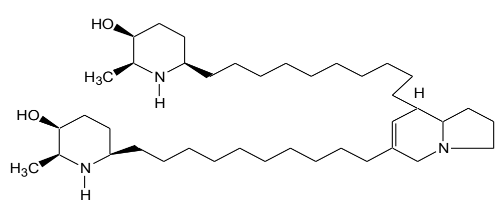

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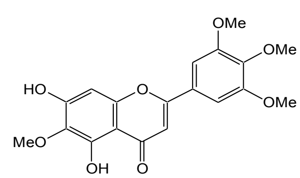

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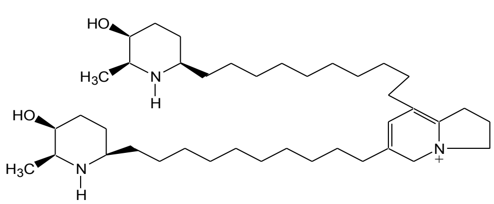

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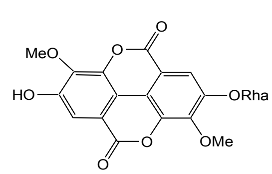

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EPERIMENTAL

The sample of different ages of Lantana Camara & Prosopis Chinensis were collected from different places of Vidisha &Raisen district of Madhya Pradesh. The sample of Lantana Camara & Prosopis Chinensis were collected from different places of Vidisha &Raisen district of Madhya Pradesh. The part of Lantana Camara & Prosopis Chinensis plant i.e leaves, wood, bark were collected in the month of July- August 2009. The wood of Lantana Camara &Prosopis Chinensis plant were grinded in a ball mill and the fraction -30 +60 mesh were taken for proximate analysis & milled wood lignin estimation which was done according to TAPPI standards T-15. 0S-58 ,T-207, 0S-75, T-204, 0S-76, T- 5m-59 ,T-212, 0S-76, T-223, 0S-71, 84 T-22-05-74method . [20 to 30]

A series of experiment were carried out to study the chemical constitution of milled wood lignin of Lantana Camara &Prosopis Chinensis . It includes the elemental chemical analysis and determination of carbonyl groups, methyl groups, total hydroxyl group, phenolic hydroxyl groups and furfural content. Methods described in TAPPI standards. The total hydroxyl content (both aliphatic and aromatic) was lignin oxidation product.

Isolation of lignin by hydrolysis of carbohydrates

Use of 72% sulphuric acid for hydrolysis of wood carbohydrate to wood lignin as the residue was made by the well-known lignin chemist Klason and the procedure became the basis of quantitative determination of lignin in wood. The lignin preparation thus obtained is called Klason lignin. But due to various reactive sites in lignin, treatment of wood with 72% sulphuric acid results in internal condensation in lignin and therefore a completely altered product is obtained.

Of the other known method to isolate the total lignin from plant materials, the periodate method avoids the condensation processes that cause changes in acid lignins but certain oxidative modifications occur. The method is tedious since it requires at least six successive treatments with per iodate (4.5% aqueous Na_3, 24 hour at 20^oC) each followed by a three hours treatment with boiling water. [19]

Isolation of lignin by use of solvents

In this type of method there are two categories (I) involving use of inorganic chemicals which are employed to dissolve lignin and separate the fibers from wood for paper and rayon manufacture and (II) where organic chemicals are used to take out lignin partially or completely. In both the methods, the lignin can be recovered by precipitation in a medium in which it is insoluble.

The chemicals used in the first case are either acidic or basic. In acid process, sulphurous acid and its salts with ammonium, sodium, calcium or magnesium as basic ions are used as delignifying agents. In alkaline process, either sodium hydroxide alone or in conjunction with sodium sulphide is used for delignification. These processes are commercially used for production of pulp for paper industry and lignin is obtained as a byproduct in spent liquors. The lignin from the spent liquor of acid process is known as lingo-sulphonate whereas the lignin of alkali process are known as soda or kraft lignin, the later is the case when both sodium hydroxide and sodium, sulphide are used as delignifying reagents. These commercial lignins have been put to research from lignin utilization point of view. But these lignins have little importance from chemical characterization and structural studies on lignin and its reactions as well.

Organosolvent lignin (Milled wood lignin)

Studies on preparation of pure lignin (as it occurs in wood) for its chemical characterization and studying its structures and reactions of technical importance is a subject of research which has been extensively investigated by many lignin chemists. A number of organic solvents have been tried from time to time. The most common ones used are ethanol, acetone, dioxane etc.

A method for preparing lignin as it occurs in wood was first reported by Bjorkman[31]. Milled wood was used for preparing lignin in this method.

The first observation on the effect of milling on the solubility of wood was made .Hess and Hewanann[32] studied vibratory milling in the presence of hydrazine hydrate, isolating 12 to 14% of lignin in spruce and beech woods and 19% in the flax, in the form of lignin by drazine compound. Grohn [33]demonstrated that dry vibratory milling for 48 hours makes a large part of the originally in extricable lignin soluble in organic solvents was applied to spruce wood, yielding 19.6% of a sample with a 15.8% methoxyl and 10.7% total hydroxyl content. The yield from poplar wood was 26.4% with 19.4% methoxyl and 9.6% hydroxyl. The analytical compositions of these preparations are quite close to those of milled wood lignin preparations, the isolation procedure of which was developed by Bjorkman[31]. According to the original method, wood meal is first given a pregrinding treatment in a Lampen Mill and the final milling (48 hours) is done using 1 to 5g samples suspended in a non-swelling medium such as toluene, in a vibratory ball mill developed has claimed vibratory ball milling at 2ºC to be more efficient than milling in toluene suspension, observe significant differences in millings at 78% and at ambient temperature. has demonstrated that ordinary ball milling in porcelain jars filled with fling pebbles produces adequate milling effect if the time requirement, ordinary ball milling is often more convenient for the preparation of milled wood lignin because, up to 40g of wood can be milled in a single one gallon gar, and the acquisition of a specific vibratory mill is unnecessary.

The maximum yields of milled wood lignin from conifer woods are usually approximately 50% and the same yields are obtained from normal and compression woods. Higher yields have been obtained from hardwoods. A mild alkaline pretreatment of Eucalyptus woods increase the rate of release and yield of milled wood lignin possibly as a consequence of specification of ester bonds between lignin and hemi-celluloses.

In the present investigation the method has been used for isolation of milled wood lignin.

Chemical compositions & reactive groups

Lignin is an essentially a three dimensional polymer made up of carbon, hydrogen and oxygen. As described in the first chapter the constitutional model of lignin is composed of many reactive groups such as ethers of various types, primary and secondary alcoholic hydroxyl groups, phenolic hydroxyl groups, carbonyl groups, carboxyl and ester functions, methoxyl groups, ethylene linkages and aromatic sites of phenyl propanoid structures.

However the studies in this investigation have been limited to the determination of total hydroxyl groups, phenolic hydroxyl and aliphatic hydroxyl content, carbonyl groups, and methoxyl groups which are important for studying the reactions of lignin from paper making point of view.[34]

RESULTS AND DISCUSSION

Table–I : PROXIMATE CHEMICAL ANALYSIS OF LANTANA CAMARA

S.No	Particulars of Proximate Chemical Analysis	Lantana Camara			
		Sample – I (Plant age-2 years)	Sample – II (Plant age-3 years)	Sample – III (Plant age-4 years)	Average
1	Ash Content	02.80	03.10	03.40	03.10
2	Cold Water Solubility	03.15	03.06	03.20	03.26
3	Hot Water Solubility	12.03	13.10	13.40	12.80
4	Ether Solubility	04.02	04.02	04.02	04.02
5	Alcohol Benzene Solubility	05.92	05.92	05.92	05.92
6	1% NaOH Solubility	27.18	28.92	29.20	28.43
7	Pentosan Content	17.50	18.17	18.25	17.97
8	Lignin Content	25.30	26.4	26.90	26.20
9	Holo Cellulose Content	72.07	72.01	72.09	72.72
10	Alpha Cellulose Content	39.90	42.58	43.21	41.89
11	Acetyl Content	02.320	02.320	02.320	02.320
12	Methoxly Content	05.70	05.70	05.70	05.70
13	Uronic Anhydride	02.70	02.71	02.40	02.20
14	Cross & Bevan Cellulose	40.00	42.00	42.00	43.00
15	Cellulose Content	39.90	42.58	41.20	41.22

Table–II:PROXIMATE CHEMICAL ANALYSIS OF PROSOPIS CHINENSIS

S.No	Particulars of Proximate Chemical Analysis	Prosopis Chinensis			
		Sample – I (Plant age-5 years)	Sample – II (Plant age-7 years)	Sample – III (Plant age-10 years)	Average
1	Ash Content	02.30	02.50	02.60	02.46
2	Cold Water Solubility	02.40	02.60	02.80	02.70
3	Hot Water Solubility	10.70	09.80	09.40	09.90
4	Ether Solubility	05.03	05.08	05.10	05.36
5	Alcohol Benzene Solubility	04.32	04.32	04.32	04.32
6	1% NaOH Solubility	23.80	26.40	27.20	25.80
7	Pentosan Content	14.90	13.93	13.24	14.02
8	Lignin Content	26.50	27.50	28.20	27.40
9	Holo Cellulose Content	69.11	71.50	71.70	70.77
10	Alpha Cellulose Content	46.80	49.09	49.90	48.59
11	Acetyl Content	02.21	02.33	02.36	02.30
12	Methoxly Content	03.00	03.020	03.10	03.10
13	Uronic Anhydride	03.07	0317	03.27	03.27
14	Cross & Bevan Cellulose	50.80	51.00	51.50	51.80
15	Cellulose Content	49.09	49.99	49.89	49.89

Table– III: PROXIMATE CHEMICAL ANALYSIS OF SOME INDIGENOUS WOODS (% on dry basis)

S.No	Particulars of Chemical Analysis	Euclayputs Hybrid	Bamboo	Piuns strobes (Pine)	Progeisus Latti Floria	Boswelia Serrata	Ipomoea Carena Jacq	Bagasse	Kenaf	Lantana Camara	Prosopis Chinensis
1	2	3	4	5	6	7	8	9	10	11	12
1	Ash Content	00.32	04.10	00.18	02.00	02.50	06.14	01.90	04.20	03.10	02.46
2	Cold Water Solubility	02.30	04.40	03.26	04.40	02.60	07.39	05.20	04.00	03.26	02.70
3	Hot Water Solubility	03.20	05.80	04.43	06.50	05.10	12.90	06.30	08.60	12.80	09.90
4	Alcohol Benzene Solubility	01.01	04.32	09.77	05.92	03.20	07.90	02.70	03.00	05.92	04.32
5	Ether Solubility	01.00	00.31	05.88	01.89	-	03.29	-	-	04.08	05.36
6	1% NaOH Solubility	14.00	26.10	19.10	17.30	19.60	27.80	18.70	30.00	28.43	25.80
7	Pentosan Content	22.09	17.07	05.82	12.00	22.20	17.13	15.08	17.09	17.97	14.02
8	Lignin Content	27.20	27.20	25.60	26.30	24.30	18.03	19.02	18.00	26.20	27.40
9	Holo Cellulose Content	70.00	66.00	66.60	62.40	68.00	66.96	68.04	66.26	72.72	70.77
10	Acetly content	00.79	02.50	01.15	-	03.70	0450	-	-	02.320	
11	Methoxyl content	07.20	03.10	05.17	-	-	04.50	-	-	05.70	03.10
12	Cross & Bevan Cellulose	51.80	57.0	-	58.00	02.320	40.84	-	-	53.20	51.80
13	Cellulose content	44.00	51.20	58.10	56.00	50.40	33.66	04.60	-	40.09	49.89
14	Uronic Anlydride	03.50		03.27	03.92		03.56	-	-	02.20	03.27

Table– 1V : ELEMENT COMPOSITION AND C_9 FORMULA OF **LANTANA CAMARA &** PROPOSIS **CHINENSIS**

Species	% Carbon	% Hydrogen	% Oxygen	% Methoxy OCH_3	C_9 Formula	Formula Weight
Lantana Camara	56.2	5.80	36.00	19.70	C9H8.12O3.40(OCH3)1.37	212.99
Prosopis Chinensis	60.70	6.30	33.00	19.78	C9H8.75O2.85(OCH3)1.39	204.82

Formula = C9H8.12O3.40(OCH3)1.37 Formula = C9H8.75O2.85(OCH3)1.39
Formula Weight = 212.99 Formula Weight = 204.82

Table– V : COMPOSITION OF C_9 FORMULA OF MILD WOOD LIGNIN OF SOME OTHER HARDWOOD

S.No	Species	% Carbon	% Hydrogen	% Oxygen	C_9 Formula	Formula weight
1.	Termanala Tomentoa	56.4	5.6	38.0	$C_9H_{7.75}O_{2.32}(OCH_3)_{1.64}$	203.71
2.	Bosswelia Serrata	57.1	5.8	33.1	$C_9H_{8.97}O_{3.06}(OCH_3)_{1.49}$	211.59
3.	Xylia xylocarpa	60.7	6.3	33	$C_9H_{8.76}O_{2.56}(OCH_3)_{1.37}$	205.06
4.	Pterocarpus Marsupu,	58.2	5.8	36	$C_9H_{8.12}O_{3.40}(OCH_3)_{1.37}$	212.97
5.	Beech	60.3	6.3	33.40	$C_9H_{8.79}O_{2.90}OCH_3)_{1.44}$	207.83
6.	Aspen	60.4	6.2	33.0	$C_9H_{8.59}O_{2.86}(OCH_3)_{1.99}$	206.99
7.	Maple	60.37	5.68	33.95	$C_9H_{7.64}O_{3.019}(OCH_3)_{1.34}$	205.48

Table–VI : REACTIVE GROUPS OF MILD WOOD LIGNINS OF TROPICAL HARDWOODS

S.No.	Species	OCH_3 per C_9 unit	CO per C_9unit	Total OH per C_9 unit	Phenolic OH per C_9 unit
1.	Terminalia Tomentosa	22.5	0.21	13.76	0.34
2.	Bosswelia Serrata	21.0	0.24	10.70	0.42
3.	Xylia xylocarpa	20.8	0.24	12.00	0.42
4.	Pterocarpus Marsupu,	19.7	0.22	11.60	0.35

A comparative study reveals the following facts related to Lantana Camara &Prosopis Chinensis (woody raw material).From Proximate chemical analysis the results investigated are depicted in Table-I & II. It gives the idea that an abnormality or decay may be noted from this result since non wood after preparation of the sample was tested for the following ash content, holocellulose content, hot water, cold water solubility, pentosans content, non cellulose content, alcohol benzene solubility and lignin content. The study of chemical analysis reveals that the ash content and other solubility are higher than bamboo, kanef, Bagasses and hard wood but lower than Ipomoea Carena Jacq .Ash content of wood gives the qualitative idea about the mineral salt present. It also represents the non volatile plus combustible and inorganic portion of the fiber material. Cold and hot water solubility are higher than kanef and hard wood. Water solubility gives the idea about lower molecular weight components and polysacharides. The low value of hot water solubility is more flexible for good pulp The alcohol benzene solubility is higher than other wood but lower than pine. It gives the idea of waxes, fats, resins and certain other soluble contents. Other solubility increases moderately. 1 % NaOH solubility is lower than kanef but higher than hard wood, bamboo, Bagassess and other non-woody plants respectively. They give the idea about fungal decay during age. It shows that the extent of fungal decay causes alkali solubility and decrease in pulp yield. The low alkali solubility is more favorable for good pulping. The chief constituents of paper making is holocellulose which is present in Lantana Camara & Prosopis Chinensis. It is 6% & 4% higher than bamboo and 2% higher than eucalyptus. The chief constituents of paper making is holocellulose which is present in Lantana Camara & Prosopis Chinensis 6% higher than bamboo and 2% higher than eucalyptus. In fact holocellulose value is high which indicates the good sign of pulp production. The plant kingdom generally term hemicellulose which is composed of cellulose and holocellulose. The holocellulose content is the qualitative indication of fibre raw material inflorescence. Consideration of its solubility of pulp and paper making, it may be pointed out that the presence of more percentage of cellulose is again a good quality. The comparative study of percentage composition of α β, cellulose & hemicelluloses reveals that all contents of a plant increase with its growth encounters to this the hemi cellulose content are less with respect to α,β cellulose which is a positive symptom for using a better raw material for pulp and paper making industries.[35]

The percentage value of acetyl, methoxyl and uronic anhydride content gradually increases with the age factor. Acetyl group are combined with polysaccharide portion of non woody plant. Methyl group are present in the lignin and they characteristic lignin. These finding are very close to the result of Singh(1971), Agrawal (1982) Nassan (1995) P.K. Sharma (1997).[36]

Pentosan analysis value of Lantana Camara & Prosopis Chinensis are lower than hard wood and equal to Bamboo but higher than baggage similar result are observed by Khare (1983) and Brochardt (1993)[37,38]

The result of elemental composition of soda lignin of Lantana Camara &Prosopis Chinensis investigated is depicted in Table-IV.

Lignin macromolecule is a three dimensional polymer made up of phenyl propane unit and therefore empirically it can be best represented by C_6-C_3 or C_9 formula. It is a principal carrier of methoxyl group in its aromatic structure. Representation of methoxyl group is also included in C_9 formula.

Table V shows the elemental composition, C_9 formula and the formula weight of mild wood lignin of wood species. On comparing the tables IV & V ,it is found that number of hydrogen is lowest which shows that the lignin is in more condensed from oxygen is highest in Lantana Camara & Prosopis Chinensis as compared to that of the species mentioned in table V. Its methoxyl value is 1.64/ C_9 which is almost equal to that of Termanolia.C_9 formula of Lantana Camara & Prosopis Chinensis was found to be Formula =

$$\mathbf{C_9H_{8.12}O_{3.40}(OCH_3)_{1.37}\ \&\ C_9H_{8.75}O_{2.85}(OCH_3)_{1.39}}\text{ respectively.}$$

The constitutional model of lignin is composed of many reactive groups such as methoxyl carbonyl and hydroxyl and furfural group. The Table IV shows the results of the group determined in Lantana Camara & Prosopis Chinensis ,the methoxyl content per C_9 unit in the lignin is 25% Carbonyl group per C_9 unit is 0.24% ,total phenolic hydroxyl content per C_9 unit is of the order 0.42% furfural content per C_9 unit was found to be nil on comparing the results, the reactive groups in Lantana Camara & Prosopis Chinensis was same with that of Bossewelia Serrata (table V) .

CONCLUSION

The experimental results as shown reveals that the reactive groups identified through milled wood lignin analysis of Prosopis Chinensis & Lantana Camara are same as that of Bossewelia Serrata which is a commonly used raw material for pulp & paper manufacturing. This will help replacing the existing sources of pulp & paper manufacturing by abundantly available, eco friendly & cheap raw material i.e. Lantana Camara & Prosopis Chinensis. The study has provided the chemical constituents & structure elucidation of Lantana Camara & Prosopis Chinensis which will be of immense importance for further research work. This has indicated that the lignin prepared from wood species Lantana Camara contains carbon 56. 2%, hydrogen 5.80% ,oxygen 36.00% and methoxy groups 19.70%. Prosopis Chinensis contains carbon 60.70% ,hydrogen 6.30%, oxygen 33.00% and methoxy groups 19.78%. The C_9 formula weight for Lantana Camara & Prosopis Chinensis is 212.99 & 204.82 respectively . The other reactive groups of lignin of lantana Camara & Prosopis Chinensis investigated were also comparable with the other non wood species.

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