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ANALYSIS QUALITATIVE ADDITION OF ADDITIVE SUBSTANCE TO PAPER MAKING PROCESS IN PAPER MACHINE 12 PT. X - KARAWANG ON PRODUCT QUALITY

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ABSTARCT

Paper is a tangible item of thin sheets which can be torn, rolled, folded, glued and crossed out. Paper is made to meet the needs of a very diverse life. The paper industry is one of the forest products industries which has a very important role in human life. There is almost no human activity that does not utilize this industrial commodity. In the process of making paper, in addition to the availability of Raw Materials there is also the use of additives. Additives are ingredients that are added to obtain certain desired characteristics of paper products. Some factors that influence the process of making paper are raw material, machine cleanliness, machine performance, human factors and additives. Additives are the main factors that influence the success of the papermaking process. There are two types of additives used in Paper Machine 12 PT.X-Karawang, namely functional additives and controlling additives. The effect of the addition of additives on Paper Machine 12 PT.X-Karawang namely, Dry Strength can increase the strength of the paper when used in dry conditions, Sizing Agent (Internal Sizing) functions to control liquid penetration, Surface Sizing Agent (Surface Sizing) functions to level the surface of the paper, Filler as filler, Dyes can give color to paper, OBA serves to increase the brightness of paper, Biocide functions to inhibit bacterial growth, Defoamer functions to prevent foam formation and Retention Aid can increase fiber retention.

Keyword: Controlling Additives, Functional Additives, Paper, Paper Machine

I. INTRODUCTION

The paper industry is one of the forest products industries which has a very important role in human life. There is almost no human activity that does not utilize this industrial commodity, ranging from activities in offices, laboratories, education, trade, households and so on (Widiastono, et al: 2007). The main raw material in the process of making paper is Pulp. Pulp is the result of the separation of fibers from Raw Materials (Wood and Non-Wood) through various types of processing (Widiastono, et al: 2007).

Pulp used in the process of making paper consists of two types of pulp, namely LBKP and NBKP (Syifa: 2019).

LBKP (Leaf Bleached Kraft Pulp) is a short fiber pulp that comes from a broadleaf tree and is a tropical plant, while NBKP (Needle Bleached Kraft Pulp) is a long fiber pulp that comes from a coniferous tree (Syifa: 2019).

In the process of making paper, in addition to the availability of Raw Materials there is also the use of Additives. Additives or Chemicals are chemicals that are added to obtain certain desired characteristics of paper products. For example strength between paper fibers, softness (for example for tissue), brightness (Brightness), giving color, and improving other quality (Casey: 1980).

Several studies have been conducted on the factors that influence the process of making paper, including the Raw Material Factor, the selection of quality or quality of Raw Materials can affect the final quality of the product, the poor quality of the Raw Material will result in the unfavorable final product as well (Haryono, et al: 2016).

Machine Cleanliness Factors, for example in Roll for pressing and Dryer so that no damage to the paper arises, if the machine is not clean, it can cause scratches on the paper and can also cause breakage on paper (Haryono, et al: 2016).

Engine Performance Factors, for example in Refiner machines for grinding fiber that can increase bonding between fibers so that they do not break easily (Asngad et al: 2016).

Human Factors, operations by humans must be in accordance with procedures in order to achieve a maximum production process (Haryono: 2016).

But among the factors above, there are main factors that play an important role in making paper, namely Additives. Here are some of the effects, namely, Additives can affect / increase the paper's tensile resistance so that the paper is strong and does not break easily during operation (Asngad: 2016).

Tensile resistance of paper that is not given additives is below the Indonesian National Standard (Syamsu et al: 2012).

Additives can increase Drainage so that paper products can be adjusted to specifications (Widiastono: 2007).

Additives can reduce foam, because foam is a problem that can cause paper to become perforated and specifications are not reached (Masriani, et al: 2012).

Based on this, it is necessary to study the effect of adding additives in the papermaking process.

II. LITERATURE REVIEW

2.1 Definition of Paper

Paper is a thin sheet made from a series of cellulose fiber bonds with the addition of several supporting materials so they can stick together. Paper is a product derived from the use of cellulose as its raw material (Syamsu, et al: 2012). Paper in English is called Paper and in Dutch it is called Papier. Paper is a tangible item of thin sheets which can be torn, rolled, folded, glued and crossed out. Paper is made to meet the needs of a very diverse life (Casey: 1981).

Paper is known as the main media for writing, printing, painting and many other uses (Bahri: 2015). One type of paper that is widely used is printed writing paper. As the name suggests, this type of paper is usually used for writing and printing for example for reports, proposals, and so on (Hakim: 2016).

2.2 Paper Making Raw Materials

The raw material in the process of making paper is fiber. Fibers that are used as Paper Raw Materials can be obtained from wood plants or non-wood plants.

2.2.1 Wood Raw Materials

Based on the length of the fibers contained in Wood, the Wood Raw Materials used for the papermaking process are divided into two, namely long fibers and short fibers (Hardwood).

Long Fiber Raw Materials can be obtained from wood species that have needle-shaped leaves (Needle Leaf). The results of long fiber processing are NBKP white pulp (Needle Bleached Kraft Pulp) and non-white NUKP pulp (Needle Unbleached Kraft Pulp). Examples of long fiber wood types (Softwood) are Pinus Merkusi and Aqathis. Paper produced from long fibers has a higher strength, the price is more expensive when compared to short fibers (Syifa: 2019).

While short fiber raw material can be obtained from wood species that have wide leaves. Another term for broadleaf wood is hard wood (Hardwood). This type of wood is widely grown in tropical regions such as Indonesia. The results of fiber processing are LBKP (Leaf Bleached Kraft Pulp) white pulp and LUKP (Leaf Unbleached Kraft Pulp) white pulp. Examples of this type of wood are Acacia Mangium and Eucaliptus sp. Paper produced from short fibers has a lower strength and relatively cheaper price when compared with long fibers (Syifa: 2019).

2.2.2 Non-Wood Raw Materials

Non-wood Raw Material is one of the main sources of fiber for Pulp Raw Materials, whether it comes from tree bark, leaves, fruit or seeds. Examples of non-wood plants whose fibers can be used for the process of making paper are Sugar (Bagasse), Straw, Banana Fronds , Bamboo, Cotton, Kenaf, Abaca and others (Syifa: 2019).

2.2.3 Recycled Fiber Raw Materials / Recycle Fiber

In the process of making paper, in addition to using Virgin Pulp Raw Materials (LBKP and NBKP), but also secondary fibers are added in the form of Recycled Fiber (Recycle Fiber) which comes from unused or reject paper commonly called Broke (Syifa: 2019).

2.3 Paper Making Process

In general, the process of making paper is divided into several stages (Bajpai: 2015), which are as follows:

a) Purification where there is decomposition of fibers in the walls of the pulp
b) Establishment aims to obtain the desired shape
c) Pressing aims to obtain sheets of paper
d) Drying is aimed at removing the water content from sheets of paper
e) Calender stack aims to control the thickness of the final result of the paper
f) Pope reel aims to cut paper from the roll

III. METHODOLOGY

The research method used is descriptive, where the implementation steps include observation and interviews.

The data was obtained by interviewing the relevant operator in the PT. X - Karawang Unit 12Paper Machine, regarding the process of adding additives, types of additives used, and the effect of adding additives on the quality of paper produced.

IV. RESULT AND DISCUSSION

In the process of making paper in paper machines 12 PT. X-Karawang, there are two types of additives used in the paper manufacturing process, namely functional additives consisting of Dry Strength, Filler, Dyes, Sizing Agent, and OBA. While Controlling Additives consist of Anti-Foam Substances (Defoamer), Anti-Bacterial Substances (Biocide) and Retention Aid.

Flowchart of the process of adding additives to the paper making process in Paper Machine 12 PT. X-Karawang is shown in **figure 4.1.**

Explanation of flow **figure 4.1** is as follows:

1) Adding OBA is done to the Mixing Chest, which is mixed together with LBKP, NBKP, and Broke. At the bottom of the Mixing Chest is an Agitator who will mix all the ingredients.
2) Addition of Dry Strength (Cationic Starch) to the Machine Chest.
3) AKD is added to the pipe before entering the silo by injection.

4) Add Biocide to Silos. This addition is done because the pulp mixed with Broke is accommodated and diluted to the silo. Broke is a reject that may be dirty in its transportation and allows the growth of bacteria. In addition, there is the addition of Starch which is Dry Strength on the Machine Chest, which Starch is a material that is preferred by microorganisms which after the Machine Chest will later be accommodated on the Silo
5) Defoamer is added to the Silo, because in the Silo there is an increase in water (Dilution of the Pulp), so that the Pulp will be stirred (mixed with water), so that no foam is formed then add Defoamer.
6) Dyes are added to the pipe after the silo by injection.
7) Calcium Carbonate (CaCO3) is added to the pipe after the silo by injection.
8) Cationic Retention Aid is added to the Pipe before going through the Screening process by injection.
9) Anionic Retention Aid is added to the Pipe after going through the Screening process by injection.
10) Adding Starch is done after the pulp becomes a sheet of paper, that is in the Size Press section by passing (dipping) paper in a container containing Starch.
11) Biocide is added to the Starch Tank because this Starch is food for microorganisms.

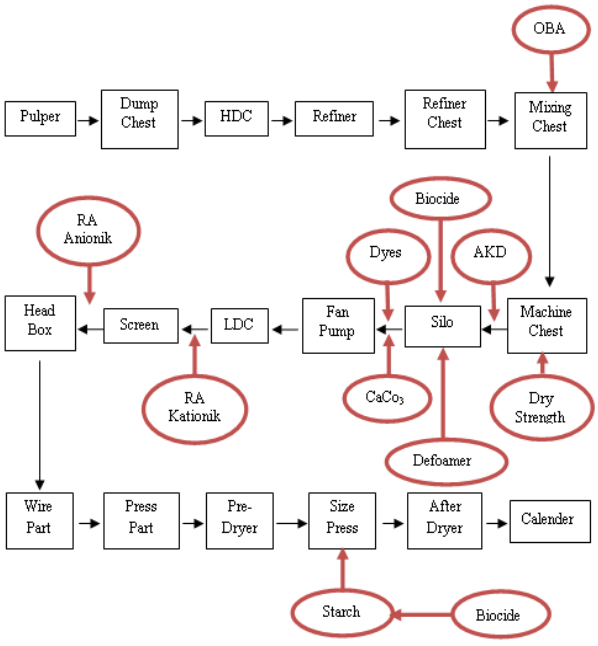


Figure 4.1. Additive Substance Process Flow Chart

4.1 Effects of Additive Additives

Functional additives are substances that have a direct role in the properties of paper. The Functional Additives consist of:

1) Dry Strength

Dry strength is a substance used to increase the strength of the paper during dry conditions when the paper is used. The effect of adding Dry Strength to the papermaking process is as follows:

a. Increase paper strength;
b. Increases tear strength;
c. Increase fold resistance;
d. Increase paper stiffness.

Dry Strength used in Paper Machine 12 at PT. X-Karawang namely Cationic Starch.

2) Fillers

Fillers are used as fillers. The filler can improve the printing properties of paper and reduce the use of fibers because this filler will later fill in spaces or gaps between fibers.

The filler material in making paper has the requirements so that the expected paper properties can be achieved, which are as follows:

a. Having a high degree of white;
b. Small particle size;
c. Does not react with other ingredients in paper making;
d. Not abrasive;
e. Good absorption properties;
f. Must be in good condition and clean (Pure)

Fillers used in PT. X-Karawang is Calcium Carbonate (CaCO3).

3) Dyes

Adding Dyes to the paper making process is to give color to the paper. Dyes used in Paper Machine 12 at PT. at PT. There are two types of X-Karawang, Dyes Blue and Dyes Violet.

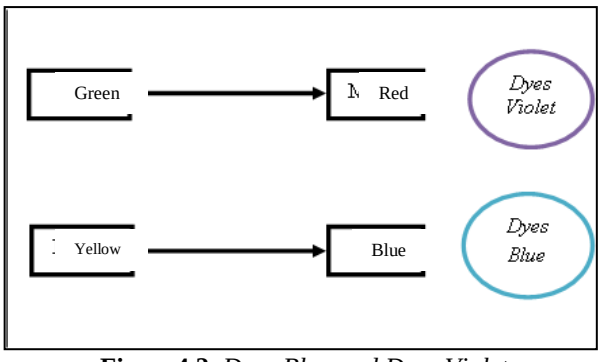


Figure4.2. *Dyes Blue and Dyes Violet*

In the picture above, it can be seen that the color control used in papermaking to produce a greenish to reddish color that is by Dyes Violet. While the color control used in paper making in order to produce a yellowish to bluish color is by Dyes Blue. Addition of two types of Dyes is adjusted to the order. To get the Color Difference value according to the order, an adjustment is made to add the amount of Dyes Blue and Dyes Violet in such a way.

The addition of Dyes Blue and Dyes Violet will produce a slightly bluish paper color. The use of Yellow Dyes and Red Dyes is used for yellowish or orange colored paper requests. However, it is very rare to request paper with this color, usually only for paper imported into Japan.

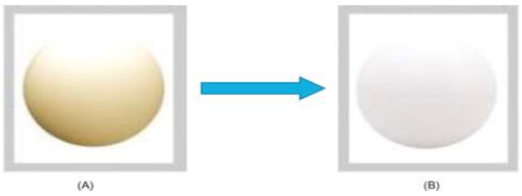
4) Sizing Agent

a. Internal Sizing
Internal Sizing is used to control liquid penetration / provide paper resistance to liquid penetration. This internal sizing will control or reduce the absorption of ink when the ink hits the surface of the paper (so that the ink is not absorbed too quickly by the paper).
Internal Sizing material used in Paper Machine 12 at PT. X-Karawang namely Alkyl Ketene Dimer (AKD). Alkyl Ketene Dimer will stick to the surface of the fiber, then deposited on the surface of the fiber and evenly distributed until it finally binds to the hydroxyl group of cellulose fibers.

b. Surface Sizing
The main purpose of Surface Sizing is to improve the quality of the surface of the paper, so that the surface becomes even. The effect of the addition of Surface Sizing is on the surface of the paper, which in turn will produce smooth and flat paper. Surface Sizing material used in Paper Machine 12 at PT. X-Karawang namely Starch.

5) Optical Brightning Agent (OBA)

The effect of the addition of Optical Brightning Agent is on the brightness of the paper, OBA will increase the brightness of the Pulp. OBA can scatter light under ultraviolet light which then the paper will have a higher brightness than before the addition of OBA.



Gambar 4.3. (A) figure before given by OBA (B) figure after given by OBA

4.2. Controlling Chemicals

Controlling Chemicals are materials that function to control the course of the process so that it runs smoothly. Controlling Chemicals consist of:

1) Anti-Foam Material (Defoamer)
This chemical is used to prevent the formation of foam. The formation of foam in the paper making process is caused by the free air formed in the pulp rising to the surface, excessive turbulence occurs due to stirring, the emergence of foam in the pulp can affect gamature and reduce paper uniformity and reduce paper quality.

2) Anti-bacterial Ingredients (Biocide)
Biocide is added to inhibit the growth of bacteria in the pulp material, and to prevent the formation of slime. Slime is a thick and slippery layer formed by microorganisms. Slime can cause corrosion of equipment and disrupt the process of making paper. Biocide used in Paper Machine 12 at PT. X-Karawang, Microbial Biocide Sodium Hypochlorite (NaOCl).

3) Retention Aid (RA)
Retention Aid (RA) is used to increase the amount of fibers retained during the formation of sheets of paper, so that RA has the effect of increasing paper retention. There are 2 types of Retention Aid used in Paper Machine 12 at PT. X-Karawang namely Anionic Retention Aid that will stick to the Cation-loaded Pulp and Cationic Retention Aid that will stick to the Anion-loaded Pulp.

Cationic Retention Aid is added before the Screening process, this is because there are Pulp loads that are Anion, so that later will be bound by Cationic Retention Aid. While the Anionic Retention Aid is added after the Screening process, this is because after passing the Screening process the unloaded Pulp loads are those that contain Cations, so that they will later be bound by the Anionic Retention Aid. The binding process of paper loads is carried out so

that all Pulp fibers bind and there is not much loss that occurs when sprayed by Headbox to Wire.

V. CONCLUSION & RECOMENDATION

There are two types of additives used in the process of making paper in Paper Machine 12 PT. X-Karawang namely Functional Additives and Controlling Additives. Functional Additives consist of Dry Strength, Filler, Dyes, Sizing Agent, and Optical Brightning Agent. While Functional Additives consist of Anti-Foam Substances (Defoamer), Anti-Bacterial Substances (Biocide) and Retention Aid (RA).

The process of adding additives to paper making in Paper Machine 12 PT. X-Karawang are as follows, adding OBA to the Mixing Chest, which is mixed together with LBKP, NBKP, and Broke.

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