

Delignification of Agricultural Residues by Hydrotropic - Agents

BHORKAR, A. N.*, CHEDE, S. K.*, DHOBLE, S. B.*, DHAKE, J. D.**

INTRODUCTION

Alongwith search for new raw materials for producing paper and board, new delignifying systems are also being developed by many investigators and delignification by using hydrotropic reagents is one of them. Hydrotropic substances are generally water soluble compounds which effect greater solubility of insoluble or slightly soluble substances than does pure water at the same temperature.

Such hydrotropic salt solutions were first proposed by McKee (1-6) who together with his students made numerous investigations on hydrotropic delignification. Most extensive work has been carried out in Russia by Gromove and co-workers (5-8). McKee has com-

pared the Kraft process with hydrotropic process and observed that latter is superior in lower chemical consumption, better pulp quality, less equipment investment and no air pollution. However the process is yet not commercialized.

The present work deals with the delignification of locally available agricultural residues and waste gunny bags, which form a raw material in the hand-made paper industry. The object of this work is to study the relative ability for the removal of lignin from waste gunny bags, cotton stalks, tuar stalks, wheat straw and rice straw by aqueous solutions of Sodium Benzene Sulphonate (S.B.S.) and Urea and Ammonium Sulphate (U.A.S.)

TABLE-I
HYDROTROPIC DELIGNIFICATION AT ROOM TEMP. AND ATMOSPHERIC PRESSURE
FOR 24 HRS

Material	Hydrotropic reagent	Concentration of Hydrotropic reagent %	Original lignin %	Lignin remaining after treatment %	Lignin removed of original %
Jute waste.	S.B.S.	20	21.14	13.31	37.00
		40	—do—	9.79	53.69
		60	—do—	10.15	48.20
	U.A.S.	20	—do—	14.59	31.00
		40	—do—	11.63	45.01
Cotton stalks.	S.B.S.	20	22.9	9.51	58.4
		40	—do—	8.53	64.5
		60	—do—	9.18	59.9
	U.A.S.	20	—do—	11.64	49.6
		40	—do—	10.00	56.7
Rice straw.	S.B.S.	20	22.9	15.78	43.68
		40	—do—	14.43	48.50
		60	—do—	14.42	48.61
	U.A.S.	20	28.02	19.40	30.76
		40	—do—	11.41	59.28
Tuar stalks.	S.B.S.	20	23.82	14.18	40.47
		40	—do—	12.33	48.23
	U.A.S.	60	—do—	12.13	49.07
		20	—do—	15.80	33.66
		40	—do—	15.18	36.31

* Students, ** Professor, L.I.T.
Nagpur University, Nagpur.

TABLE - II
RESULT OF HYDROTROPIC DELIGNIFICATION AT 115°C AND 15 PSI FOR 2.5 HOURS

Material	Reagent.	Concentration of reagent. %	Original lignin. %	Lignin remaining after treatment. %	Lignin removed of original %
Jute waste.	S.B.S.	20	21.14	13.68	38.0
		40	—do—	90.0	57.1
		60	—do—	10.70	50.1
	U.A.S.	20	—do—	13.90	34.42
		40	—do—	10.13	52.30
Cotton stalks.	S.B.S.	20	22.9	9.08	60.3
		40	—do—	6.92	69.8
		60	—do—	8.16	62.3
	U.A.S.	20	—do—	10.95	52.2
		40	—do—	8.45	63.1
Wheat straw.	S.B.S.	40	26.8	10.1	62.32
	U.A.S.	40	—do—	14.5	46.2
Rice straw.	S.B.S.	20	26.8	7.87	71.91
		40	—do—	6.97	75.11
		60	—do—	6.99	75.04
	U.A.S.	20	28.02	7.52	73.16
		40	—do—	9.77	65.13
Tuar stalks.	S.B.S.	20		9.52	58.64
		40		6.90	10.03
		60		6.93	69.80
	U.A.S.	20	23.02	9.82	57.35
		40		8.00	65.25

EXPERIMENTAL

Straws and stalks were well washed with water to remove dirt and other foreign material and then dried. A meshed sample of (—40+60) was obtained for experiments. Waste in jute sample was obtained by washing waste gunny bags with water to remove dirt, drying and cutting into small pieces.

Experimental samples were steeped in aqueous solutions of hydrotropic agents of different concentrations (raw material : liquor ratio as 1:8) at room temp. for 24 hrs. After steeping period the sample was separated completely from the liquor by filtration under suction, washed with 10% hydrotropic solution followed by a wash with distilled water. The washed material was then dried in oven and the lignin content of the delignified sample was determined according to TAPPI Standards. The results are given in Table-I.

Results of delignification at 115°C. and 15 p.s.i. for 2.5 hrs. are given in Table-II.

DISCUSSION

It is observed that sodium benzene sulphonate is more effective than mixture of urea and ammonium sulphate. More than 50% of original lignin is removed by sodium benzene sulphonate from jute waste, cotton, straw at room temp. by using 40% concentration of the reagents. It is observed from Table-II, that at increased temp. and pressure both reagents can remove near about or more than 60% of the

original lignin from jute waste, cotton stalks, rice straw and tuar stalks. It is also seen from Table-I and II that increasing the concentration of reagents above 40% does not increase its ability to remove lignin and 40% concentration appears to be the most desirable.

REFERENCES

- 1) McKee, R.H., U.S. Pat. I, 929, 438 (Oct 10, 1933).
- 2) McKee, R.H., Ind. Ing. Chem, 38, 382-4 (1946).
- 3) Pelipetz, M.G., Ph.D. Dissertation, Columbia Uni. (1937).
- 4) Lan. Hng., Paper Indus. Paper World 23,247 (1941).
- 5) Gromov, V. and Odincov, P., Trudy Inst. Lesokhoz. problem. Akad. Nauk Latv. S.S.R., Voprosy lesokhim i Khim Drevesiny 12:63-78, 79-90, 91-100 (1957). (C.A. 52 : 21080 g; 210819).
- 6) Gromov, V. and Odincov, P., Trudy inst. Lesokhoz. problem. Akad. Nauk Latv. S.S.R., Voprosy Lesokhim i Khim Drevesiny 17: 93-103 (1959) (C.A. 54 : 10318 b).
- 7) Gromov, V., Trudy Inst. Lesokhoz. Problem. Akad. Nauk Latv. S.S.R., Voprosy Lesokhim i Khim Drevesiny 17 : 105-14 (1959) (C.A. 54 : 233118 i).
- 8) Gromov, V. and Tupureine, A.D., Trudy Inst. Lesokhoz. problem. Akad. Nauk Latv. S.S.R., Voprosy Lesokhim i Rhim Drevesiny 19 : 169-76, 177-83 (1960) (C.A., 55: 4951 h ; 5945 C).
- 9) Technical Association of Pulp and Paper Industries TAPPI, Standards, 360, Lexington Avenue, New York-10017.