The Challenge of Corrugated Board Adhesive System

For the trend of high speed corrugator
and recycled fiber as a paper based material

SMS Corporation Co., Ltd.

CORRUGATED BOARD INDUSTRY, GROWING TREND TO WATCH

Corrugated Board Industry is on a growing trend and expected to keep momentumof more than 4% annual growth through 2019 with volume of more than 115 million tons valued over $176 billion (Ref.www.smitherspira.com)Some key drivers are growth in population to over 7.5 billion in 2017 (Ref.www.worldometers.info/world-population)and consumption growth in online shopping.

To remain competitive, corrugated board manufacturers must reprocess for profitability with newer technology using high speed corrugator machine, improving sheet board strength, using recycled paper and lightweight paper for cost down while retaining quality performance. Manufacturers in the corrugated board industry including sheet board, corrugator machine, glue mixing system, starch adhesive, other chemical adhesive have turned to modified starch as an important ingredient for production of quality corrugated board. They are increasing their productivity by running faster corrugator machines at higher production capacity and maintaining efficiency by controlling waste from production. Some of the quality checks are PAT, ECT, FCT, BCT, and in some cases, water resistance.

There are 3 key components to production of corrugated board: Kraft paper, Corrugator machine, and Adhesive System. Manufacturers of each component need to tune their production process and quality to meet current competitive demands

KRAFT PAPER: INCREASING TREND TO USE RECYCLED PAPER

Necessity to reduce cost and help conserve the environmenthave dictated widely popular use of recycled paperassourceforcorrugatedboardproduction.Morethan274 million (Ref. Recovered paper market in 2015, BIR Global facts & figures) tons were used in 2015 and growing since. Fiber strands in the pulp of recycled paper get shorter and less intertwined causing for loss of strength after each recycle. Note that paper can be recycled up to 7-10 times depending on processing quality. To increase the strength of recycled paper, starch is added in surface sizing process. However, this method makes smooth and less porous surface allowing for less adsorption of adhesive to paper which in turn causes board delamination when board liner and corrugated medium do not adhere during production. This can be a major problem during production run resulting in wastes.

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CORRUGATOR: INCREASING SPEED WITH HIGHER PRODUCTION CAPACITY

Corrugators have evolved to run faster and the width of machine have grown. In the past, a corrugator usually runs at speed of 100-120 meters per minute (MPM) with capacity for 12,000-48,000 tons per annum (TPA). Now, a world class corrugator from Germany can run up to 400-450 MPM with capacity up to 80,000-150,000 TPA and width up to 3.35 m. This speed and volume require quality Kraft paper matched with Adhesive system.

ADHESIVE SYSTEM: MODIFIED STARCH FOR TOTAL QUALITY PERFORMANCE AND COST REDUCTION

Adhesive is used to hold together the Liner paper and Corrugated medium. Modified starch is used to formulate adhesive for high speed corrugated board production, sometimes with other chemical additives such as crosslinking agent, water resistance, viscosity stabilizer. The key importance is to be able to bond the very smooth surface of recycled size pressed paper to the recycled corrugated medium. Modified starch has been widely accepted as an innovative, effective, and environmentally friendly adhesive solution. Using only Chemical additives tend to be less effective and not environmentally friendly.

There are 2 types of adhesive system or glue kitchen: No Carrier System and Carrier System. No Carrier System is the old conventional by mixing starch with water and caustic soda, then Borax at final stage. This system has a down fall with viscosity instability during production run. At initial mixing at the start of production, the adhesive has very high viscosity from swelling of molecules making it difficult to pump through but then the molecules start to breakdown through shearing after start of production, so viscosity continuously drop. The viscosity cannot be consistently managed by adding another batch or partial batch as this would cause for too much viscosity to pump.

Carrier System is replacing the conventional system with the main advantage being a two-phase adhesive system which can better control drop in viscosity with higher mixing speed and a separate tank for mixing and activating the new batch. This control of the swelling of molecules at two phases eliminates the problem with over viscosity. Carrier starch (10-15% of total starch), the primary starch in the first phase, is mixed with water and caustic soda and cooked to 30 - 35°C then pumped to mix with the secondary uncooked starch(85% of total starch). This system is suitable for use with SMS carrier starch. Solid content and other glue parameters can be controlled and optimized for ideal bonding at high speed and no delamination waste.

SMS Corporation (Thailand), a leader in Innovative Modified Tapioca Starch has formulated Modified Carrier Starch for optimizing adhesion in corrugated board production up to 300 MPM. Many plants have saved more than $30,000 per year with SMS Modified Carrier Starch solution.

•**SMS C300**: suitable for production cost reduction. This solution improves water holding and bonding to paper with less splashing during machine run, resulting in 10-15% less glue consumption. Higher viscosity stability helps glue distribute more evenly over all paper surface for consistent adhesion.

•**SMS GREEN416**: specially optimized for use with recycled size pressed paper. This solution adsorbs and bonds quickly to the smooth surface of recycled paper thus allowing for faster machine speed and less delamination waste.

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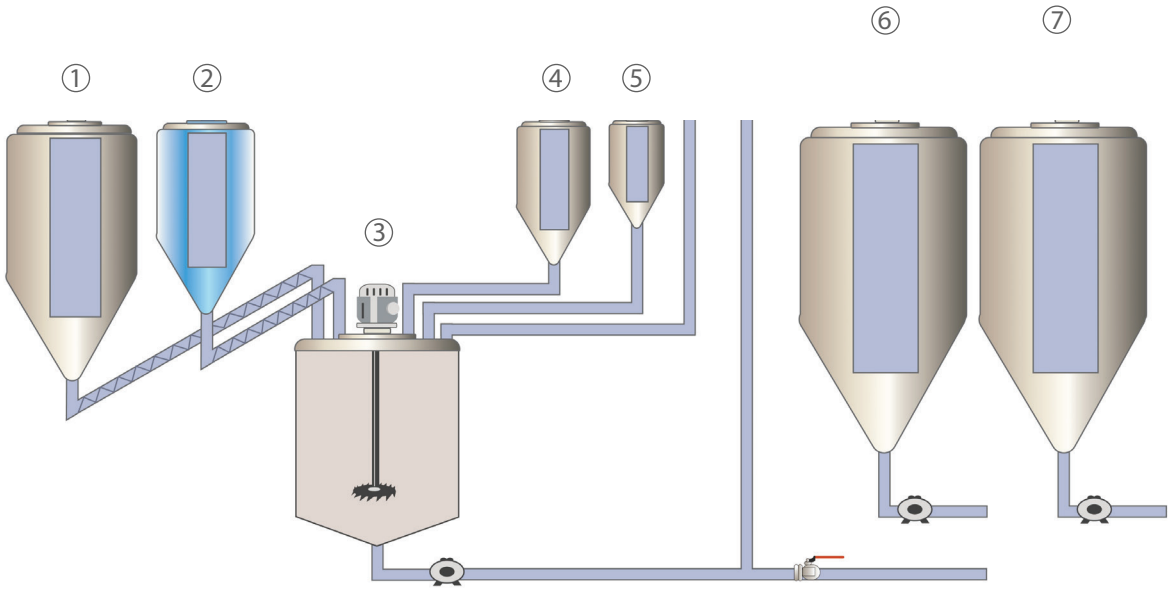

Auto Glue Kitchen

GLUE KITCHEN: PICKING THE BEST SYSTEMS FOR MANUFACTURERS

The conventional Manual Glue Kitchen such as Stein Hall System requires Glue Makers to prepare and manually measure the volume of the starch, chemical, and water mixtures. This risk human error and is inconsistent in quality. As the industry grew, Auto Glue Kitchen became more popular as it is easy, consistent in quality mix, and can work continuously through batches. Large manufacturers (48,000 TPA and up) prefer Auto Glue Kitchen to handle continuous high speed production.

However, Auto Glue Kitchen is only a partial solution to production speed, corrugated board lamination, and waste reduction. Modified starch is required in the mix for final solution ideally used in the Auto Glue Kitchen with Carrier system where SMS C300 or SMS GREEN416 is the carrier part. The most modern Auto Glue Kitchens today are designed with modified starch as carrier part in mind; one silo for native starch and one silo for carrier starch part. The system is programmable for mix volume, speed, time, and sequence as illustrated here.

CONCLUSION: TECHNOLOGY TREND FOR CORRUGATED BOARD INDUSTRY

High growth in the corrugated board industry and environmental conservation awareness have led to wide spread use of recycled paper for corrugated board production. The requirement for quality at lower cost and less waste have necessitaed for new Corrugators with higher speed to work in combination with new Auto Glue Kitchen with Carrier System using Modified Starch. SMS C300 or SMS GREEN416 modified starch increases the adhesive properties for lamination of corrugated board even while running at speed over 300 MPM with little waste. The modern modified starch carrier system is the best choice for a corrugatingplant's high quality board, speed productivity, and waste efficiency while also conserving the environment.

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