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**YY Sumthane**

Department of Forest Products,  
Dr. Y.S. Parmar University of  
Horticulture and Forestry,  
Nauni, Solan, H.P, India

**KR Sharma**

Department of Forest Products,  
Dr. Y.S. Parmar University of  
Horticulture and Forestry,  
Nauni, Solan, H.P, India

## Studies on Cell wall substances of Toon wood procured from local markets of Himachal Pradesh

**YY Sumthane and KR Sharma**

### Abstract

Wood as a product of biological development is a complex substance both anatomically and chemically. It is a heterogeneous substance differing markedly between trees of different species, to some extent between individuals of the same species and not unoften even from part to part within the same tree of trunk and branch or sapwood and heartwood. Cell wall substance is a chemical treatment of wood it provide the knowledge of the chemistry of wood and its components is therefore an essential preliminary to the understanding of the principles and techniques in the different fields of chemical utilization. Generally wood contains cell wall substances it is components of cell wall mainly contains holocellulose and lignin. Among the different market sites average maximum holocellulose content (72.34%) was recorded in Bhalja. The minimum value (67.03%) was noticed in Baroh. Lignin was recorded highest in Kheri (24.65%) and the lowest value (21.70%) was found in Rajgarh. Holocellulose, which partly skeletal and incrusting and partly reserve materials they occur not only as cell wall constitutes and their incrustations but also within the cell. They were extractable with dilute alkalis and not with water and are readily hydrolysis to the constituent sugars and a sugar acids by boiling with dilute mineral acids. They appear to be in some sort of chemical combination with the other cell wall components namely cellulose and lignin because while they were not extractable with water from the original material they become soluble in the same solvent when once they were isolated.

**Keywords:** Wood, holocellulose, lignin, toon, cellulose

### 1. Introduction

Toon (*Toona ciliata* M. Roem.) a native tree of Afghanistan belong to family Meliaceae, It is commonly known as red-cedar and also spelled tooni or toon is a large deciduous moderate light demanding tree with a spreading crown, attaining a height of 20-30 m and 1.8-3m of girth. It grows best in small gaps in the forest and cultivated fields. It occurs frequently on moist localities such as ravines, stream banks or swamps with best growth in deep rich moist loamy soil including cultivated fields and often found growing on roadsides. In Himachal Pradesh it is found in humid and sub-humid subtropical zone and lower areas of wet temperate zone climatically being distributed all over Shiwalik region and Flood Plains. As toon tree has a wide distribution with varying climatic and edaphic factor lead to difference in its wood timber quality. While inert in many respects wood is readily oxidised dissolved or converted into some other products under suitable conditions or treatments. The chemical utilization of wood will come up for study under several headings such as pulping, hydrolysis and destructive distillation or chemical treatments designed to improve the properties of wood. Knowledge of the chemistry of wood and its components is therefore an essential preliminary to the understanding of the principles and techniques in the different fields of chemical utilization.

### Material and methods

Klason-lignin content (T12m-59-Anonymous, 1959c)

Two grams oven dry sample pre-extracted with alcohol-benzene (1:2 v/v) was treated with 15 ml of 72 per cent sulphuric acid for 2 hours at 18-20°C with constant stirring. The material was brought down to 3 per cent by adding 345 ml of double distilled water. The solution was refluxed for 4 hours and then allowed to settle. The contents were filtered, washed with hot distilled water and dried in an oven at 105 ± 2°C till constant weight and expressed in percentage on oven dry weight basis.

### Holocellulose (T9m-59-Anonymous, 1959)

Five grams oven dry sample pre-extracted with alcohol-benzene (1:2 v/v) was taken in a conical flask and 160 ml of distilled water was added to it.

### Correspondence

**YY Sumthane**

Department of Forest Products,  
Dr. Y.S. Parmar University of  
Horticulture and Forestry,  
Nauni, Solan, H.P, India

The contents were treated with 1.5 gram of sodium chlorite and 10 drops of acetic acid at 70-80 °C on a water bath for one hour. The process was repeated four times till the meal became white. The contents were then filtered through IG-2 crucible, washed with water and finally with acetone. The sample was dried in an oven at 105 ± 2 °C to a constant weight. The extracted holocellulose content was calculated on the basis of the oven dry weight.

## Results and Discussion

Holocellulose, which constitute cellulose and hemicelluloses, is the major portion of fibrous raw material. Lignin is highly amorphous phenolic polymer of indeterminate molecular weight and it is responsible for providing stiffness to the cell wall. It also serves to bond individual cells together in the middle lamella region. The data on average content of holocellulose and lignin of *Toona ciliata* wood samples from different market sites are presented in Table 1. Statistical analysis carried out on data for all the parameters were found to be significant at 5% level of significance.

**Table 1:** Average content of Holocellulose and Lignin of *Toona ciliata*

S. No	Sites	Holocellulose (%)	Lignin (%)
1	Badibhu (Solan)	69.06	23.68
2	Baroh (Kangra)	67.03	23.53
3	Bhalja (Sirmaur)	72.34	22.63
4	Bijhari (Hamirpur)	68.27	23.95
5	Galore (Hamirpur)	71.14	23.93
6	Ghumarwin (Bilaspur)	71.85	24.23
7	Kandaror (Bilaspur)	70.96	23.63
8	Kheri (Hamirpur)	69.53	24.65
9	Nauni (Solan)	68.65	24.08
10	Nainikhad (Chamba)	68.54	22.83
11	Rajgarh (Sirmaur)	68.00	21.70
12	Sarahan (Sirmaur)	67.97	23.25
13	Shambhuwala (Mandi)	70.26	24.58
14	Shahpur (Kangra)	70.29	21.83
15	Soutta (Hamirpur)	70.26	24.15
16	Wasni (Sirmaur)	72.05	23.50
	Mean	69.76	23.51
	SE (d)	1.60	0.85
	CD <sub>0.05</sub>	3.25	1.73

Among the different market sites average maximum holocellulose content (72.34%) was recorded in Bhaljawhich was statistically at par with Wasni (72.05%) followed by Ghumarwin (71.85%), Galore (71.14%), Kandaror (70.96%), Shahpur (70.29%), Shambuwala (70.26%) and Soutta (70.26%). The minimum value (67.03%) was noticed in Baroh which was statistically at par with Sarahan (67.97%), Rajgarh (68.00%), Bijhari (68.27%), Nainikhad (68.54%), Nauni (68.65%), Badibhu (69.06%), Kheri (69.53%), Sautta (70.26%), Shambuwala (70.26%) and Shahpur (70.29%).

Lignin was recorded highest in Kheri (24.65%) which was statistically at par with Shambuwala (24.58%), Ghumarwin (24.23%), Soutta (24.15%), Nauni (24.08%), Bijhari (23.95%), Galore (23.93%), Badibhu (23.68%), Kandaror (23.63%), Baroh (23.53%), Wasni (23.50%) and Sarahan (23.25%). The lowest value (21.70%) was found in Rajgarh which was statistically at par with Shahpur (21.83%), Bhalja (22.63%), Nainikhad (22.82%) and Sarahan (23.25%).

Lignin is distributed throughout the secondary cell wall with the highest concentration in middle lamella. Because of the difference in volume of middle lamella and secondary cell wall, about 70 per cent of the lignin is located in cell wall. Lignin provides stiffness to the secondary cell wall, cohesion between cells, and consequently to wood tissue (Carpita & McCann, 2000) [4], and it has a strong influence on

mechanical properties of wood (Nakajima *et al.*, 2009) [6]. Lignins from hardwood is mainly a polymerization product of coniferyl alcohol and are called "guaiacol lignin". Lignin found in woods contain significant amounts of constituents other than guaiacol units (Sarkanen and Ludwig, 1971) [8]. Lignin content varies among species, individuals and within plant as have been reported by Belem and Harkin (1975) [2]. The variation can be due to age, variation in site or variation due to accumulation of different amount of lignin in different parts. Admopolous *et al.*, (2005) studied the variation of lignin content from top to bottom.

The major carbohydrate portion of wood is made up of holocellulose (40-45% cellulose and 15-25% hemicelluloses) i.e., 65-70% of the dry weight (Rowell, 2013) [7]. In present study, there is significant difference in both holocellulose and lignin contents of wood. The lignocellulosic materials having higher lignin have lower holocellulose content and vice-versa (Sharma, 1997) [9]. Sczukowski *et al.*, (2008) [10] have reported variation in lignin and holocellulose contents of *Salix viminalis* and its cross with *Salix purpurea*. Guller *et al.*, (2007) [5] have observed an increase in holocellulose content from juvenile to maturity stage (64.7 to 72.2%).

## Conclusion

Chemical study of wood helps to observed the cell wall constituents of the species and it showed the species value regarding exact use of the species. Holocellulose and lignin these are main componebt help to know the species use full for paper and pulp industries. According to results *Toona ciliata* is good for paper and pulp making.

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