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Automatic Cationic Starch Preparation in Paper Industry

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ABSTRACT

This paper on "Cationic Starch Preparation", starch plays an important role in paper industry. It used to furnish the paper .Starch is a maize powder .Using the conveyor to transport the corn powder into the receiver tank.5% of water and 24% of starch mixed in the above mentioned proportion into the reactor tank. Using the furnace to heat the mixture at 99℃. And store the mixture in the storage tank. Our paper suggested that to control the level, temperature, pressure and flow of the starch preparation tank.

INTRODUCTION

In this paper work, **"Cationic Starch reparation"** which is considered to be one of the most important process**.** In a paper industry, there are many process involved in the formation of paper. Before the paper formation process in paper machines, some chemicals added at each stage of the process.

Types of starches

Classified into two types. Native starch and modified starch (cationic starch).

Native starch

The most common native starches are corn starch, tapioca starch, waxy maize starch, potato starch, wheat starch and rice starch.

Modified starch

Cationic starch, amphoteric starch, oxidized starch etc.

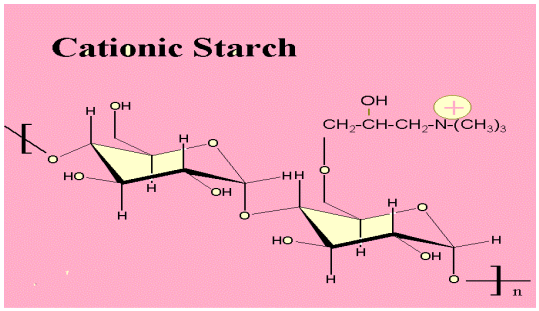

Fig: 1 Structure of cationic Starch

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Specification Of cationic starch

Physical state: odorless powder
Moisture Content % w/w (at 105°C-110°C): 14 max
pH value: 10% solution, 5-8,Viscosity 5% at50℃: high (greater than 2200 cps),Whiteness: 88% min.
Fineness (100 mesh): 99% min,Nitrogen content: up to 0.3%

Starch is a maize powder. The molecular formulae of starch is $(C_6H_{10}O_5)_n$. Starch is used in paper industry to improve dry strengthen and surface. The molecular weight is higher. Cationic starch has lower viscosity. The main sources of starches are regular corn, tapioca, waxy maize, wheat and potato.The plant at which all the chemicalsare made is called [1-3].

CHEMICAL ADDITIVE PLANT (CAP)

Specification Of cationic starch

Physical state: odorless powder,Moisture Content % w/w (at 105°C-110°C): 14 max, pH value: 10% solution, 5-8,Viscosity 5% at 50℃: high (greater than 2200 cps),Whiteness: 88% min,Fineness (100 mesh): 99% min,
Nitrogen content: up to 0.3%

The starch preparation process is also done in this plant. In this process the starch is prepared and stored in storage tank. In this project we are going to monitor and control some important parameter such as **level, temperature, pressure** of the diluted starch.

LITERATURE SURVEY

Preparation of Cationic Starch Ether: A Reaction Efficiency Study

By M. E. Carr and M. O. Bagby, Peoria, III.

The reaction efficiency (RE) of native corn starch and 2chloro-3-hydroxypropyltrimethylammonium chloride was evaluated in aqueous systems to form lowly substituted (DS about 0.01-0.07) cationic starch ether. The study was prompted by widespread interest in these derivatives as end papermaking additives and by the demand for more efficient reaction systems. Variables, including low energy input, were identified which allow high RE of 084-88% (% of monomer reacted). For example, a DS of0.044 representing an RE of84% was achieved at either 25'C in 48 h or 50'C in 4 h using 0.05 mole of monomer/mole of starch. Rate of reaction was greatest with the lowest monomer incorporation (0.025 vs. 0.05 and 0.10 mole ratio).

A Review of Amphoteric Starches in Preparation and Applications

ZHANG Min1,2, ZHANG Shu-fen1,*, JU Ben-zhi1, YANG Jin-zong1

Amphoteric starches are receiving increased attention because of the low cost and availability and environmental acceptability. But amphoteric starches have relatively low volume products and hence command premium prices which further restrict their usage. Though amphoteric starches are used in some areas, they should be used more widely, especially specific use areas. Meanwhile reaction efficiencies and the use effectiveness of amphoteric starches should be improved. It is necessary to develop amphoteric starches with high properties and multifunction. The kinds of amphoteric starches are not enough, new amphoteric starches need to be prepared ,and a variety of products with different anionic:cationic ratios can be produced as needed. Besides, dry process should be encouraged to apply during the production of amphoteric starches. It is known that amphoteric starches have greatly potential application in the future. Further research will focus on the property improvement of conventional amphoteric starches, the preparation of new kinds of amphoteric starches and their novel applications. In this new technology we used automatic.
Starch preparation technique. It will reduce the energy and water conservation with the help of modifying existing system. But in this project we are only using one STARCH-mixing tank with an agitator; level transmitter are used. So the hardware components used are reduced. In this process, tearness, less stiff, loss of furnish is over come.

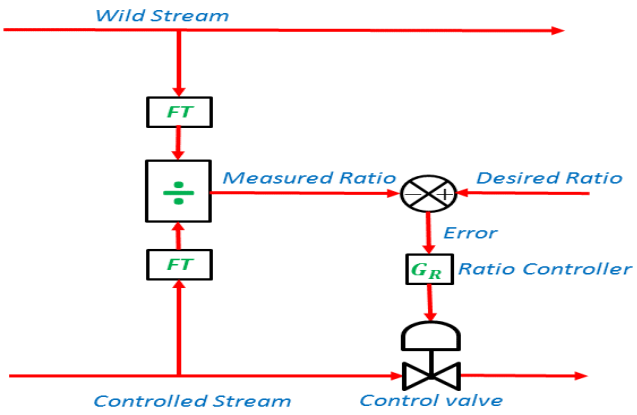

Fig: 2 Ratio Control

EXISTING METHOD

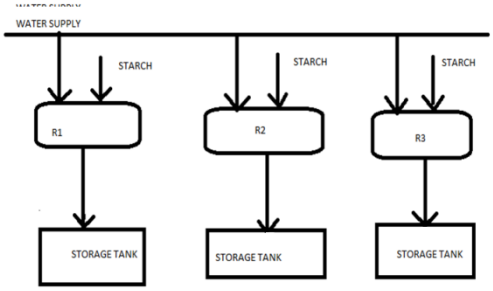

Fig:3 Existing Method

The existing method they are working with separate pipelines for filling each tanks. They are works manually in industry so they have some drawback like excess usage of water creates physical damages to the paper like tearness, loss of furnish, less stiff. In this process required more amount of water.It consists of separate starch mixing tank with Sagitator, level transmitter for each tank

PROPOSED METHOD

In this new technology we used automatic starch preparation technique. It will reduce the energy and water conservation with the help of modifying existing system. But in this project we are only using one STARCH-mixing tank with an agitator; level transmitter are used. Process, tearness, less stiff, loss of furnish is over come.

BLOCK DIAGRAM

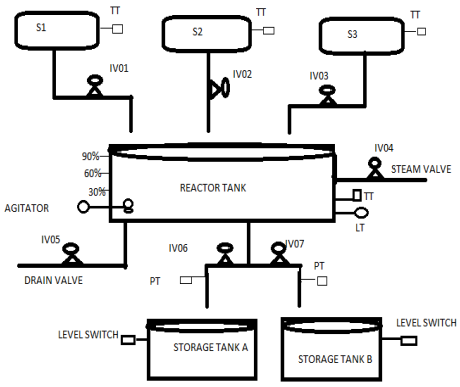

Fig: 4 Block Diagram

CONTROL TECHNIQUES

Ratio control

Ratio control is an application of feed forward control. Ratio control is almost applied to flow-rate control. The mixing of two or more fluids in a specified proportion.

In this process we mix the 2 substancein specified proportion. There are water and the corn powder. 5% of water and 24% of corn powder mixed in proportion into the reactor tank. [4-6]

Proportional-integral-derivative actions (PID)

The combination of proportional, integral and derivative control action is called PID action control and the controller is called three action controller. Here the proportional part of the control action repeats the change of error and derivative part of the control action adds an increment of output so that proportional plus derivative action is shifted ahead in time. The integral part is further increment of output proportional to the area under the deviation line.

The PID controller calculation (algorithm) involves three separate parameters; the Proportional, the Integral and Derivative values. The Proportional value determines the reaction to the current error, the Integral determines the reaction based on the sum of recent errors and the Derivative determines the reaction to the rate at which the error has been changing. The weighted sum of these three actions is

used to adjust the process via a control element such as the position of a control valve, the power supply of a heating element or DC motor speed and position.

The error between the reference speed and the actual speed is given as input to a PID Controller. The PID controller depending on the error changes its output, to control the plant input such that the error is minimized.

$$C(s) = Kp(1 + \frac{1}{TIs} + TD * s)$$

Where,

K_P: Proportional Gain constant

T_I: Integral reset time

T_D: Derivative time or rate time

The proportional control (Kp) is used so that the control signal responds to the error immediately. But the error is never reduced to zero and an offset error is inherently present. To remove the offset error the Integral control action (T_I) is used. Derivative control (T_D) is used to remove the oscillations in the response. Also, the presence of derivative control reduces the need of selecting large Kp value to achieve stability.

WORKING

With this unit, we can control the level, temperature and pressure in starch preparation system. A level,flow, sensors are placed in the

tanks which sense the solid and liquid substance. The temperature sensor is used to monitor the temperature. The sensed signal is transmitted to the microcontroller through comparator. The microcontroller receives the signal and works based on the sensed level of solid or liquid substances. If the level of the starch is less than the set value, the relay switch starts the pump and the water flows to the tank. If the level of the starch is more than the set value, the relay switch stops the pump in turn stopping the flow of starch from the pump. Then the tank filled with the starch it will goes to the reactor tank. In this reactor tank agitator to be placed. Agitator is used to mix the water and starch powder. The pressure and the temperature sensor is placed in the reactor tank used to monitoring purpose. Reactor tank will reach the set point it moves to the storage tank. The matrix keyboard is available to change the required set point.

RESULT&SIMULATION

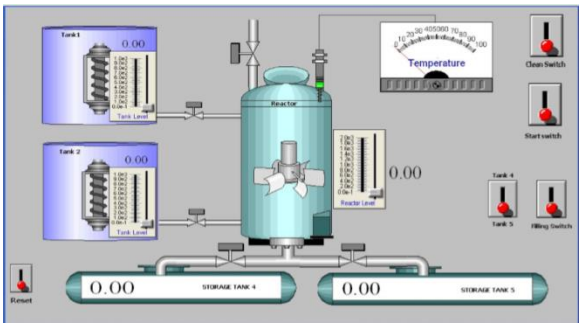

Fig: 5 Result&Simulation

ADVANTAGES

Advantages of Modified Over Native Starches**:** The advantages of modified starches over native starches are multiple. The most significant of all are the enhanse in productivity and paper quality has improved. Therefore, the best value provided by the modified starch over native starch is the reduction in downtime and improvement in paper quality

modified starch paper increase strength, water drainage, retention, improve quality; minimize dusting, size addition; greater control of paper making process hence less paper web breaks and improve paper machine run nability as well as productivity. It is a surface size, cationic starch improves stiffness ,brightness, opacity and printing quality.

CONCLUSION

Thus, the use of modern starch in industrial manufacturing process appears to be a major source of contamination for a number of other consumeables we tested. this paper overcomes all the defects and faults of the existing method. The major problem of the is water conversation is rectified. Hence, the process is optimized and reliable output is obtained at the end as the result of performance of the proposed method.

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