ISSN: 0379-5462
IPPTA: Quarterly Journal of Indian Pulp and Paper Technical Association
Vol. 29, E3, 2017, pp.1-4

BUCKMAN DEVELOPS THIRD GENERATION MAXIMYZE® FOR RECYCLED PACKAGING

Rosa M. Covarrubias

Abstract :

Development of biotechnology for the pulp and paper industry has been long studied. Twenty years ago, knowledge about enzyme mechanisms for different applications was limited. In addition, production of the appropriate enzymes on a commercial scale was costly. Only recently have we been able to produce enzymes that have acceptable costs and to achieve a more in-depth understanding of how enzymes work in the modification of wood and wood components.

Buckman has dedicated significant resources to fundamental enzyme research in order to gain a better understanding of their mechanisms. This work has provided a solid base for successful development and marketing of enzyme based technologies for the pulp and paper industry.

This dedication to identifying more effective ingredients and application expertise that drive improved program effectiveness is reflected in Buckman's new Maximyze3504. This third generation fiber modification product is designed specifically for recycled packaging. It addresses some of the "blind spots" experienced with generations 1 and 2: achieving an increase in mullen/burst and effectively treating recycled fiber in the absence of refining. This article will demonstrate the increased effectiveness of Maximyze 3504 over existing formulations.

HISTORY

The use of enzyme based products in the pulp and paper industry has grown extensively and will continue to expand in the future as environmental regulations become more stringent. The use of these technologies is interesting and attractive for several reasons, but most importantly: (1) they have a very low toxicity, making them quite safe to use, and (2) they are produced from natural, renewable sources with low energy requirements.

Ten years ago,after dedicating resources to fundamental enzymatic research in order to gain a better understanding of their mechanisms, Buckman introduced their first Maximyze product. These firstgeneration products were single-component enzymes stabilized with a patented technology to allow product storage in paper mill conditions for up to six months.While effective on bleached Kraft pulps, success in recycled packaging fiber systems was minimal. Continued research led to the blending of multiple single-component enzymes into one product, improving the product's access to unbleached recycled fiber. This second generation of Maximyze was and continues to be successful in delivering improved strength and productivity while often reducing the energy required to manufacture recycled packaging grades. With these products, Buckman was awarded the US Environmental Protection Agency's Presidential Green Chemistry Challenge Award in 2012. However, there are some process conditions where the second generation was not economically viable. Second generation Maximyze struggled with packaging grades requiring high mullen/burst specification. In addition, operations that ran without refining the fiber could not take economic advantage of Maximyze. A more effective product was needed.

Introducing Maximyze® 3504

The dedication to identifying more effective ingredients and application expertise that drive improved application effectiveness is reflected in Buckman's third generation product for fiber modification, Maximyze 3504. This blend of several single-component enzymes, combined with potentiators that boost enzymatic activity and improve access of the enzyme molecules to the fiber surface, has demonstrated marked advantages to either first or secondgeneration Maximyze products.

After extensive testing, Maximyze 3504 was introduced into the recycled packaging market, where it has clearly demonstrated improved effectiveness. The thirdgeneration product has shown improvements over the second generation with and without refining. Figures 1-2 show the effect of Maximyze 3504 in recycled fiber without refining and Figures 3-4 show results applying 1000 revs using a PFI mill. In both studies handsheets were made using TAPPI standards test methods.

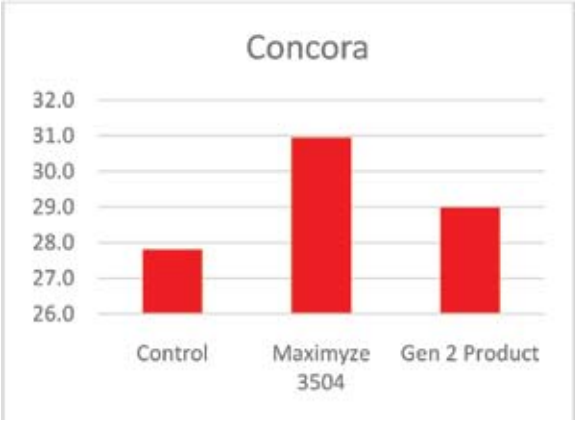

Figure 1: CMT 100% OCC without refining

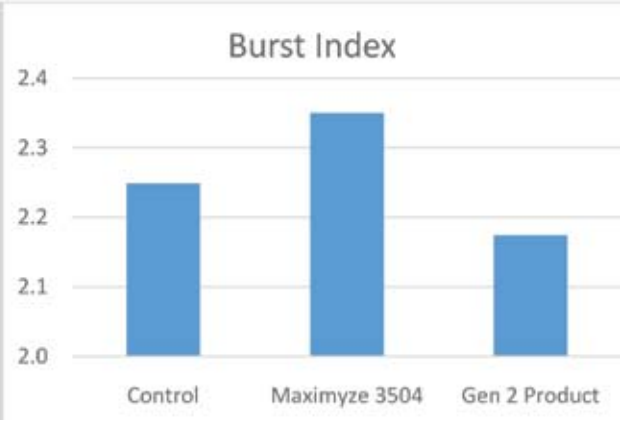

Figure 2: Mullen 100% OCC without refining

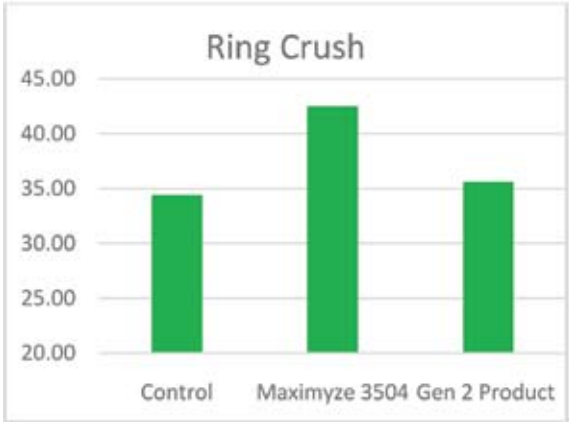

Figure 3: Ring crush 100% OCC refined

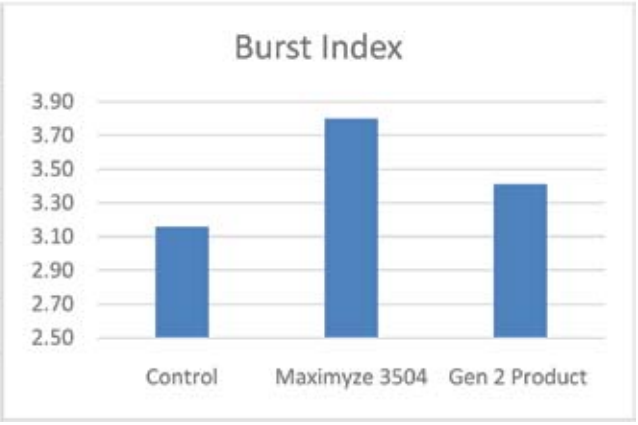

Figure 4: Mullen 100% OCC refined

Currently, there are several applications using Maximyze® 3504. In one application, we replaced Buckman's secondgeneration product with Maximyze 3504. We achieved the same strength values (Concora and Ring Crush) with lower refining and higher machine speed. In another application, we evaluated both our second generationproduct and Maximyze 3504. In this case, both products allowed the mill to reduce grammage while maintaining Ring Crush slightly above the control as shown in Figures 5 and 6. However, Maximyze 3504 enabled greater grammage reduction.

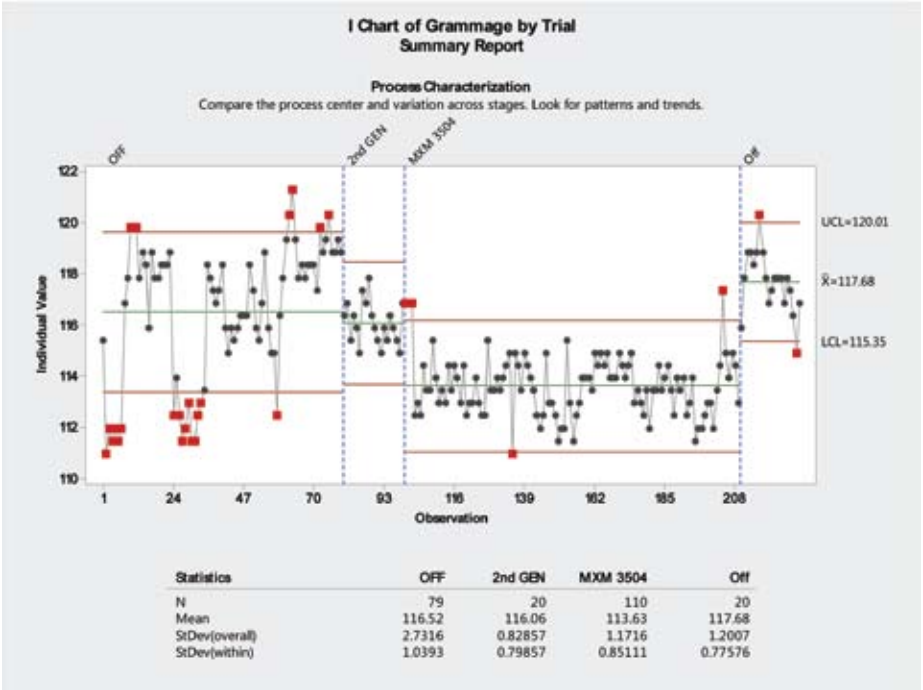

Figure 5: Application 2: Grammage

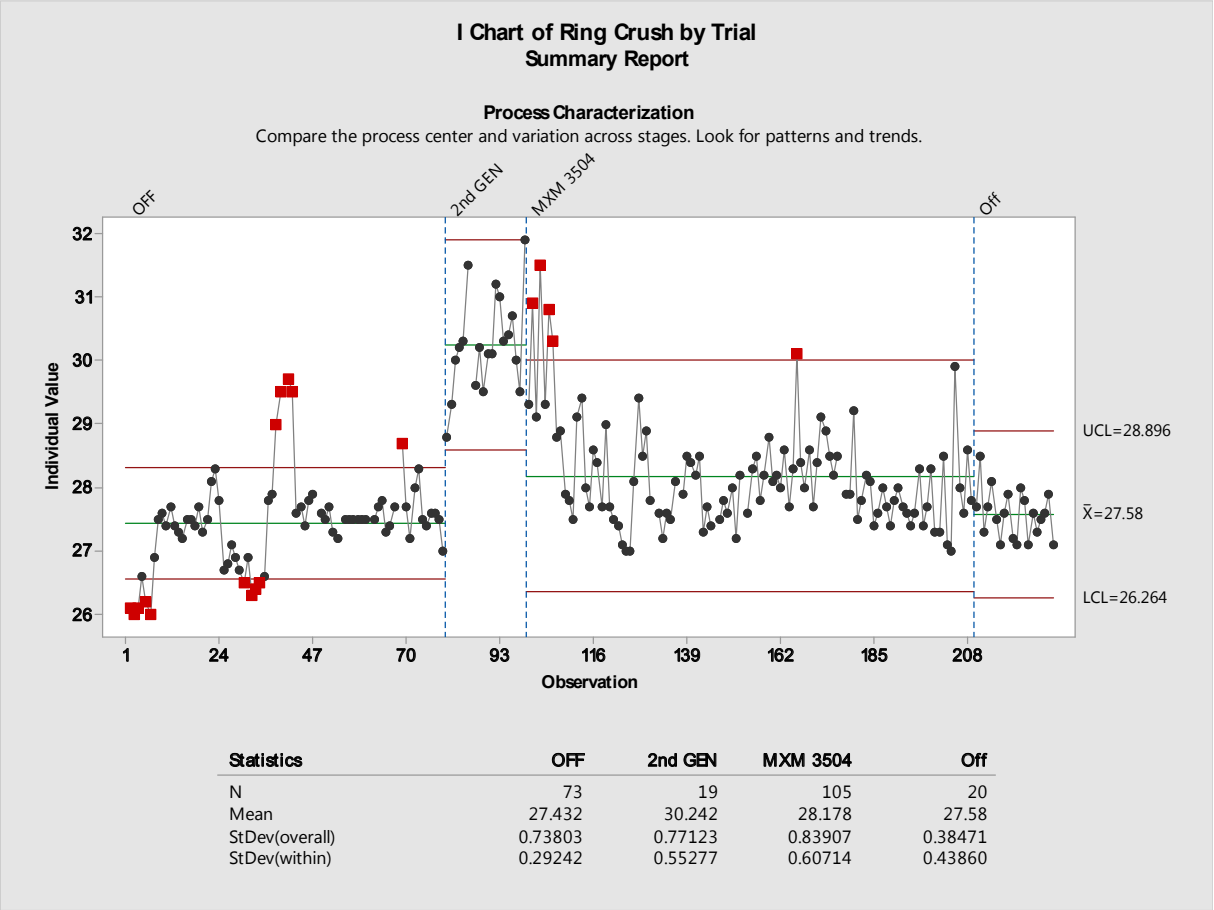

Figure 6: Application 2 Ring Crush

Application 2 financial return

	Value	ROI $/Day
Grammage Reduction	2.89 gsm	$2,851
Refiner Loading Reduction	4 kWh/T	$317
Maximyze 3504 Cost		$ 1,373
ROI		**$ 1,795/Day**

Feeding Maximyze®products

Maximyze utilizes simple feeding systems as shown in Figure 7. Product makedown is not necessary. The product is typically fed with simple addition pumps. In some cases, post-dilution with either fresh water or clarified whitewater can improve mixing and product effectiveness. In papermachines with multiple plies we typically add the product to all plies at an equal dosage. However, every system is different and sometimes dosing strategy for each ply is necessary.

The specific application point for Maximyze® varies by system. Identifying the best application point is sometimes an iterative process. Several factors should be taken into consideration:

- Size of the stock preparation system in terms of time from the pulper to the headbox; some operations have one hour or less while others as much as six hours. The correct application point needs to be close enough to the machine to allow for dosage adjustments with an appropriate response time. In most cases, the Maximyze addition point is one hour or less in time from the headbox, which varies depending on temperature and pH of the system.

Figure 7: A Maximyze® feed system for a two-ply paper machine

- Degree of closure of the whitewater system and water locks:The components in the third generation Maximyze do not bind to the fiber, meaning there is a cycle-up effect of Maximyze in the whitewater. The time to see the full effect of a Maximyze application varies depending on the size and degree of closure of the whitewater system.

The ideal addition point is one that provides excellent mixing, promoting intimate contact between Maximyze and the fiber. In most successful applications, Maximyze is fed to a pump suction, utilizing the pump impellor to thoroughly distribute the product throughout the entire stock stream. If refiners are utilized, feeding Maximyze to the suction of the refiner feed pump has proven most effective in many applications.

Ideal Maximyze Target Characteristics

There are several system parameters as well as operational variables that are conducive to success with third generation Maximyze 3504:

- Recycled fiber (Old Corrugated Containers, Double-Lined Kraft, Curbside Waste, etc.)
- Near-neutral pH
- System temperature greater than 45 deg. Celsius is preferred
- Some sort of production limitation:
    - o Forming or press section drainage
    - o Main dryer section capacity
    - o Refining limits machine speed and production rate
    - o Running grammage/basis weight above target to achieve strength
- A market for additional, incremental production

Next Steps

The challenge of turning recycled fiber into first-quality packaging grades continues. Not only is fiber quality deteriorating, but the actual fiber content of recycled fiber is also decreasing as both filler and starch usage increase. The gradual deterioration of fiber quality is a valid concern and results in a high degree of operational variability. Pressure from both cost and environmental perspectives continue to drive reductions in fresh water usage, creating higher conductivity and making it more challenging for all chemistries to perform. Maximyze has demonstrated the ability to maintain effectiveness in high conductivity systems that challenge traditional charged chemistries used to improve drainage and strength. Geographically, there are areas where system temperatures are not high enough to make Maximyze economically viable. Research efforts into formulating future generations of Maximyze will be focused on performance in even higher conductivity systems as well as at lower system temperatures in order to preserve existing recycled fiber length through reduction or elimination of refining. Buckman remains committed to continuously working to develop more effective Maximyze® products.

References

U.S. Environmental Protection Agency, Designing Greener Chemicals Awards (2012). Buckman International, Inc.: Enzymes Reduce the Energy & Wood Fiber Required to Manufacture High-Quality Paper and Paperboard. Retrieved from http://www.epa.gov/greenchemistry/pubs/pgcc/winners/dgca23.html.

Conyngham, M. (2011, August-September). Enzyme products offer greener solutions to the Pulp & Paper Industry. White Paper on www.risiinfo.com (available upon request from webmaster@buckman.com)

Denowski, D. (2014) Maximyzing Productivity in Recycled Packaging. World Pulp & Paper, 2014