

Determination of permanganate and kappanumber of pulps with high ASH content

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The oxidative methods using potassium permanganate as oxidant (permanganate number and kappa number)^{1,2,3} & ⁴ are fairly established to assess the extent of delignification, the requirement of bleaching chemicals of pulps and also for comparing the quality of different pulps.

The above tests are related to the volume of 0.1 N potassium permanganate, consumed by 1.0 g. O.D. pulp under specific reaction conditions where by the residual lignin in pulp is quantitatively oxidised by the potassium permanganate. The presence of small quantity of ash i.e. below 2%, in most of softwoods⁵ and bamboo pulps⁶ does not significantly interfere with the oxidation reaction nor does it influence the final permanganate values. However, the test can be accurately carried out only for pulps having a low ash content (2-3%) since the pulp weight is not corrected for ash content.

In India and other rice producing countries, rice straw is abundantly used as a raw material for pulping and paper-making and is thus subjected to the above test procedure for determination of permanganate number and kappa number.

In the case of rice straw pulp, the ash content is significantly high 10-20%^{7,8,9} and in determination of kappa/permanganate number, the actual quantity (ash free) of pulp taken for the reaction with permanganate is effectively less than 1.0 ± 0.02 g which leads to erroneous results. The magnitude of error increases with increase in ash content of the pulp and gives correspondingly lower kappa/permanganate number values, compared to ash corrected pulps. Further, when comparing straw pulps having different ash content for their extent of delignification, the comparison becomes erroneous, since the actual weight of ash free pulp is different in each case. In Table-I, the permanganate numbers of rice straw pulps with and without ash correction are recorded.

In order to confirm the validity of this assumption

tion rice straw pulps having same KmnO_4 number but different ash content Table-II were examined for their bleaching chemical requirement, final brightness etc. Bleaching (using C.E.H. sequence) was carried out at optimized conditions Table-III. It can be

TABLE-1 PULPING OF RICE STRAW*

1. Chemical (NaOH as such)	%	8	10	14
2. Ash in the pulp	%	20.0	15.4	9.2
3. K. No. (25 ml) as such		7.8	6.5	5.7
4. K. No. (25 ml) on ash free basis		9.5	7.5	6.4
5. Error in weight of O.D. Pulp	%	20.0	15.4	9.2
6. Error in K. No.	%	18.0	15.0	10.0
*Cooking Conditions — 50 — 140°C — 1.0 hrs				
At 140°C — 1.5 hrs				
Bath Ratio — 1 : 4				

TABLE-2 PREPARATION OF PULPS WITH SAME KMnO_4 No. BUT DIFFERENT ASH CONTENTS

Particulars		Cook-1	Cook-2
1. NaOH on O.D. Straw	%	6.0	11.0
2. Maximum temperature	°C	160	130
3. Time to maximum temperature	hrs	1.0	0.75
4. Time at maximum temperature	hrs	0	0
5. Ash in the pulp	%	19.57	8.08
6. KMnO_4 number of the Pulp.	Nos	13.5	13.5

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TABLE- III BLEACHING OF PULP*

Particulars	Pulp 1					Pulp-2				
CHLORINATION										
Cl ₂ added, %	2.0	3.0	4.0	5.0**	6.0	2.0	3.0	4.0	5.0	6.0**
Cl ₂ consumed, %	1.98	2.94	3.78	4.43	5.36	1.97	2.96	3.94	4.94	5.78
Final pH	4.7	2.8	2.4	2.1	2.1	5.0	4.9	3.5	2.9	2.4
ALKALI EXTRACTION										
NaOH added, %	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2	1.2
A.E. pulp KMnO ₄ No.	6.4	4.1	2.4	2.0	1.8	7.3	5.3	4.4	3.2	2.5
HYPO STAGE										
Cl ₂ added, %	1.0	1.5	2.0	2.5		1.5	2.0	2.5	3.0	
Cl ₂ consumed, %	0.93	1.32	1.68	1.68		1.37	1.83	2.27	2.69	
Final pH	7.8	7.5	7.4	7.2		7.1	6.9	6.8	6.6	
Brightness % (Elrepho)	80.2	81.0	82.4	82.6		79.0	82.1	83.6	84.6	

* Constant conditions

a) Chemicals were added on OD unbleached pulp basis			
b) Consistency, %	C	E	H
	3.0	5.0	5.0
Temperature °C	Ambient	50	40
Ret. time, hr	0.5	1.0	2.0

** Taken as optimum condition and further processed for hypo stage.

observed from this table that pulp having low ash content required more bleaching chemical compared to the other pulp, thus confirming our view.

CONCLUSION :

It is suggested that for pulps having a high ash content (eg. straw etc.) the determination of permanganate/kappa number should be carried out on actual pulp basis. after correcting the weight of pulp for % ash content. The results thus obtained will be more appropriate for controlling the process parameters in plant operation.

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