Journal of Scientific Insights
E-ISSN: 3062-8571
DOI: https://doi.org/10.69930/jsi.v2i4.482
Research Article

ScienceTech. Group

Vol. 2 (4), 2025
Page: 367-375

The Comparison of the use Of Talc 76% Iso With 80% ISO for Pitch Reduction in The D0 Stage Pulp Bleaching Process

Ni Njoman Manik Susantini *, Linda Ardiyana

Department of Pulp and Paper Technology, Faculty of Vocation, Institut Teknologi Sains Bandung, Indonesia
*Email (corresponding author): njoman.manik@itsb.ac.id

Abstract. *One of the problems that occur in pulp and paper mills is the problem of pitch content. The addition of talc chemicals in the D0 stage bleaching process is known to reduce the pitch content in the pulp. This study aims to determine the effectiveness of talc 76% ISO and Talc 80% ISO in reducing the pitch content in the D0 stage bleaching pulp and to determine the quality of the D0 pulp produced after the addition of the two types of talc. In this experiment, Talc 76% ISO and Talc 80% ISO were added and varied the addition of chlorine dioxide to the pre-D0 pulp, then the DO stage bleaching was carried out. The research method used was a testing method by examining the quality parameters of the D0 pulp, namely brightness, residual lignin content, viscosity, and pitch content. Based on the experiments carried out, it was concluded that Talc 80% ISO was more effective than Talc 76% ISO in reducing the pitch content in D0 pulp, with a reduction efficiency of Talc 76% ISO of 14.2% and Talc 80% ISO of 41.6%. And based on the comparison of data processing results, the comparison results of the quality of D0 pulp produced between the two types of talc are not very significant, so this cannot prove the author's hypothesis which states that the quality of D0 pulp in samples using 80% ISO Talc is better than samples using talc 76% ISO.*

Keywords: *Pitch content, talc, D0 stage, pulp, bleaching*

1. Introduction

Reuse and recycling are essential to the circular economy, potentially enhancing waste value and reducing environmental harm. Using bio-waste, including pulp, stubble, seeds, leaves, and bagasse, to synthesise nanoparticles is an economical, low-energy, and ecofriendly method.

Global demand for packaging paper and tissue is increasing rapidly. As an illustration, Indonesia as one of the paper producing countries, in 2022 has exported 18,000 tons of food packaging paper, an increase of 47.9% from 2021(Mardiansyah, 2024). Thus, the pulp and paper industry in Indonesia, in addition to increasing production as done by PT Indah Kiat Karawang("Tahun 2025, INKP Targetkan Pabrik Karawang Kapasitas 3,9 Juta Ton Beroperasi," 2023). Despite the increasing demand for packaging paper and tissue, the pulp and paper industry continues to carry out efficiency, inovations (Uniyal et al., 2025)and continuous improvement of all problems in the pulp and paper manufacturing process.

One of the problems in the pulp mill is the presence of pitch which can cause a decrease in pulp quality such as darker pulp color, unscheduled shutdown, use of more chemicals than planned (Dou et al., 2023), (Lahti et al., 2021), (Qin et al., 2003) .

Pitch is a resin-like compound that is usually found in virgin pulp (Indriati, 2009). Pitch comes from chemical pulp and mechanical pulp of wood, in the form of resin and extractives that are insoluble and do not like water or hydrophobic (Holik, 2006; McLean et

Received: 11 July 2025 / Accepted: 29 July 2025 / Available online: 30 July 2025

al., 2005). The composition of pitch will change with changes in pH and temperature (McLean et al., 2005)

Pitch-related problems in pulp mills can account for around 2–8% of the total composition depending on the species and time of year (Farrell et al., 1997). In fact, pitch will decrease during storage (Gutiérrez et al., 2001). The pulp industry can use various methods to overcome this pitch problem. One method that can be taken is to use talc chemicals. Talc is a chemical that is insoluble in water(Biza, 2001) so it can be added to the initial pulp bleaching process or D0 stage (Susantini & Mulyadi, 2021),(Sezgi et al., 2016) , (De Almeida Batista et al., 2020), (Susantini & Mulyadi, 2021), (Trismawati et al., 2024).

Talc is known to be able to decompose large pitch deposits into smaller particles so that pitch is easier to remove and reduces its appearance in the pulp. Talc has been one of the principal fillers used as dissolved colloidal material (DCM) control agent (Tijero et al., 2012). Although talc is still the primary mineral used in certain regions for pitch and sticky control, the search for alternatives is not misplaced(Gaskin & Marshall, 2024) . In Indonesia, that this research took place, the pulp industry in under reviewed, talc of the 76% ISO type is used. To optimize production, talc of the 80% ISO type was tested.

2. Methods

The following is Figure 1 which explains the research flow of 2 types of talc for pitch content reduction.

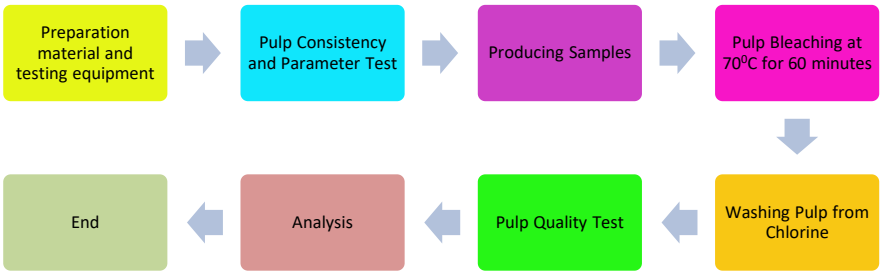

Figure 1. Reseacrh Work Flow

In the initial stage, all tools and materials are prepared first. The tools used include: analytical balance, measuring cup, beaker, burette, volume pipette, dropper, bulb, oxygen tube, 120 and 80 mesh sieve, 300 ml Erlenmeyer flask, 25 ml dispensette, thermometer, vacuum pump, buchner funnel, magnetic stirrer, magnifying glass (Lup), waterbath, semi-automatic hand sheet former, sheet press, blotting, viscometer, and pH meter. Other materials are pre-DO pulp, pure water, destilled water, chlorine dioxide.

The next stage is testing pulp samples from the D0 process. The D0 pulp samples are removed from the water bath and washed clean. The next steps are pH testing, residual chlorine analysis, pulp consistency testing, residual lignin content testing, pulp viscosity testing, brightness testing and pulp dirt testing.

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3. Results and Discussion

Laboratory scale research and using 2 types of talc, namely talc 76% ISO and talc 80% ISO. Both types of talc have the same specifications, but after testing, different results were obtained. The following parameter values and test results for the two types of talc are presented in the table below.

Table 1. Parameters and Test Results of Talc 76% and 80% ISO

Type of Talc	Item	*Standard*	Result	Unit
76 % ISO	*Brightness*	≥ 76.0	76.1	%
	LOI	4.5 - 6.5	4.54	%
	Moisture	≤ 3.0	0.80	%
	Total CaO	≤ 0.80	0.39	%
	pH 10%	8.0 – 10.5	9.54	%
	Whiteness	≥ 85.0	85.09	%
80 % ISO	*Brightness*	≥ 76.0	81.14	%
	LOI	4.5 - 6.5	5.23	%
	Moisture	≤ 3.0	11.16	%
	Total CaO	≤ 0.80	0.78	%
	pH 10%	8.0 – 10.5	8.75	%
	Whiteness	≥ 85.0	88.62	%

3.1. Pulp Testing Results at Pre D0 Stage

The following is the data from the pre-D0 stage pulp bleaching parameter test results which will later be compared with the results of the D0 stage pulp parameter test.

Tabel 2 Result of Pulp Test before Pre D0 stage

Sample	*Pulp pre* D0
Pitch content (mm2/m2)	15.835
Kappa Number	10.79
Brightness (% ISO)	44.70
Consistency (%)	29.25
Viscosity (cm3/gr)	737

3.2. Pulp D0 Stage Test Results with Application of 2 Types of Talc and Variation of Active Chlorine

From the pulp bleaching experiment at stage D0, with active chlorine variations of 25 Kg/T, 24 Kg/T, and 23 Kg/T, the test results were obtained which will be presented in Table 3 and Table 4 as follows:

Tabel 3. Test Result of Active chlorine, end pH and residual chlorine

Sample	Type of Talc (0,5 Kg/T)	Active Chlorine (Kg/T)	End pH	Residual Chlorine (ppm)
sample 1	76% ISO	25	3.57	22.1
sample 2	76% ISO	24	3.61	23.2
sample 3	76% ISO	23	3.92	10.0
sample 4	80% ISO	25	3.42	22.5
sample 5	80% ISO	24	3.58	20.3
sample 6	80% ISO	23	3.74	4.3

Tabel 4. Test Result of Brightness, CEK, Viscositu and Pitch Content

Sample	*Brightness* (% ISO)	Chlorine Equivalent Kappa (CEK)	Viscosity (cm3/gr)	*Pitch content* (mm2/mm2)
sample 1	63.74	3.49	691	10.665
sample 2	62.24	3.59	717	14.67
sample 3	62.03	3.65	723	15.415
sample 4	64.12	3.23	711	10.08
sample 5	62.94	3.62	717	8.915
sample 6	62.40	3.64	721	8.75

3.3. Analysis

Based on the compilation of test result data listed in Table 3 and Table 4, a discussion and analysis of pulp quality parameters of D0 stage samples with Talc 76% ISO and samples with Talc 80% ISO were then carried out.

3.3.1. Chlorine Equivalent Kappa (CEK)

The following are the results of the lignin content residual test.

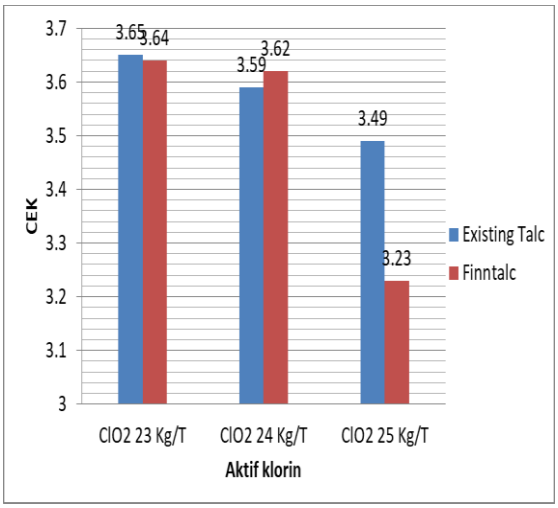

Figure 2. CEK on active chlorine variation and talc charge 0.5 kg/T

The CEK value in D0 pulp is expected to be low or the lignin reduction value is high. The target CEK value at stage D0 is 3-4. And it can be seen from the CEK test results as an

indication of the remaining lignin content in the pulp after stage D0 as in Figure 2, the lowest Remaining Lignin Content value is at active chlorine consumption of 25 Kg/T pulp for both types of talc charge, with higher lignin reduction efficiency in Talc 80% ISO compared to Existing talc. Where the lignin reduction efficiency in the use of Talc 76% ISO is 67.65%, while in finnatalc it is 70.06% with a difference in value between the two samples of 2.41%. So it can be concluded that the lignin reduction value of the sample with the addition of Talc 80% ISO is more/higher than the sample with the addition of Existing talc. With a comparison of lignin reduction values that do not reach 5% between the two types of talc, it cannot be determined which CEK D0 value quality is better between the 80% ISO Talc sample and the 76% Talc sample.

3.3.2. Viscosity

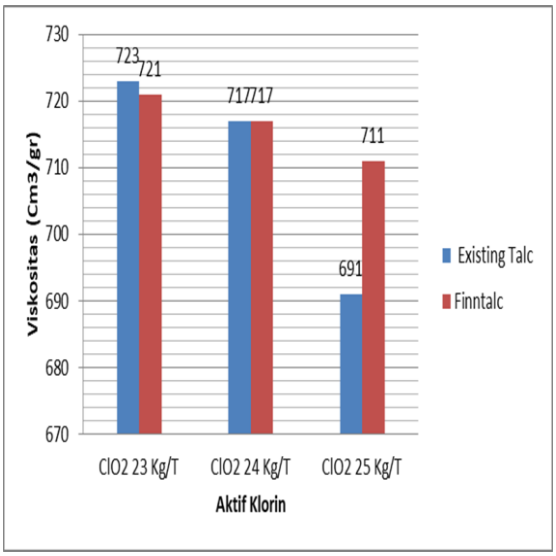

Figure 3. Decrease in pulp viscosity value at D0 stage with variations in active chlorine and talc charge of 0.5 kg/T

In Figure 3, it can be seen that at the same variation of active chlorine and the same charge talc between the Talc 76% ISO sample and the Talc 80% ISO sample. Talc 80% ISO, there is a decrease in viscosity value with increasing active chlorine consumption. active chlorine consumption, but with the use of Talc 80% ISO, the reduction in pulp viscosity was not significant for each active chlorine variation. each active chlorine variation. And for the lowest viscosity value can be seen at an active chlorine charge of 25 Kg/T, at this charge the viscosity value of the sample with 80% ISO Talc is higher than the Existing talc sample. With viscosity drop efficiency of 6.24% for the Talc 76% ISO sample and 3.53% for the Existing talc sample.

Talc 80% ISO, with a difference in value between the two samples of 2.71%. So that from the results of the comparison of visco-values between the Talc 80% ISO sample and the Talc 76% ISO sample in a chlorine charge of 25.71%. 76% ISO in this 25 Kg/T chlorine charge, it can be concluded that the viscosity value of the sample with Talc 80% ISO is higher than the sample with Talc 76% ISO or the the viscosity drop value is more in the 80% ISO Talc sample compared with Existing talc sample. But with the comparison of lignin reduction values which does not reach 5% between these two types of talc, therefore it cannot be determine which D0

pulp viscosity value quality is better between the 80% ISO talc sample and the Existing talc sample.

3.3.3. Brightness

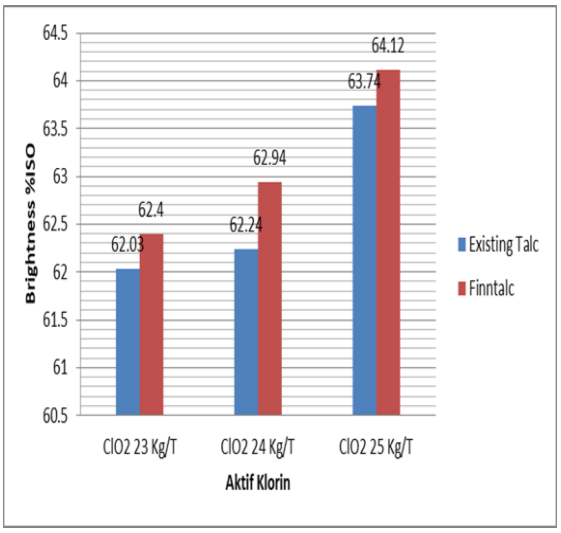

Figure 4. Brightness value at active chlorine and talc charge variation of 0.5 Kg/T

For the brightness value target at the D0 stage is 68-70%. When viewed from the research results in Graph 4, the brightness value target was not achieved in every variation of active chlorine. This could happen because the kappa number value in the pre D0 sample was too high, namely 10.79, so that during the bleaching process at the D0 stage.

The D0 brightness target was still not achieved with active chlorine consumption of 23, 24, and 25 kg/T. One solution to increase the brightness value of this D0 pulp sample is to reduce the kappa number of the pre-D0 pulp sample during the Oxygen Delignification (MCO2) process to 8-9, so that the target brightness value can be achieved at the active chlorine consumption as in the research variation.

Furthermore, based on Figure 4, with a consumption of 25 kg/T active chlorine and 0.5 kg/T talc, the highest increase in brightness value can be seen. At this 25 kg/T active chlorine consumption, the brightness value of Talc 80% ISO is 0.38% higher than that of the existing talc. The graph also shows that the brightness value of the sample with Talc 80% ISO is higher than that of the sample with Talc 76% ISO at all active chlorine charges. Therefore, it can be concluded that the brightness value of the sample with 80% ISO Talc is higher than that of the sample with Existing Talc. However, the difference in brightness values is small, or less than 5%. Therefore, it cannot be concluded which brightness value is better between the 80% ISO Talc sample and the 76% ISO Talc sample, as the difference in brightness values is not significant. Furthermore, the graph also shows that the more ClO2 added, the better the brightness quality of the resulting pulp.

In Figure 4, it is known that the brightness value of the sample with Talc 80% ISO is higher than Talc 76% ISO at all the same chlorine charges. So it can be concluded that the addition of talc affects the difference in the resulting brightness value. This can occur because of the characteristics of Talc 80% ISO, especially the brightness and whiteness values of Talc 80% ISO which are higher than Existing talc, therefore the brightness value of pulp D0 produced from the Talc 80% ISO sample is higher than the Existing talc sample.

3.3.4. Pitch Content

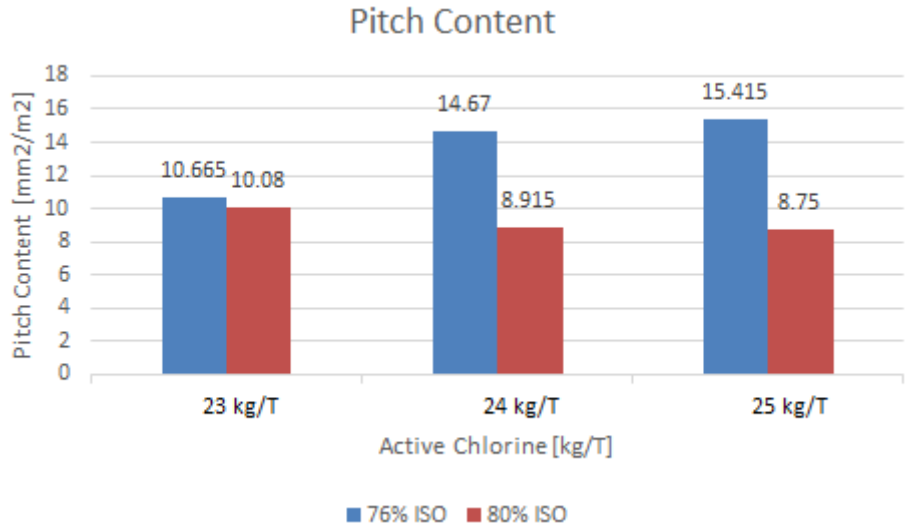

Figure 5. Pitch Content with pulp charge 0,5 Kg/T

The main purpose of adding talc in this study is to reduce the pitch content in D0 pulp. In Figure 5, it can be seen that if using active chlorine 25 Kg/T with the same consumption and talc (0.5 Kg/T), then the pitch content in the pulp is almost the same between Talc 76% ISO and Talc 80% ISO, the difference is only 0.585 mm2/m2 higher than Talc 76% ISO than Talc 80% ISO. And it can be seen in all chlorine charges, for the pitch content value in the Talc 80% ISO sample is lower than the Existing talc sample. Where if averaged for the pitch content reduction value in each active chlorine variation, the pitch content reduction efficiency in the sample with Talc 76% ISO is 14.2% and the sample with Talc 80% ISO is 41.6%. So from the comparison of the reduction value of the overall sample variation it can be concluded that the pitch content reduction efficiency using Talc 80% ISO is higher than Existing talc. And it is proven that Talc 80% ISO is better and more effective in reducing pitch content in D0 pulp than Existing talc.

Conclusions

Judging from the average pitch content detected in the pulp sheets in all sample variations, the pitch content value in samples with Talc 80% ISO is lower than samples with Existing talc. Where the pitch content reduction efficiency of Talc 76% ISO is 14.2% and Talc 80% ISO is 41.6%. So from the comparison of the data processing results obtained, it can be concluded that the addition of Talc 80% ISO is better and more effective in reducing the pitch content in D0 pulp than Talc 76% ISO.

The main parameters of D0 pulp quality such as residual lignin content (Remaining Lignin Content), viscosity, and brightness remain the determinants of the effectiveness of talc use in D0 bleaching stage with variations in active chlorine, where the talc charge used is 0.5 Kg/Ton pulp calculated as a water-free condition (oven dry condition). It can be seen in the variation of active chlorine consumption of 25 Kg/T pulp, the efficiency of kappa number reduction (Remaining Lignin Content) in the Talc 80% ISO sample is 2.41% higher, the drop in viscosity value is 2.71% lower and the increase in brightness is 0.38% higher ISO in the Talc 80% ISO sample compared to the Existing talc sample. And based on the comparison of the results of the two talcs, it can be concluded that the comparison of the quality of the D0 pulp

(including the value of Residual Lignin Content, viscosity, and brightness) produced between the two types of talc is not very significant, because the comparison obtained does not reach 5% in each parameter of the quality of the D0 pulp produced between the two types of talc, and the comparison of these values cannot be used as a reference to determine which pulp quality is better.

D0 is better between samples with Talc 80% ISO and samples with Existing talc. So it can be concluded that the results of the research on the quality of pulp D0 produced from both types of talc, namely Talc 80% ISO and Talc 76% ISO are not in accordance with the hypothesis made by the author, which states that the quality of pulp D0 samples with Talc 80% ISO is better than samples with talc 76% ISO.

Conflicts of Interest

The authors declare no conflict of interest.

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