

# Some properties of paper and wet-end characteristics with Polyvinylamine

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## Abstract

This study was performed to introduce recently developed Polyvinylamine as a wet-end process improving aids and paper properties improving aids.

As a retention and drainage aids, cationicity of Polyvinylamine was a very important factor of BCTMP and ONP stock condition. As a dry tensile strength aids, The hydrogen bond of acrylamide functionality and hydroxyl functionality of the pulp was a very important factor of LBKP stock condition and cationicity of Polyvinylamine was a very important factor of BCTMP and ONP stock condition.

## 1. Introduction

The components of the paper were pulp fiber part, mineral part and organic polymer additives part. Because organic polymers among the above components were easy to modify molecular weight, molecular weight distribution, they were applied various paper making fields as a retention and drainage aids, dry strengthening aids, Size improving aids etc.1)2)3) Polyacrylamide has been mainly applied to retention and drainage aids and dry strength aids. AKD and ASA have been applied to Size improving aids and Polyamine, PolyDADMAC and Poly-DCDA of cationic low molecular weight polymer have been used Fixing aids of various anionic substance, Anionic trash catcher and Retention aids.1)2)3) The characteristics of these high cationic and low molecular weight polymers were explained as follows. Polyamine which was very high cationic density made from

condensate of Dimethylamine and Epichlorohydrine. Main applications were anionic trash catcher and retention and drainage aids.1) Poly-DADMAC which applied to very similar application with Polyamine was made from radical polymerization of the DADMAC monomer.1) Cationicity of this was lower than Polyamine however, it seemed good performance on the stocks of fluctuated pH conditions.1) P-DCDA has been applied to Dye fixing aids. And recently developed Polyvinylamine was expected unique performance compare to above polymers. Cationicity of Polyvinylamine was very higher than others and It has been reported very good wet strengthening aids.4)5)9) therefore, We studied Polyvinylamine as a wet end improving aids and paper quality improving aids to modify cationicity of Polyvinylamine.

## 2. Materials and methods

### 2.1. Pulps and additives

LBKP, BCTMP and ONP were used as a pulps for the lab. hand sheet making. As a additives Polyvinylamine (PVAmine), Anionic poly acrylamide (APAM) and Poly-(aminoamide)-epichlorohydrin (PAE) were used.

### 2.2. Beating

Beatings were performed using lab. Valley beater by following TAPPI Standard T-OM 85. LBKP is 400 ml CSF, BCTMP is 100 ml CSF and ONP is 150 ml CSF.

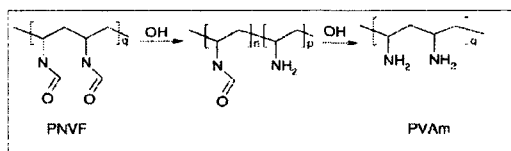


Figure 1. Chemical reaction formula of polyvinylamine synthesis from N-vinylformamide

### 2.3 Hand sheet making and determination of retention and drainage

RDA-HSF paper machine conditions were explained as belows. The concentration

of the stock was 0.18% and the volume of the stock was 1,000 ml. Vacuum condition at the drainage part was 200 mmHg at the main and sub tank. The sequence of chemical time contact of the stock was as followings. At first, stock was introduced to the jar and let it steered at the condition of 1,000 rpm x 15 sec. and then, Cationic polymer was injected and let it steered at the condition of 1,500 rpm x 15 sec. and If needed, anionic polymer was injected and let it steered at the condition of 1,000 rpm x 15 sec. and we made 60 g/m<sup>2</sup> Hand sheet paper. To measure turbidity of white water using 2020 Turbidimeter of LaMotte, retention values were estimated and drainage degree was estimated by comparison of the slope of vacuum releasing profile at the wire part. Wet hand sheets were dried at the 130°C temperature using drum dryer.

#### 2.4 Measurement of paper strength

Wet tensile strengths were measured by following procedures of TAPPI Standard T-494 OM01 and TAPPI Standard T-403 OM02. In case of measuring wet tensile strength, water soaking time was 5 minutes.

### 3. Results and Discussion

#### 3.1 Retention and drainage

Figure 2 were the retention results of the each stock conditions. In case of LBKP stock condition, cationicity of PVamine was not linearly correlated with retention results. This phenomena could be explained that cationicity of PVamine was not a important factor of retention because of low cationic demands of LBKP. However retention results of BCTMP and ONP stock conditions were remarkably linearly correlated with cationicity of PVamine. This phenomena could be explained that cationicity of PVamine was a important factor of retention because of high cationic demands of BCTMP and ONP.

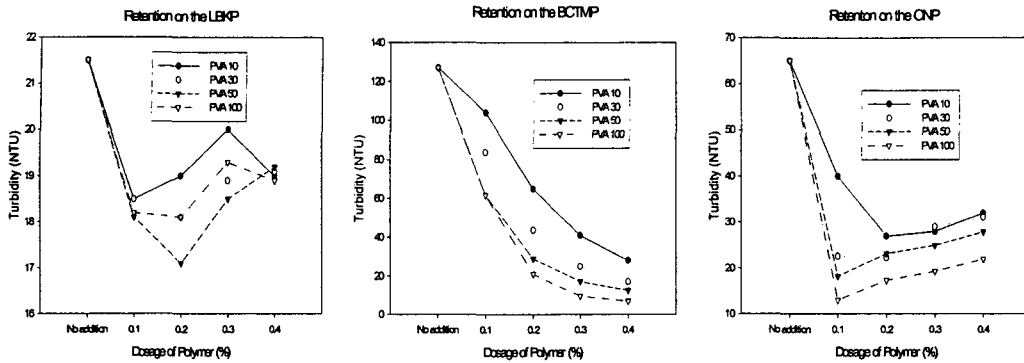


Figure 2. Retention of PVAmine according to Ionicity on the LBKP /BCTMP /ONP

### 3.1 Paper properties

Figure 3 were the wet tensile strength results of the each stock conditions. In case of LBKP stock PVA condition, dual dosing of PVAmine and APAM or single dosing of PAE was good performance. However, In case of BCTMP and ONP stock conditions, PVAmine was much better performance than PAE . This was also highly related the reaction of PVAmine with anionic trash.

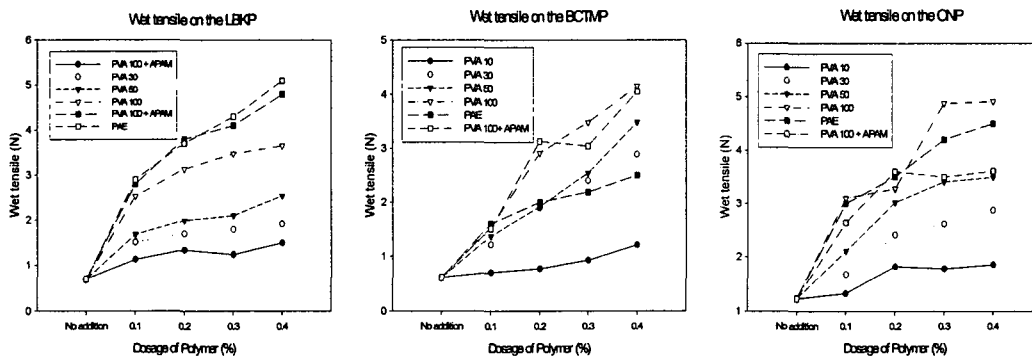


Figure 3. Wet tensile strength on the LBKP / BCTMP /ONP

## 4. Conclusions

1. As a retention and drainage aids : Cationicity of PVAmine was linearly correlated to performance in the BCTMP and ONP stock conditions except LBKP stock condition. This could be explained by reaction of high cationic charge of

PVAmine with abundant anionic substances of BCTMP and ONP stocks.

As a conclusion, In case of BCTMP and ONP stock conditions, retention and wet tensile strength were improved by increase of cationicity of PVAmine. In case of LBKP stock condition of low anionic trash, PVAmine with APAM was better performance of wet tensile strength.

#### 5. Literature Cited

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