International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST229584

The Application Poly Aluminum Chloride as an Anionic Trash Catcher to Enhance Medium Paper Properties

Ni Njoman Manik Susantini [*1], Muhammad Rizky Darwis Putra[2]

[*1,2]Pulp and Paper Technology Department, Institut Teknologi Sains Bandung, Bekasi, Jawa Barat, Indonesia

Article Info

Publication Issue
Volume 10, Issue 1
January-February-2023

Page Number
138-143

Article History
Accepted: 10 Jan 2023
Published: 23 Jan 2023

ABSTRACT

The use of secondary fiber and rejected pulp as fiber raw material for medium paper is very economical. However, the use of reject pulp results in the breaking or removal of the fiber charge due to highly anionic in the rejected pulp. This research aims to determine the optimum dosage of poly aluminum chloride (PAC) as an anionic trash catcher. The anion trash catcher has the role of reducing the value of particle charge in the rejected pulp. In this study, the following variations were used: blank (without PAC), 1 kg PAC/ton paper, 2 kg PAC/ton paper, 3 kg PAC/ton paper, and 4 kg/T paper. The method is first adding PAC to the pulp and then giving retention aid afterwards. The results of the charge test showed a decreasing charge in the pulp from -789.3 -µeq/L to -44.45 -µeq/L. Paper properties tested include ring crush, corrugated and internal bonding. The best ring crush test value was 15.4 kgF at a PAC dose of 2 kg/ton paper. The medium corrugated test (known as concora test) value was 19.79 KgF at a PAC dose of 4 Kg/ton of paper. The internal bounding value was 167.70 J/m2 at a PAC dose of 3 Kg/T. All of these properties' test results have entered the referenced standard. This research concludes that retention aid works effectively on fiber after adding PAC, which acts as an anionic trash catcher.

Keywords: Medium Paper, Poly Aluminum Chloride, Anionic Trash Catcher

I. INTRODUCTION

Recycled fiber is a potential alternative raw material because it can overcome environmental problems. In addition, the paper used with virgin pulp has a higher cost production than paper produced with recycled fiber raw materials [1]. Several paper types can be produced using recycled fiber, such as medium paper.

Medium paper is kraft paper used as packaging paper. Currently, there is a fairly good market for packaging paper and is expected to continue because almost all industrial sectors use such packaging materials. In addition, medium paper is very suitable for using recycled fiber raw materials because using virgin pulp fiber will increase production costs. This is not comparable to the relatively cheap selling price on the market [2].

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To reduce the cost of raw materials, reject pulp as raw materials, but refuse pulp can increase the stock charge. The relatively high anionic charge of mechanical pulp and unbleached kraft that due to the presence of resin acids, fatty acids, hemicelluloses, and other products of lignin degradation [3].

Cationic retention aid is less effective in systems contaminated by anionic substances [4]. Anionics are dissolved from fiber, additives, broke, and other sources. Referred to as "anionic trash" or DCS (dissolved and colloidal substance) they are usually considered to form "inactive" bonds with cationic polyelectrolytes, so retention aid chemicals must be added in excess to overcome it. Therefore, the detrimental effect of anionics on retention aid performance must first be addressed by adding a strongly charged cationic polyelectrolyte as a catcher.

Anionics need to be reduced, so in this study, PAC was used. PAC is a chemical that has a strong cationic charge [3]. The addition of poly aluminum chloride (PAC) with the right dose can optimally overcome anionic trash contained in the stock, with this chemical retention aid added afterwards will work optimally on the fiber, thereby increasing the physical strength of the paper produced.

This study aimed to determine the potential of poly aluminum chloride to reduce the charge value and to determine the effect of adding poly aluminum chloride on the properties of medium paper.

II. METHODS AND MATERIAL

This study uses pulp from the OCC Plant, namely, waste paper, and the addition of reject pulp with a composition of 50% short fiber, 45% long fiber, and 5% reject pulp. The chemicals used as retention aids are cationic polyacrylamide (CPAM) and Poly aluminum chloride (PAC). These two chemicals will act as anionic trash catchers. Variations in PAC doses are as much as 0 (blank), 1,2,3,4 kg/ton of paper. CPAM dosage variations are 0, 250, and 350 ppm. The handsheet sample in this study was in the form of medium paper with a gramature of 125 gsm.

Pulp from chest short fiber as much as 50%, chest long fiber as much as 45%, chest reject pulp as much as 5%, then pulped using a disintegrator. Then, variations in the dosage of PAC and CPAM were carried out with a contact time of 5 minutes for each chemical. The pulp is checked for consistency. After the slurry (pulp) is ready, drainage and charge tests are carried out, and the properties are checked on the handsheet.

Analysis of the wet end properties of the slurry was carried out to determine the load, drainage, and first-pass retention of each variation composition. Load testing and first pass retention were carried out using the 2022 paper industry QC laboratory SOP, and drainage testing was using the TAPPI T221 method.

Analysis of the physical properties of the paper sheet was carried out to determine the effect of adding poly aluminum chloride on the properties of the resulting sheet. The physical properties of the sheet include internal bonding using the TAPPI T521 method, ring crush test using the TAPPI T818 method, and flat corrugated compressive resistance (concora medium test) using the TAPPI T809 method.

III.RESULTS AND ANALYSIS

A. Effect of Addition of Poly Aluminum Chloride on Charge

The charge test parameter in the papermaking process determines the level of anionic trash contained in the stock slurry, including chemicals and the load in the fiber raw material to be used. The effect of the load is to see how well the fiber can bind with the additional chemicals that will be used so that the additional

chemicals can work effectively during the production process [1].

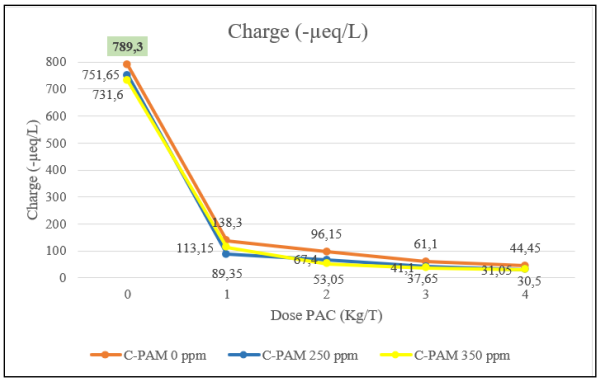

Figure 1: Effect of PAC composition on charge

Based on Fig. 1, the blank handsheet (without adding chemicals) obtained an average charge of -789.3 eq/l. In the fig. above, it can be seen that the charge of the blank sample was more significant than the negative charge before adding PAC and CPAM chemicals. The lowest charge value was found in the second experiment with a PAC dose of 4 kg/T. The charge was getting closer to neutral as the PAC dose increased. This is known because PAC has a positive charge, thus showing PAC can reduce the anionic trash in the stock. [6]. Then the third experiment, the charge is smaller than in the second and first experiments. This happens because C-PAM, which has a positive charge, is added more so that CPAM causes the charge to be closer to neutral. However, in the second and third experiments, the PAC 2, 3, and 4 Kg/T doses did not significantly increase. With this, the PAC performance could have been more effective. The effect of PAC composition on the value of charge

B. **Effect of Addition of Poly Aluminum Chloride on Drainage**

Drainage is the speed of the process of removing water that is still contained in the stock slurry. The testing process is seen by how much water volume (ml) is accommodated within 15 seconds. Flocculation due to retention affects drainage. Evaluation of flocculation is critical to control the wet end stage because the retention and drainage performance and the quality of the final product depend on the degree of flocculation and the floc characteristics [2].

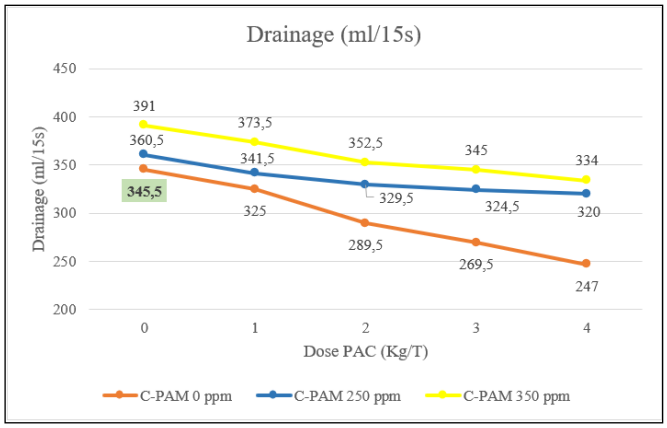

Figure 2: Effect of PAC composition on drainage

Based on the drainage value test results, the first experiment with a dose variation of PAC 4 Kg/T had the lowest value, 247 ml/15 sec. Figure 2 shows that the addition of PAC resulted in a decrease in the drainage value of the stock. The drainage value decreases with increasing PAC composition. The cause of the decreasing drainage value is PAC adsorbs and flocculates fines and anionic trash, resulting in high flocculation. In addition, the high flocculation rate, resulting in large flocs, reduces the drainage rate because it is challenging to remove interstitial water from very large flocs[3].

C. **Effect of Addition of Poly Aluminum Chloride on First Pass Retention (FPR)**

Retention is the ability of fibers or other particles, such as fines, fillers or additives, to be retained to form a sheet on the wire. Retention is one of the critical parameters in the forming section process because the efficiency of the process depends on the number of particles retained on the fiber. The higher the retention ability, the more fiber and non-fiber materials, such as added chemicals, are retained on the fiber. So that the effectiveness of the chemical also increases. The higher the retention value, the more efficient the process [2].

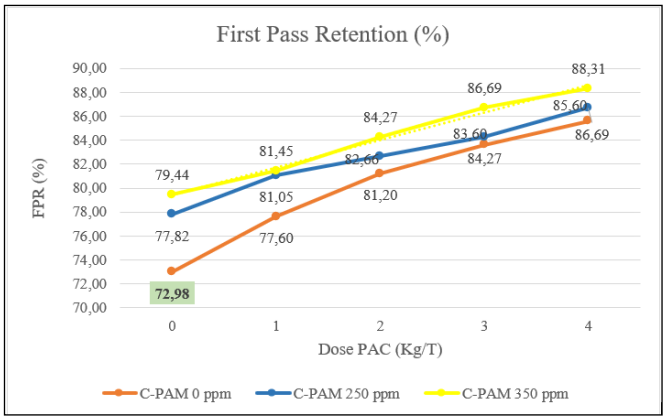

Figure 3: Effect of PAC composition on First Pass Retention (FPR)

Based on the retention test, the optimum value of using PAC in each experiment can be seen. Judging from the Fig. 3 shows the addition of PAC increases the retention of the fiber. The third experiment with PAC 4 Kg/T got the highest value. In the first experiment show that the retention value increased. It indicated fines retained on fiber. Fines form a network due to the presence of positive ions from PAC and the adsorption of PAC macromolecular chains on the fines to form an agglomeration of fines flocs retained in the forming process [2].

In the second and third experiments, after the positive ions from PAC reduced the anionic trash contained in the stock, adding a retention chemical (CPAM) was more effective. It can be seen from Fig. 3 that with the addition of the PAC dose, there was an increase in the retention value, indicating that the retention chemical (CPAM) formed a bond between the fibers and the fines during the forming process. The addition of additives has a good role in binding fines and other small particles in the furnish. This is also in line with the lower load value, the lower the fiber loss in white water obtained [4].

D. **Effect of Addition of Poly Aluminum Chloride on Ring Crush Test**

Based on the ring crush test, it can be seen that the value of the first trial ring crush (blank), where without the addition of PAC or CPAM, is 13.26 KgF. This does not meet the required standard of 15.0 KgF. In the first experiment, the dose variation of PAC 2 Kg/T was 15.4 KgF. In the second experiment, the PAC 1 Kg/T dose variation was 15.65 KgF. In the third experiment, the dose variation of PAC 0 Kg/T was 15.09 KgF.

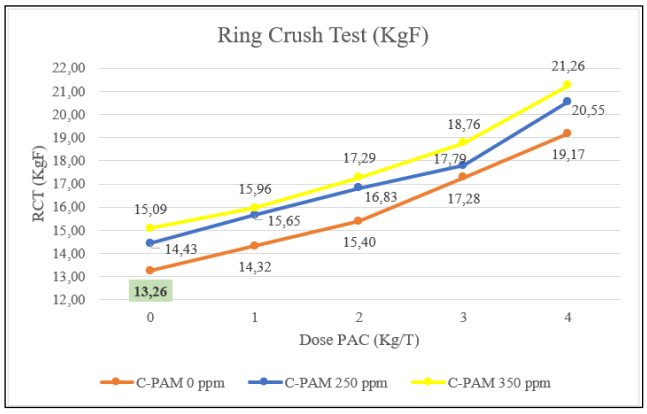

Figure 4: Effect of PAC composition on Ring Crush Test (RCT)

Furthermore, as the PAC dose increases, the value of the ring crush produced increases. The ring crush's value increase is due to the retained fines. Fines will form a bond with the fiber, thereby increasing the bond between the fibers formed so that when testing the edge of the circumference, the ability to withstand pressure is higher. This follows the statement [5] that the bond between fibers, fiber length, and good fiber internal braid influences ring crush.

Based on Fig. 4, it can be seen the comparison of the increase in the value of the ring crush from the first experiment to the second and third experiments. This is due to differences in composition, namely the addition of CPAM chemicals. CPAM has a positive charge to work on the fiber and form a bridge between and with the fines. The addition of additives has a good role in binding fines and other small particles in the furnish. By doing this, the bond between fibers increases, so the strength of the paper produced will also be higher [4].

E. Effect of Addition of Poly Aluminum Chloride on Concora Medium Test

Based on the concora test, it can be seen that the concora value of the first experiment (blank) without the addition of PAC or CPAM was 16.01 KgF, it is known that it has not met the required standard, which is 18.5 KgF. In the first experiment, the dose variation of PAC 4 Kg/T was 19.79 KgF. The second experiment used the variation in the PAC 3 Kg/T dose was 19.03 KgF, and the third experiment was on the PAC 2 Kg/T dosage range was 18.96 Kg/T.

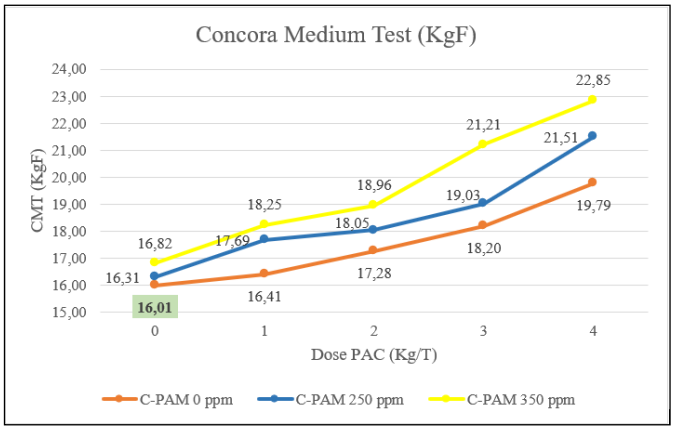

Figure 5: Effect of PAC composition on Concora Medium Test (CMT)

Furthermore, with the addition of the PAC dose, the concora value increased due to the retained fines. Fines will form with the fiber, multiplying between the fibers formed so that the pressure is higher when testing the floating medium. These parameters are influenced by the length of the fiber, the amount of inter-fiber, and the amount of filler [6].

Based on Fig. 5, a comparison of the increase in the value of Concora from the first experiment with the second and third experiments can be seen. This is due to differences in the addition of CPAM chemicals. CPAM has a positive charge to work on the fiber and form a bridge between and with the fines. In addition, the additives play an excellent role in binding fine and other small particles in furnish. Therefore, by making more fibers, the strength of the paper produced will also be higher [4].

F. Effect of Addition of Poly Aluminum Chloride on Internal Bounding Test

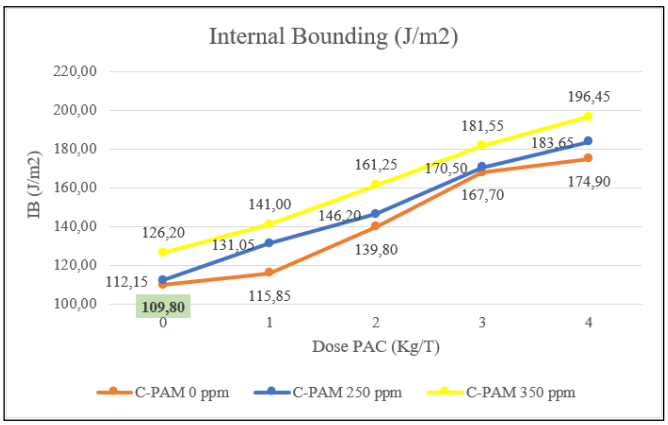

Figure 6: Effect of PAC composition on Internal Bonding

Based on the internal bonding test, it can be seen that the internal bonding value of the first experiment (blank) without the addition of PAC or CPAM was 109.8 J/m2. It is known that it needs to meet the required standard, 180 J/m2. In the first experiment, no one met the standard, the second experiment with variations in the dose of PAC 4 Kg/T was 183.65 J/m2, and the third experiment varying the dose of PAC 3 Kg/T at 181.55 J/m2 then, along with the addition of the PAC dose occurred. The increase in the value of internal bonding was due to the retained fines. Fines will form a bond with the fiber, increasing the bond between the fibers formed. So that when testing internal bounding, the bond between fibers increases, and the value of internal bonding increases. These parameters are influenced by the bond between the fibers, the type of raw material, the number of fines, the amount of filler, and the distribution of the fibers on the handsheet [7].

Based on the graph above, a comparison of the increase in the value of Internal Bounding from the first experiment with the second and third experiments can be seen. This is due to differences in composition, namely the addition of CPAM chemicals. CPAM has a positive charge to work on the fiber and form a bridge between and with the fines. The addition of additives has a good role in binding fines and other small particles in the furnish. Therefore, by

making more bonds between fibers, the strength of the paper produced will also be higher [4].

From the value of the properties test, it was found that PAC can increase the value of retention, ring crush, concora medium, and internal bounding. However, it hurts the drainage value because PAC forms high flocculations, resulting in large flocs thus reducing the drainage rate. After all, it is difficult to remove water in vast flocks. In addition, due to a large bonds between fibers, many pores are covered by fines that are retained during the forming process [2].

IV. CONCLUSION

Poly aluminum chloride can be used as an anionic trash catcher in the pulp. So in this experiment, there was a decrease in the charge contained in the pulp. A significant decrease occurred in the variation of the PAC dose of 1 Kg/T paper, with a decrease of 82.4%. For the next dose, there is still a decrease in the value of the load, but the decrease is not too significant. Then along with the addition of the dose of poly aluminum chloride, the properties of the resulting medium paper also increased. In the first trial, the RCT value increased by 30%. The CMT value increased by 19%. IB value increased by 37%. The increase in the second and third experiments was the same as the dose of poly aluminum chloride increased. The value of the charge on the pulp affects the properties of the resulting medium paper. When the charge obtained gets smaller, the resulting properties are higher.

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Cite this article as :

Ni Njoman Manik Susantini, Muhammad Rizky Darwis Putra, "The Application Poly Aluminum Chloride as an Anionic Trash Catcher to Enhance Medium Paper Properties ", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 10 Issue 1, pp. 138-143, January-February 2023. Available at doi : https://doi.org/10.32628/IJSRST229584

Journal URL : https://ijsrst.com/IJSRST229584