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COMPARISON OF HOLOCELLULOSE, ALPHACELLULOSE AND LIGNIN CONTENTS OF TRUNK AND BRANCH WOOD OF SOME CONIFERS OF PAKISTAN.

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Summary

Trunk and branch wood of seven conifers viz. *Abies pindrow, Cedrus deodara, Juniperus polycarpos, Pinus halepensis, P. roxburghii, P. roxburghii-americana* and *P. wallichiana* were compared for holocellulose, alphacellulose and lignin contents. Holocellulose content in branchwood of *C. deodara, J. polycarpos, P. halepensis* and *P. roxburghii-americana* was comparable with the corresponding values for their trunkwood. The branchwood of *A. pindrow, P. roxburghii* and *P. wallichiana* contained slightly lower holocellulose content as compared to trunkwood. Amount of alphacellulose in branch and trunk wood was comparable in *C. deodara, J. polycarpos, P. roxburghii-americana* and *P. wallichiana* while in trunkwood of *A. pindrow, P. halepensis* and *P. roxburghii* amount of alphacellulose was slightly higher than branchwood. Lignin content of trunk and branchwood was comparable in *A. pindrow, C. deodara,* and *P. roxburghii-americana* whereas in the remaining species lignin content of trunk and branch wood showed little variation.

Introduction

In developing countries like Pakistan, wood is in great demand by the wood based industries. The coniferous trees, of which Nasir et al (1969) have reported 10 genera comprising 20 species from Pakistn, are the chief forest makers of Pakistan. The importance of coniferous trees for timber, pulp & paper industry, resins, gums, etc. is well understood throughout the world. In Pakistan the importance of this wealth is no less. Coniferous wood is regarded as ideal raw material for pulp & paper manufacture but in Pakistan, which is short of forests, coniferous wood is the major source of timber and hence their trunkwood can not be freely used in pulp and paper industry. Present work was carried out to compare cellulose and lignin contents of trunk and branch wood of seven coniferous species.

Materials and Methods

Wood samples were obtained from sound and healthy trees growing under forest conditions. Samples were collected from trunks as well as branches of the same trees. Wood chips were ground in an Apex – knife grinder and the fraction of wood meals which passed a British standard 40 mesh sieve (420 um) and retained on BS 60 mesh sieve (250 um) was used for analyses. Analysis of holocellulose, alphacellulose and lignin were carried out from extractive Methods. Holocellulose was extracted by modified chlorite method of Wise et al (1946) developed by Erickson (1962). Trials were run and it was found that six one-hour sodium-

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chlorite cycles were required to fully delignify the wood. Holocellulose prepared by the method of Erickson was subsequently used for extraction of alphacellulose. Alphacellulose content was estimated as described by Siddiqui (1976). Lignin content was determined by TAPPI Standard Method T13-m-54.

Results

Values of holocellulose, alphacellulose and lignin contents of trunk and branch wood are goven in Table 1.

Amount of holocellulose in trunkwood ranged between 63.87-72.40% being highest in *C. deodara* and lowest in *J. polycarpos.* On the other hand in branchwood of *P. halepensis* contained maximum (71.73%) and *A. pindrow* / minimum (61.45%) holocellulose. Alphacellulose content of trunkwood varied vetween 39.67-48.00%, being maximum in *P. halepensis* and minimum in *P. wallichiana* whereas in branchwood its values ranged between 33.8743.26%, *P. halepensis* containing maximum and *A. pindrow* showing minimum. Amount of lignin in trunkwood was found highest in *C. deodara* (41.33%) and lowest in *P. halepensis* (25.28%) while for branchwood its values varied between (31.40-40.93% being maximum in *P. roxburghii* and minimum in *J. polycarpos.*

TABLE 1.

Holocellulose, alphacellulose and lignin contents of trunk and branchwood of some conifers of Pakistan (all values in percent of extractive free wood).

S.No.	Species	Holocellulose		alphacellulose		Lignin	
		TW	BW	TW	BW	TW	BW
1.	*Abies pindrow*	67.95 ± 0.31	61.45 ± 0.52	47.67 ± 0.55	33.87 ± 0.12	36.36 ± 0.55	38.28 ± 0.47
2.	*Cedrus deodara*	72.40 ± 0.61	71.33 ± 0.88	42.33 ± 0.99	42.33 ± 0.76	41.33 ± 0.64	39.33 ± 0.86
3.	*Juniperus polycarpos*	63.87 ± 0.32	65.00 ± 0.33	41.51 ± 0.25	42.22 ± 0.21	35.97 ± 0.16	31.40 ± 0.30
4.	*Pinus halepensis*	68.94 ± 0.23	71.73 ± 0.86	48.00 ± 0.26	43.26 ± 0.40	25.28 ± 0.04	31.80 ± 0.25
5.	*P. roxburghii*	70.09 ± 0.93	61.67 ± 0.63	46.80 ± 0.94	37.40 ± 0.11	30.86 ± 0.34	40.93 ± 0.38
6.	*P. roxburghii-americana*	70.26 ± 0.48	70.73 ± 0.86	43.33 ± 0.46	40.73 ± 0.98	30.33 ± 0.29	31.80 ± 0.25
7.	*P. wallichiana*	70.75 ± 0.15	65.57 ± 0.41	39.61 ± 0.11	36.35 ± 0.34	30.48 ± 0.58	34.70 ± 0.58

TW = Trunkwood BW = Branchwood.

Discussion

In trunk and branch wood of *C. deodara, J. polycarpos, P. halpensis* and *P. roxburghii-americana* amount of holocellulose was camparable while in branchwood of *A. pindrow, P. roxburghii* and *P. wallichiana,* holocellulose content was slightly lower than trunkwood of the same species. Trunk and branchwoods of *C. deodara, J. Polycarpos, P. roxburghii-americana* and *P. Wallichiana* were comparable with respect to alphacellulose content whereas in branchwood of *A. pindrow, P. halepensis* and *P. roxburghii,* amount alphacellulose was lower than the trunkwood. In trunk and branchwood of *A. pindrow, C. deodara* and *P. roxburghii-americana,* the amount of lignin was comparable but in *J. polycarpos, P. halepensis* and *P. roxburghii,* trunk and branchwood varied in lignin content.

From the present results it may be infered that branchwood of these conifers is also a potential source of cellulose like industry. However, establishing suitability of branchwood of a particular species as raw material for pulp and paper manufacture a number of parameters e. g. wood density , bark/wood ratio, fiber dimensions and derived values, pulping and bleaching conditions, physical characteristics of unbleached and bleached pulp, etc, must be taken into consideration. Further research is needed in these lines.

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REFERENCES

Erickson, H.D. (1962). Some aspects of method in determining cellulose in wood. *Tappi,* 45:710-719.

Nasir, E; M.A. Siddiqi and Ali, Z. (1969). *Gymnosperms of West Pakistan,* Botany Department Gordon College, Rawalpindi, Pakistan. PP. 21.

Siddiqui, K. M. (1976). Relationship between cell wall morphology and chemical composition of early wood and latewood in two coniferous species. Pak, J. For. 26: 21–34.

The Technical Association of the Pulp and Paper Industry (1975). *Standard and suggested, methods,* TAPPI, Georgia, U. S. A

Wise, L. E; M. Murphy and A.A. D' Addieco (1946). Chlorite holocellulose, its fractionation and bearing on summative wood analysis and on studies on the hemicellulose. *Paper Trade Journal.* 122 (2) : 35–43.