ADVANCED ADHESIVES REPORT

AUGUST 2004

Your corrugating adhesives newsletter from Harper/Love Adhesives Corporation

Making your numbers:

What do you measure, and how?

By Rex Woodville-Price

There is an old saying in the corrugating industry: "This is a tricky business because we buy paper by the pound and sell board by the square foot." While this is not entirely accurate and not all box plants do this, it does highlight a sometimes confusing truth: not every plant measures its output the same way.

Weight, area, or length?

Output based on weight will usually be stated as weight divided by time. This would be something like tons per hour or tons per month. Integrated box plants tend to prefer this type of measurement because that's how the mills measure output.

To express output based on area, the area is divided by time. This gives us terms such as million square feet per month. Independents commonly use this measurement because it relates more directly to how they measure sales.

When output is expressed in length, it will be stated as a lineal dimension divided by time. The result is terms such as million lineal feet per month. Corrugator crews tend to use this method since they have no control over the width of the orders and it allows them to compare machines of different width.

What do the numbers mean?

These numbers can be a bit confusing when comparing different box plants running different product mixes. For example, consider two imaginary box plants producing the same square footage per shift. Plant A runs lightweight board and Plant B runs heavyweight double wall. Because of this Plant B will produce much more in tons per shift than Plant A. Likewise, two corrugators of different widths producing the same lineal feet, will have different outputs in square feet.

Machine speed is often mentioned as well, although strictly speaking, it is not a measure of production. Speed is usually expressed in terms of a lineal dimension divided by a time unit, i.e., feet per minute. (We could also use miles per hour, but the number wouldn't be very impressive; 1,300 fpm = just 16 mph. Even a bicycle could beat that.) Speed can be misleading. As in the fable of the tortoise and the hare, it is average speed, including downtime, that matters most.

(To make this all more interesting, the rest of the world uses the metric system. So instead of square feet they use square meters, and lineal meters instead of lineal feet. Tons are still used but a metric ton is 1000 kilograms which is equal to 2205 pounds.)

However and whatever you measure in your plant, the path to success is to establish benchmarks, set goals, and manage the entire process scientifically to achieve the improvements you seek. Your Harper/Love representative is eager to help.

How do your numbers compare?

	FAST	*FASTER*	*FASTEST*
Top speed	500 fpm	800 fpm	1200 fpm
Average speed	300 fpm	450 fpm	750 fpm
Lf/h	18,000	27,000	45,000
Machine width	78"	87"	98"
Average width	70"=5.8'	78"=6.5'	88"=7.3'
Square feet/hr	104,400	175,500	328,500*
Square feet/shift	835,200	1,404,000	2,628,000
3 shifts (total)	2,505,600	4,212,000	7,884,000
Tons/hour	6.8	11.4	21.4**
Tons/day	163	274	514

Assumptions: In order to keep this table to manageable size, some assumptions were made.

1) To obtain average speed numbers from the top speed one must consider that not only downtime will lower the average. Not all orders can be run at top speed because of restrictions such as cut length or heavyweight board.

2) Average width numbers are lower than actual machine width because of side trim and scheduling efficiency.

3) For the conversion from msf to tons we use an average basis weight of 130 lbs/msf. To calculate lbs/msf for combined board you take the weight of the liners plus the weight of the medium multiplied by the takeup factor.

**This is enough board to cover seven football fields every hour.*

*** To put this number into perspective this corrugator would almost use up one railcar (20 rolls) of paper every two hours.*

(Now when somebody tells how much they ran last shift, you'll know if they are bragging or complaining.)

The economics of liquid-enhanced adhesives

Using liquid adhesives is an investment in cost savings. They more than pay for themselves through improved R. O. I.

By Lou Cuccia

Corrugating plants are more streamlined than ever. Modern equipment and attentive management have them running faster, with greater efficiency and lower cost than ever before.

The marketplace, however, will not tolerate complacency. The search for improvements never ends. Liquid-enhanced adhesives provide an opportunity to improve your return on investment without simply resorting to attractive but counterproductive cost-cutting measures.

Technical benefits

Liquid-enhanced adhesives have a dramatic effect on quality, cost and productivity. Once the technology was developed to suspend performance-enhancing ingredients with specially blended dissolved starches in liquid form, the next generation of performance adhesives was born.

Chemically enhanced liquid starch adhesives are tailor-made to penetrate tight paper fibers, dry faster, and create stronger bonds. Liquids have the characteristics of modifying the rheology of the starch, resulting in better film forming. The better the film-forming characteristic, the better the pick up and transfer of the starch adhesive. The end result is more consistent application, reduced consumption, and drier, firmer, flatter sheets coming off the corrugator.

Handling benefits

These liquid performance products fit the new automatic starch mixing systems with the benefit of reduced labor cost. Liquids can be supplied in totes or bulk, reducing space and inventory. They can be automatically metered or pumped to the starch system eliminating the need for cutting and handling of bags. They eliminate the cost and risks of handling pallets and bags. They do away with the environmental concerns of airborne particles. There are no more bags to dispose of.

Dollars and sense

The big news is that liquid-enhanced adhesives make sense economically. Getting a handle on that contribution requires an analysis of true applied costs. Let's take a look at four ways using liquid-enhanced adhesives can improve your R.O.I.

1. Greater machine speeds

Liquid-enhanced adhesives let you run faster. If you can experience a 2% increase in corrugator speed, say from 25,000 lineal feet per hour to 25,500 lfph, your output with 90" paper would step up from 187,000 square feet per hour to 191,250 square feet per hour. This increased production reduces your machine cost per thousand square feet (msf), and therefore your total production cost per msf.

2. Lower consumption

The superior film-forming properties of a liquid-enhanced adhesive allow greater control over adhesive usage. Exploiting this feature will allow for adhesive consumption reductions. A reduction of just two-tenths of a dry pound per msf can result in significant annual savings.

3. Less waste

Liquid-enhanced adhesives produce superior bonds (especially with heavyweight and HRC liners). Better bonds reduce waste and returns. A waste reduction of just one quarter of one percent can yield dramatic savings.

4. Converting efficiency

Flat, dry, high-quality sheets improve throughput and kicks per minute. If a converting machine is running 36,000 square feet per hour, and increases production by only 0.5%, an increase in contribution would result.

Machine A is converting 36,000 sfph:

0.5% increase sfph	= 180
x hours run per week	= 100
x weeks per year	= 52
Add'l sf per year	= 936,000

If the material contribution margin (net sales less raw materials) is $13.35 per msf, the yearly return would be $12,500 (936 msf per year x $13.35 per msf.)

Our model plant parameters:

• Model plant is running three shifts, 5 days per week.	
• Average machine speed	25,000 lf/hr
• Average paper width	90 inches
• Average square feet/hour	187,000
• Average yearly msf	1,125,000
• Average basis weight	146 pounds per msf
• Average monthly waste	7.5%
• Machine fixed cost per hour	$500.00
• Machine fixed cost per msf	$2.67
• Modified carrier formula cost per msf	$3.05
• Liquid-enhanced formula cost per msf	$3.08

The results

1.	Increase speed 2%. Machine cost reduction	$34,425
2.	Reduce consumption 0.2 dry pounds per msf	6,082
3.	Reduce waste 0.25% (paper cost only)	62,825
4.	Improve converting efficiency 0.5%	12,500
	Total savings	**$115,832**
	Annual additional investment to use liquid-enhanced adhesives	**($33,750)**
	Return on investment (243%)	**$82,082**

It all adds up.

Taken together, these liquid-enhanced adhesive improvements can make a big difference in the profitability of your corrugating operation. Careful analysis reveals that what matters is not the *investment* (the price of the adhesive), but the *return on the investment*.

There are many calculations involved in getting to the bottom line. Space here does not allow a full development, but a copy of our calculations, tables and results is available from your Harper/Love representative.

More to the point, he can also help you work through the same calculations using your plant's actual numbers.

Looking for trouble

Stop problems before they start with a weekly search for dust and starch buildup

By Wayne Porell

Buildup of paper dust, starch, and other grime in your corrugator's insides can contribute to problems with productivity and board quality. Here are some things to look at in your weekly maintenance routine.

- Sensors. Even a small amount of dust on sensors can compromise their performance. Faulty signals from sensors can trigger a host of problems resulting in waste-producing warp, delamination, and more.
- Mechanical stops. Don't let dust, starch, grease and grime accumulate under stops. This buildup can create unparallel rolls, and in the case of the pressure roll, decreased pressure. Again, worst-case scenarios include warp and delamination.
- Glue roll cells. When glue roll cells are not clean, the cells cannot hold the correct amount of starch. Uneven starch application can result in S-warp across the machine.
- Ductwork. On vacuum machines, buildup of dust, wax, or oil in the ductwork to the vacuum pump and in the silencer increases the risk of fire. Keeping the ductwork clean dramatically reduces this risk.
- Seals. On positive-pressure machines, dirty seals can keep the vacuum chamber from sealing, resulting in insufficient pressure to hold the medium to the corrugator roll, especially at higher speeds. On cartridge machines, dirt can prevent the cartridge from setting in the correct position.
- Vacuum guides. Clogged vacuum holes in these guides can cause end-to-end warp. They can also cause the blower motor to overheat, risking damage, fire, and downtime.
- Slitter-scorer. Dirt and grime can keep your slitter-scorer from setting up accurately, resulting in ragged edges. If the lock-down bar has dust and oil built up around it, the bar will react slower; the heads will not lock down in the correct position.
- Knife. When dust and paper build up inside the knife, you'll experience more knife jams. It can also keep the sheets from coming out of the knife properly.

  Dust buildup behind the exit rolls can also create stacker jams and contribute to premature wear on these rolls.

  Clogged holes in the vacuum section exiting the knife, or a full vacuum bag, can prevent the sheets from shingling correctly and cause stacker jams.

And don't forget the starch kitchen

- Mixing tank. If you want batch-to-batch consistency, clean your starch tank on every shift so the load cells will zero properly. Ten minutes per shift is a small investment for predictable performance.

Pay me now or pay me later

Diligent preventive maintenance and supervisor involvement can pay off big. Yes, it costs to maintain equipment properly, but deferred maintenance costs even more. Well-maintained equipment produces more, faster, better, with fewer problems and less waste.

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Harper/Love Adhesives Corporation
11101 Westlake Drive
P.O. Box 410408
Charlotte, North Carolina 28241-0408

Leaders in the science of making good adhesives better.™

800-438-3066
www.harperlove.com
e-mail: salestech@harperlove.com

IN THIS ISSUE

Aquaseal Plus™ Outstanding performance. Superior wet strength.

This unique product combines water resistance and high performance in one easy-to-use liquid product.

- Reduces cost compared to using carrier starch for performance, plus resin for wet strength
- Stable viscosity
- Exceeds TAPPI 24-hour soak test
- Better bond quality
- Increased corrugator speeds on heavyweight grades
- Single, simple application
- Easy-to-use liquid for any manual or automatic mixing system
- Safe to use. FDA approved

For detailed technical information or a demonstration in your plant, contact your Harper/Love representative or call us toll free at 800-438-3066.