Avebe

Solvicol®

HOLDING IT ALL TOGETHER

ADHESIVES FOR PAPER SACKS

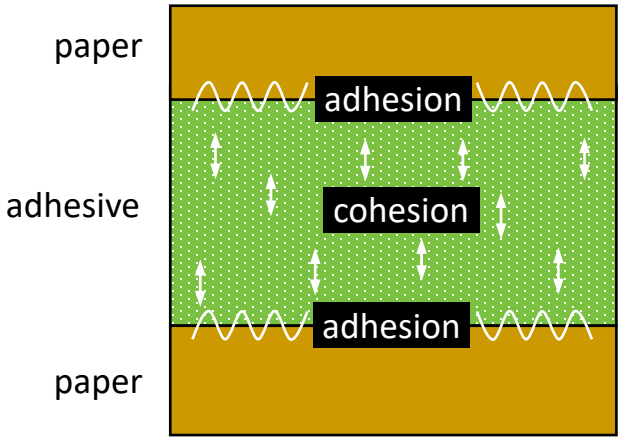
BILLERUD SEMINAR 2023

Contents

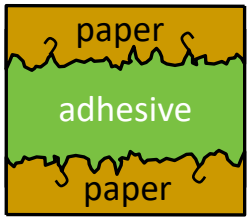
Mechanism of Gluing

Adhesion:
Force on the interface of two unlike substances.
Bonding of an adhesive to a surface by a combination of mechanical, physical and chemical forces.

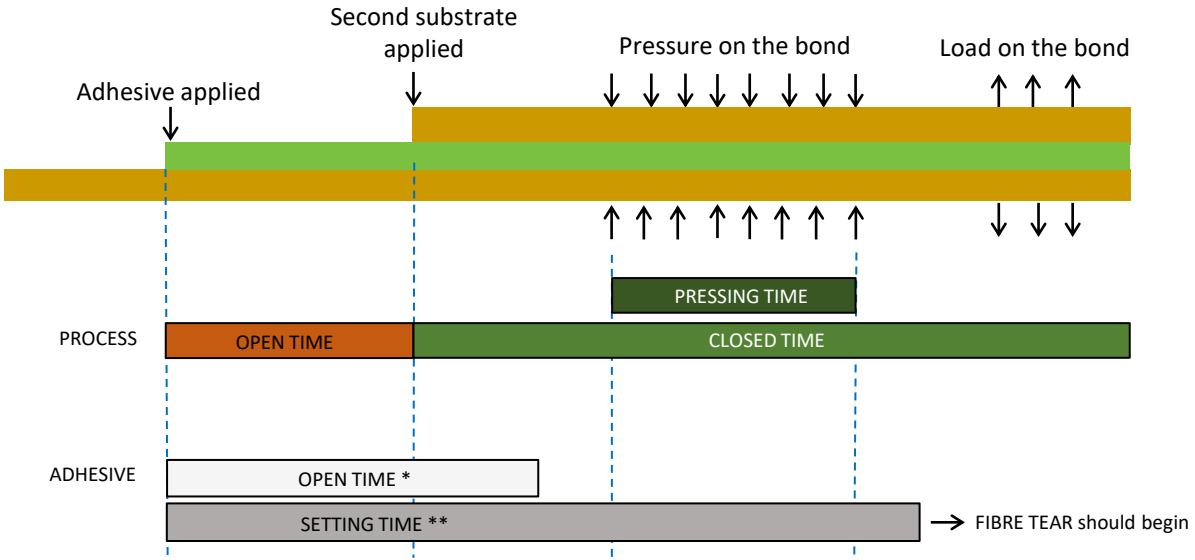
Cohesion:
Where the particles of a single substance holds itself together.



Anchoring of an adhesive into paper
(for visualisation only)



Process of Adhesion



- Adhesive should not set immediately
  Open time of the adhesive should be longer than the process time to allow for minor adjustments (alignment)
- Adhesive should set before the process is complete
  The setting time should be shorter than the open time + the closed time of the process. Fibre tear should be expected after the setting time.

Note : Setting time is the time after which fibre tear occurs. Setting time is not the same as drying time.

Viscosity

Viscosity is the resistance to flow & measured by either a viscometer or with a calibrated cup.

Influenced by:

- adhesive composition
- degree of dilution (dry solid content)
- temperature
- shear applied
- time (stability)
- equipment

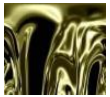
Examples of different viscosities

Peanut Butter

Sour cream

Ketchup

Motor Oil

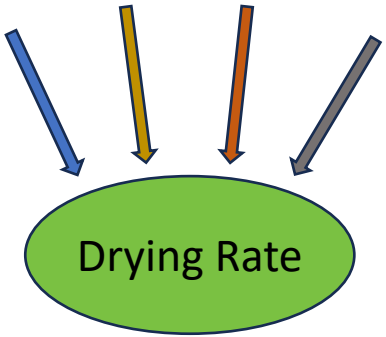


Water

Side Note : Quality Control : When measuring viscosity, always

• keep a log of measurements for each batch	QC control
• let a sample rest for 20 minutes before measuring	to allow entrained air to escape
• record measuring temperature	QC control
• measure at the same temperature	consistent measuring parameter
• record glue type and batch number	QC control
• record glue to water ratio	consistent measuring parameter

Factors that Influence Paper Sack Drying Rates



• Composition of adhesive	(binder/polymer/ds)
• **Quantity of adhesive applied**	(grams glue + grams water)
• Paper quality	(porosity/cobb)
• Bag design	(PE liner/# plies)
• **Environment** }	(Evaporation °C, %RH)
• **Ventilation** }	(stacking pattern, storage)
• Machine design	
• Roller Pressure	(improve spread and penetration)

Glue qty applied, ie, solvent content, has a very big influence on drying time

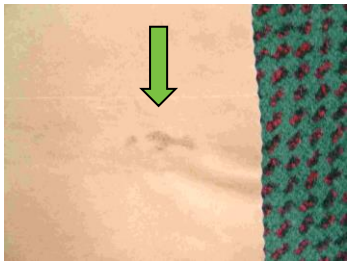
Liquid adhesive amount	Dry solids content of the adhesive	Water content in the adhesive
100	17%	83%
100	30%	70%

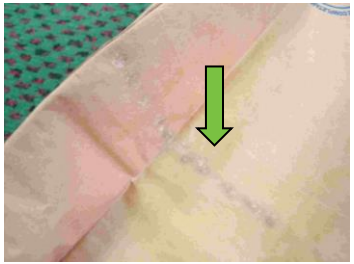
Common Issue : Strike Through

This is when the adhesive penetrates through the paper, causing adjacent sheets to stick together.

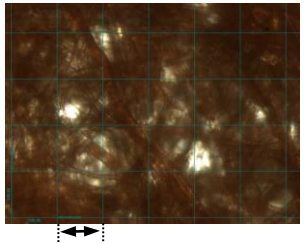
Due to

- Too much adhesive used,
- Splashing of adhesive
- Poorly designed glue
- Paper porosity
- Excessive roller pressure



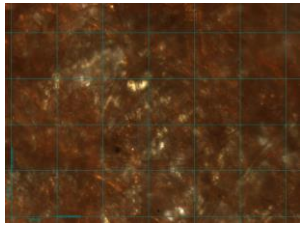


High porosity paper
(Gurley 5 s/100ml)



100 µm

Normal paper
(Gurley 20 s/100ml)



Challenges of Adhesion to HP Papers

The concern : glue penetration control

The paper influencing factors :

- Grammage
- Porosity
- Pore size
- Roughness of surface
- Water absorption (cobb)

Roughness

High Roughness Low gsm

Roughness causes pooling and thus, may promote bleed through

Porosity and Grammage

Low Porosity - High Grammage

traditional - usually easily manageable

paper
adhesive
paper

High Porosity - Low Grammage

specially engineered adhesives needed to prevent bleed

Desired Outcome

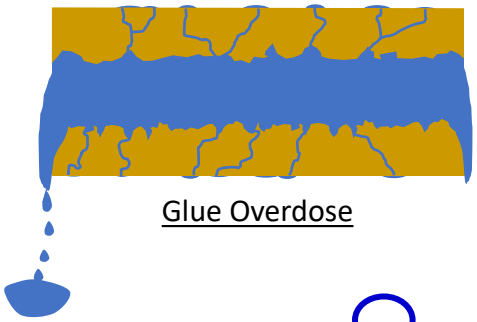
Ideally ...

- even film forming
- sufficient anchoring
- controlled penetration

High Porosity - Low Grammage

Definitions :
high porous (≤ 5 s)
low grammage (≤ 70 g/m2)
pore size 1 - 80 µm average 25 µm
70 g/m2 paper = average 100 µm thick
liquid adhesive amount applied = average 100- 150 µm thick

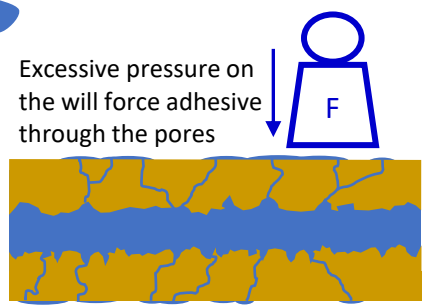
Effect of Overdose, Excessive Pressure & Solids



paper
adhesive
paper

Glue Overdose

Excessive pressure on the will force adhesive through the pores

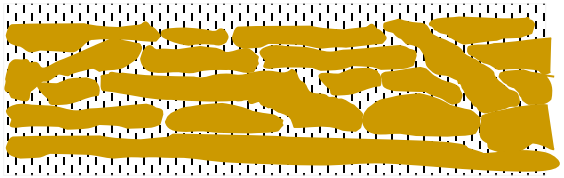


Excessive Pressure

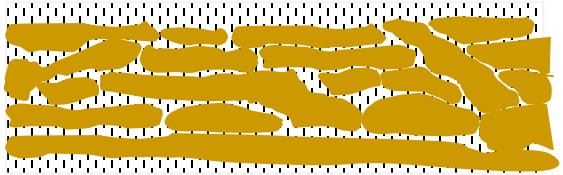
With the correct dosage and pressure

Dry solid content (15–30 %)

Low Solids - high water content



Low Molecular Weight
no resistance to penetration



Adhesive Types

Adhesives

- Modified starch-based (modified starch dissolved in water)
- PVAc based (Dispersion of polyvinyl-acetate in water)

Modifications to starch-based adhesive

- Add a filler (calcium carbonate, clay) not for nozzle applications
- Add PVAc (not recommended, but if needed, only on traditional older machines)
- Adjust dissolving ratio (fine-tune viscosity)
- Try alternative Solvicol products

Starch adhesive dissolved in water
17% solids (approx.)

water binding – controlled film forming
good open time
easily tuned to optimize performance
Easy to clean machine – minimise down time
bond not affected by heat
does not stick well to plastics*

* will work with corona treatment but, PVAc is easier

PVAc* dispersed in water
50% solids (approx) (polymer + plasticizer)

water pushed out – fast film forming
very short open time
Hard residue – hard to clean
Longer machine down time – production loss
bond can soften when hot cement loaded

Sometimes, PVAc has to be used, but where possible, use a starch based product

Additives & their Effect on Solvicol

Type of additive : Filler (10–30 % on Solvicol powder)
General Effect : increase dry solids
change rheology (structure)
closing of the paper pores
shorter drying time

Possible fillers
$CaCO_3$ - (1–20 µm)
Clay - (1–10 µm)

Type of additive : PVAc dispersion (25–30% on Solvicol powder)
General Effect : increase dry solid
faster film formation
closing of sheet surface

Plasticized homopolymer (should be compatible with starch)

New System Start Up

When a new system is started up, a number of parameters must be checked upon.

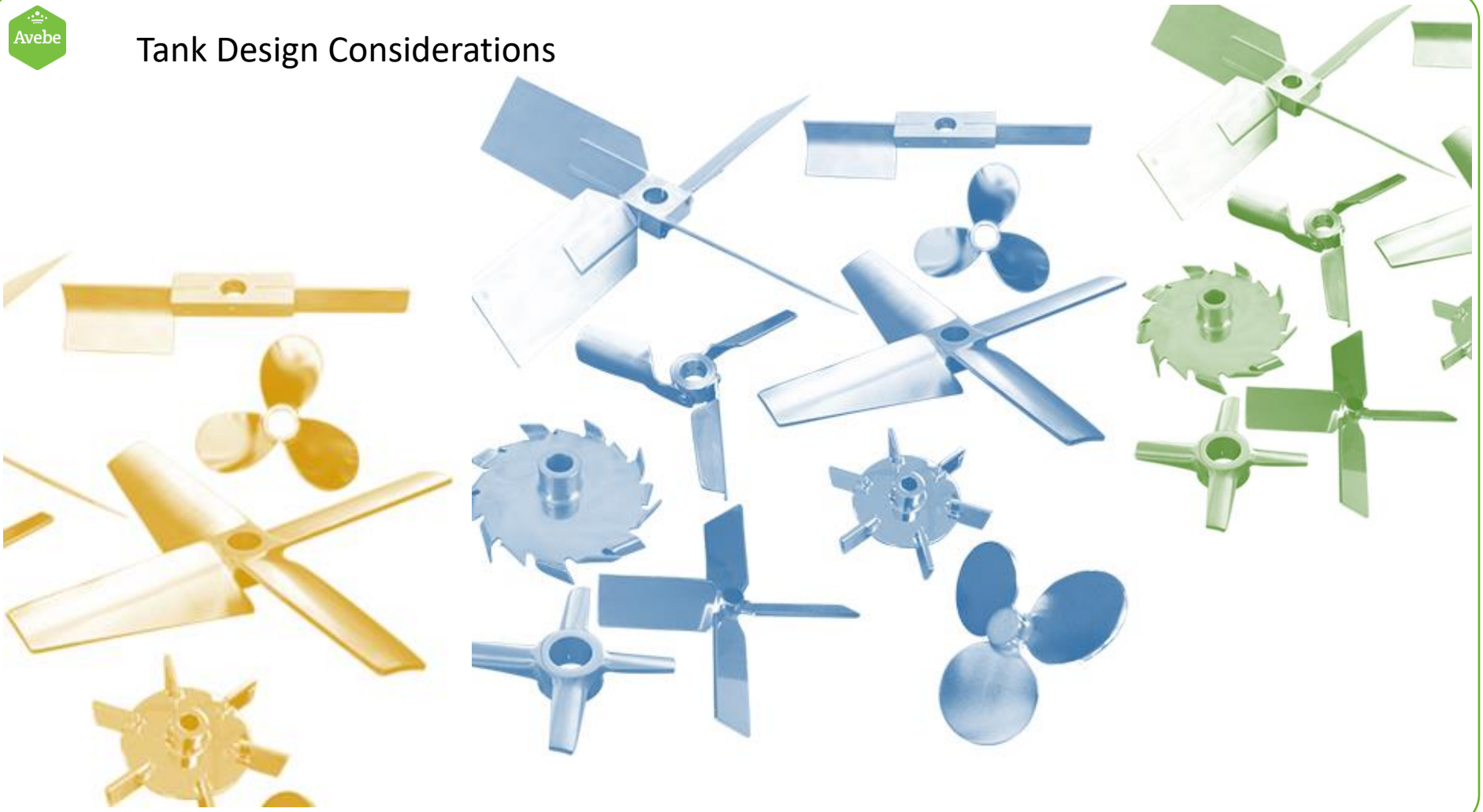
Please do not assume that a new glue make down system is designed ideally. Engineering companies will design a theoretically derived ideal system to the best of their knowledge.

However, we are dealing with adhesives, and some parameters could have been overlooked. Factors that would compromise the efficiency and flexibility of your system.

Please do contact AVEBE (me). I will request for certain information that will help me evaluate the system and propose modifications and upgrades if necessary. We have designed and upgraded many systems

(Your information will remain confidential. Most of the time, what you may think is top secret is actually common knowledge, and only you think it is top secret ☺)

Tank Design Considerations



Glue Make Down Factors

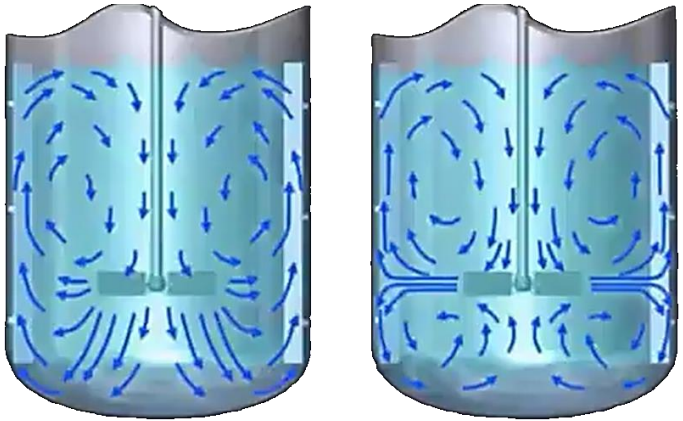
There are many factors that influence the the quality of the glue that is made down

- Tank design (Flow. Dispersion. Blend. Dissolve. Air Entrainment)
- Impeller used (Dispersion Efficiency)
- Pouring speed (Paste Quality. Lumping)
- Water quality (Bacteria. Enzymes.)
- System hygiene (Piping design. Dead spots. Flushing frequency. Biocide type.)
- Storage tank design (Agitator speed. Agitator type. Storage time. Covered)
- Distribution system (Pump. Pressure tank. Manual.)

Tank Design Factors

Flow pattern

which is the ideal flow pattern?!

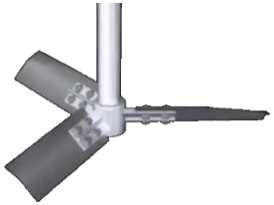


Axial Flow

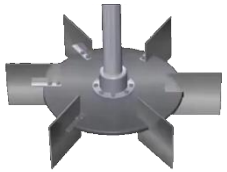
Radial Flow

Impeller type

which one to use?!



Low Viscosity Hydrofoil



Rushton Turbine

Wide Blade Hydrofoil

Marine Propeller Impeller

Factors that Influence Mixing

click on video to play

well dispersed

poor dispersion

due to powder dissolving too fast

Factors that could cause this -

- High water temperature (too fast dissolving)
- Poor tank/mixer design (poor dispersion and turbulence)
- Incorrect addition rate
- Powder dissolving rate

Biodegradable? 😳 A little bit about Sustainability and Pollution

https://www.dezeen.com/2019/04/30/biodegradable-plastic-bags-research-university-plymouth/

Bags labelled as “biodegradable” still usable after 3 years when tested under normal conditions.

It takes many MANY years for a plastic bag or PP bag to *degrade* (they do not decompose as they are not organic) in a landfill. Unfortunately, the bags don't break down completely but instead photo-degrade, becoming microplastics and continue to pollute the environment.*

*ACS Publications. 2020. “Degradation Rates of Plastics in the Environment,” Pages 3495, 3499-3500, 3503. https://pubs.acs.org/doi/10.1021/acssuschemeng.9b06635

Use natural safe organic products *wherever possible**. eg, paper, starch etc
These will decompose over time as they are organic.

Sometimes, synthetics must be used. Imagine what those trillions of PP bags in dumps are doing to your water, land and families. Only use non-decomposable products when absolutely necessary.








DRATJER
VEENDAM
2000

ALWAYS READY TO HELP

WITH A GOOD SOLUTION

BECAUSE
WE
KNOW
HOW

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