GREEN TECHNOLOGY: LAST DEVELOPMENTS IN ENZYMES FOR PAPER RECYCLING

VH Biotechnology, Inc.

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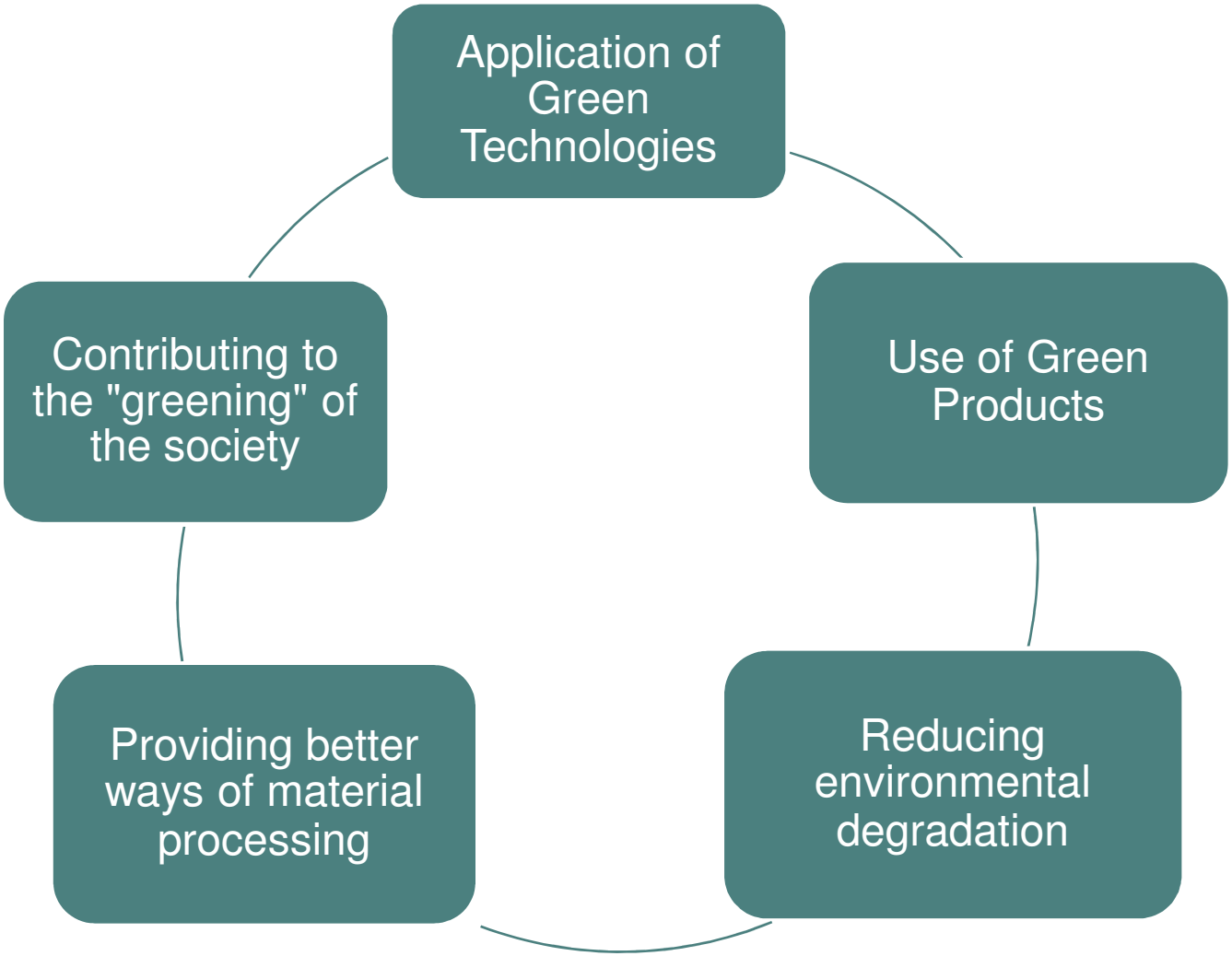
Northern Kentucky Convention Center

RETHINK PAPER:
Lean and Green

SUSTAINABLE DEVELOPMENT & GREEN TECHNOLOGY



NEW ENZYMES FOR PULP & PAPER RECYCLING

1. A slime cleaning agent based on cell wall lytic activities (enzymatic green biocide).

2. A wide spectrum sterolytic enzyme for dealing with the very complex problem of stickies.

3. An enzymatic product to hydrolyze wet strength resins.

4. A deinking enzyme for complex furnish formulations at tissue mills.

ENZYMATIC "GREEN" BIOCIDE

- Based on cell wall lytic enzymes.
- Damages bacterial cell walls by hydrolyzing non-specific components of the cell wall membrane.
- It eliminates biological slime in piping and equipment doing a permanent boil-out.
- It replaces standard biocides used at the mill.
- It is an non–hazardous biodegradable product.

ENZYMATIC "GREEN" BIOCIDE

- It has residual effect & can be applied by shock loads.
- Does not allow bacteria to create microbial resistance.
- Reduces paper breaks at the PM and increases stability of the PM.
- Reduces bad odors in the water circuits and final products.
- Allows closure of mill water circuits.

ENZYMATIC "GREEN" BIOCIDE

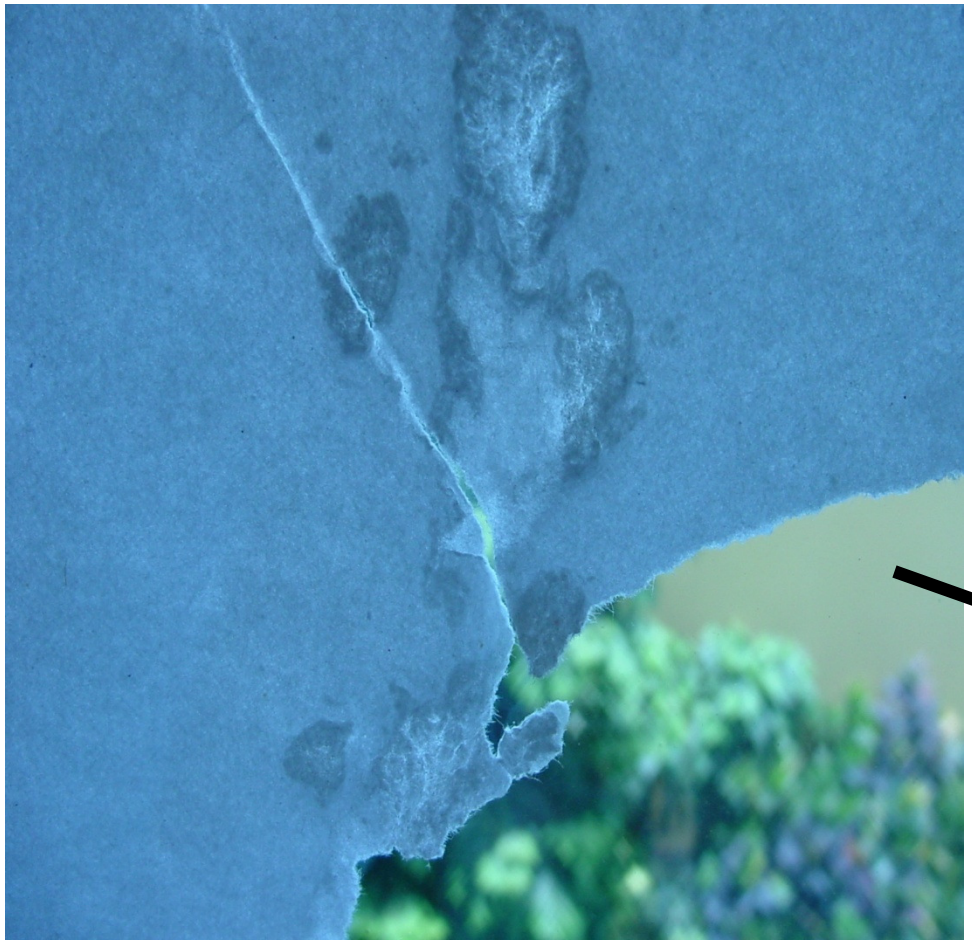
- A tissue mill reduces its water consumption from 40-60 m^3/Ton to 4-6 m^3/Ton → 90 % reduction.
- An OCC recycling mill reduces its water consumption from 20 m^3/Ton to 4 m^3/Ton → 80 % reduction

ENZYMATIC "GREEN" BIOCIDE

CASE 1. Bacterial control at a tissue paper mill starting the use of the enzymatic biocide.

DAY	BACTERIAL COUNT AT WIRE PIT
0	60 millions CFU/g
5	15 millions CFU/g
10	4 - 5 millions CFU/g

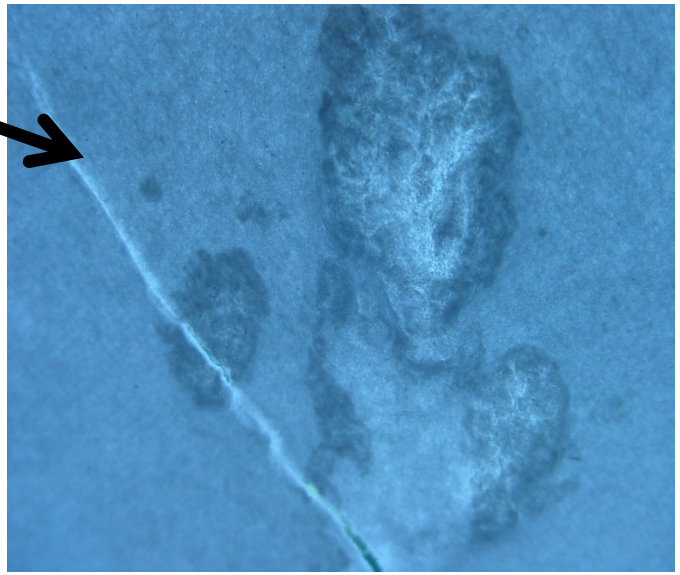
SLIME & DIRT DETACHMENT



Causes paper breaks at the PM

Reduces productivity

Lowers paper quality



ENZYMATIC "GREEN" BIOCIDE

CASE 2. Downtime reduction at a paper machine by using the enzymatic biocide at an OCC mill:

Due to elimination of dirt detachment:

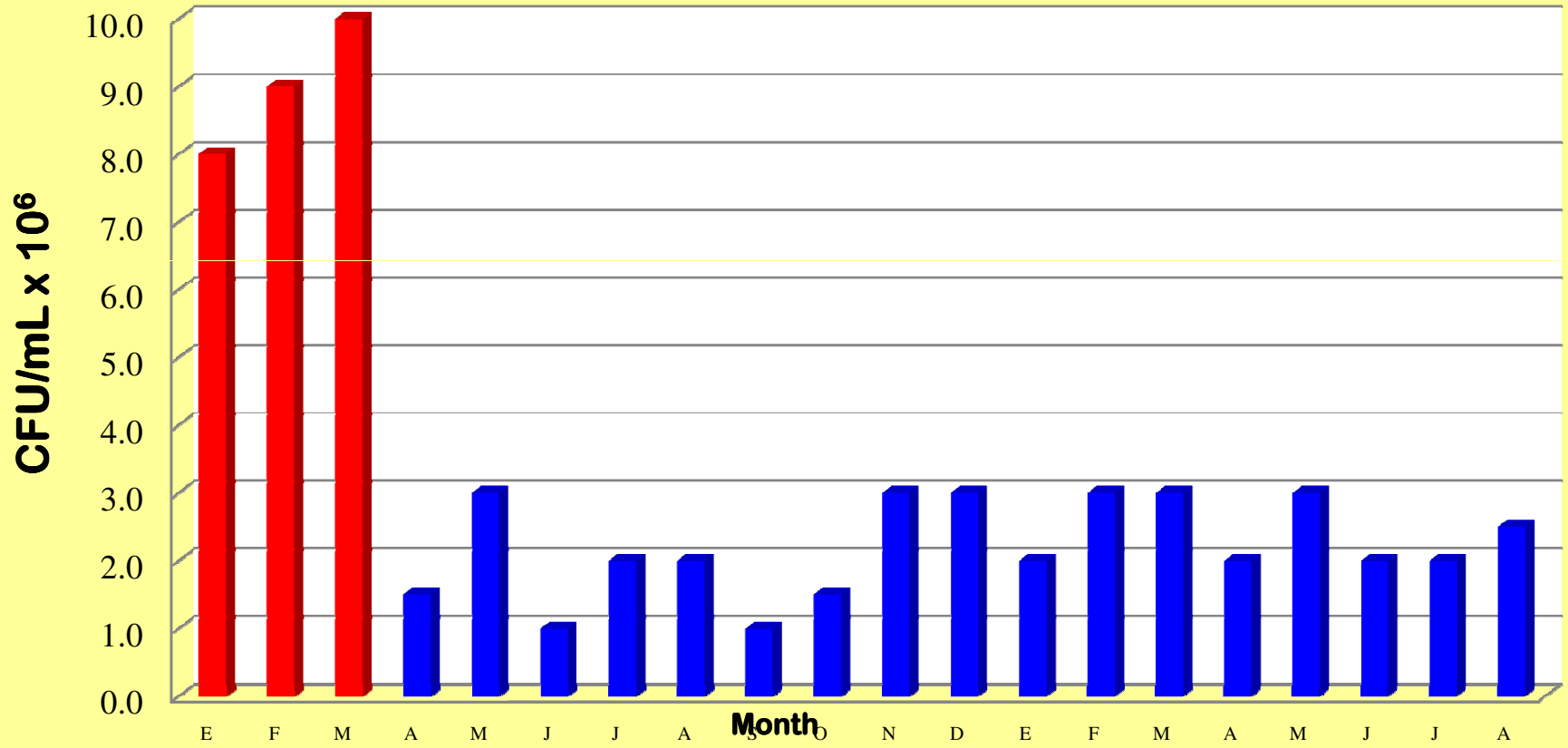
- From 5,6 to 0,4 h/day on PM 1 (**Reduction 93 %)**
- From 2,7 to 0,2 h/day on PM 2 (**Reduction 92 %)**

Due to elimination of slime detachment:

- From 0,5 to 0,1 h/day on PM 1 (**Reduction 74 %)**
- From 0,8 to 0,3 hr/day on PM 2 (**Reduction 70 %)**

THE ENZYMATIC "GREEN" BIOCIDE

Monthly average values of Total Bacterial Count at the wire pit in a tissue mill using the enzymatic biocide. Red bars indicate Base Line values.



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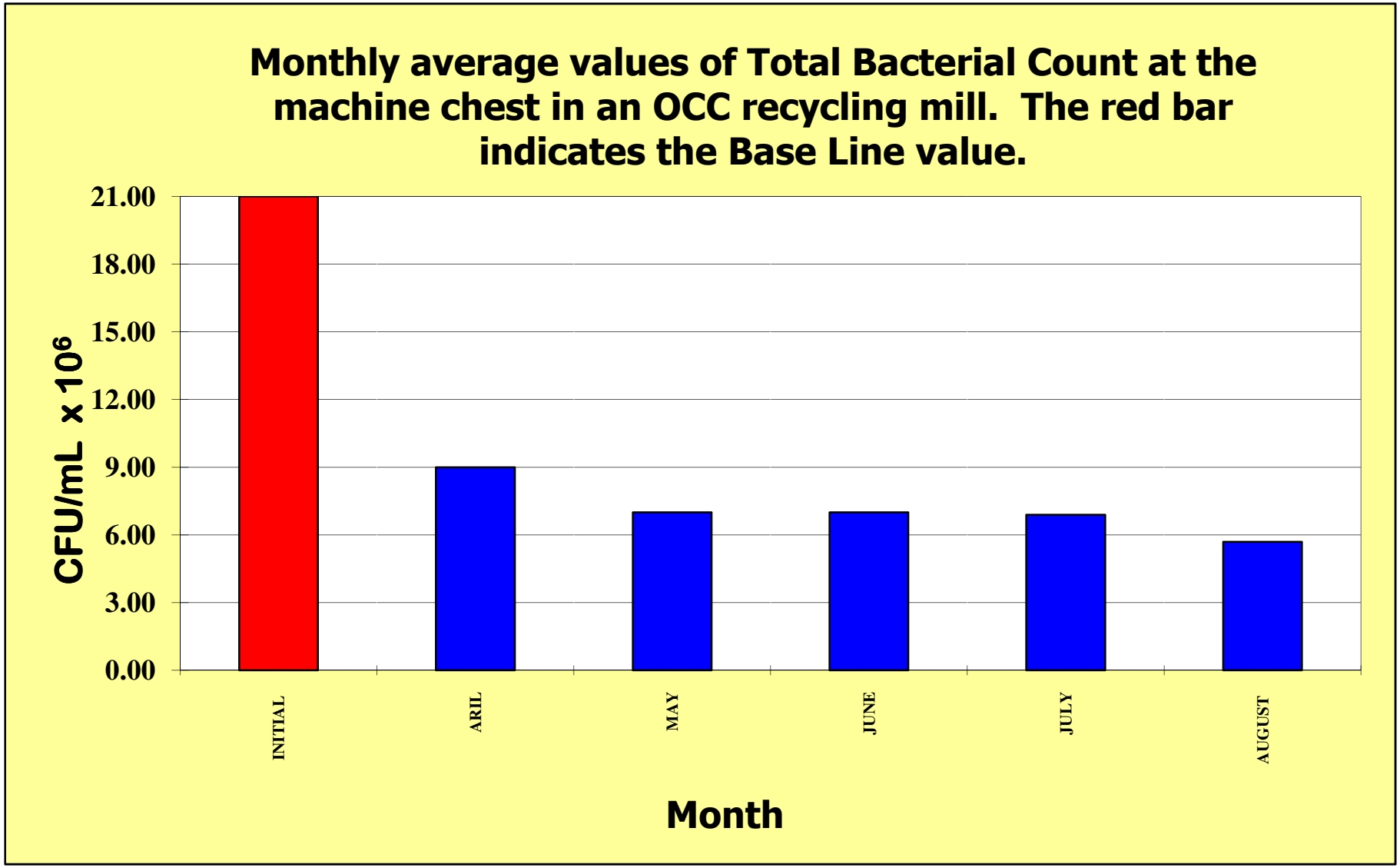


THE WS ESTEROLYTIC PRODUCT

The extreme complexity of stickies in pulp & paper mills has been well documented.

A complex mix of waxes, tackifiers, PE, hot melts, styrene butadiene, polybutene, PVAc, acrylics, starch, pitch and fibers.

A complex problem requires a complex solution.

THE WS ESTEROLYTIC PRODUCT

- It contains various ester hydrolases that hydrolyze complex sticky materials.
- Reduces stickies counts by more than 70 %.
- Allow tissue formulators to use low quality furnishes, such as envelopes; i.e.: allowing 10 % envelopes in formulations.
- Increases life span of wires and felts by reducing cleaning operations with organic solvents.

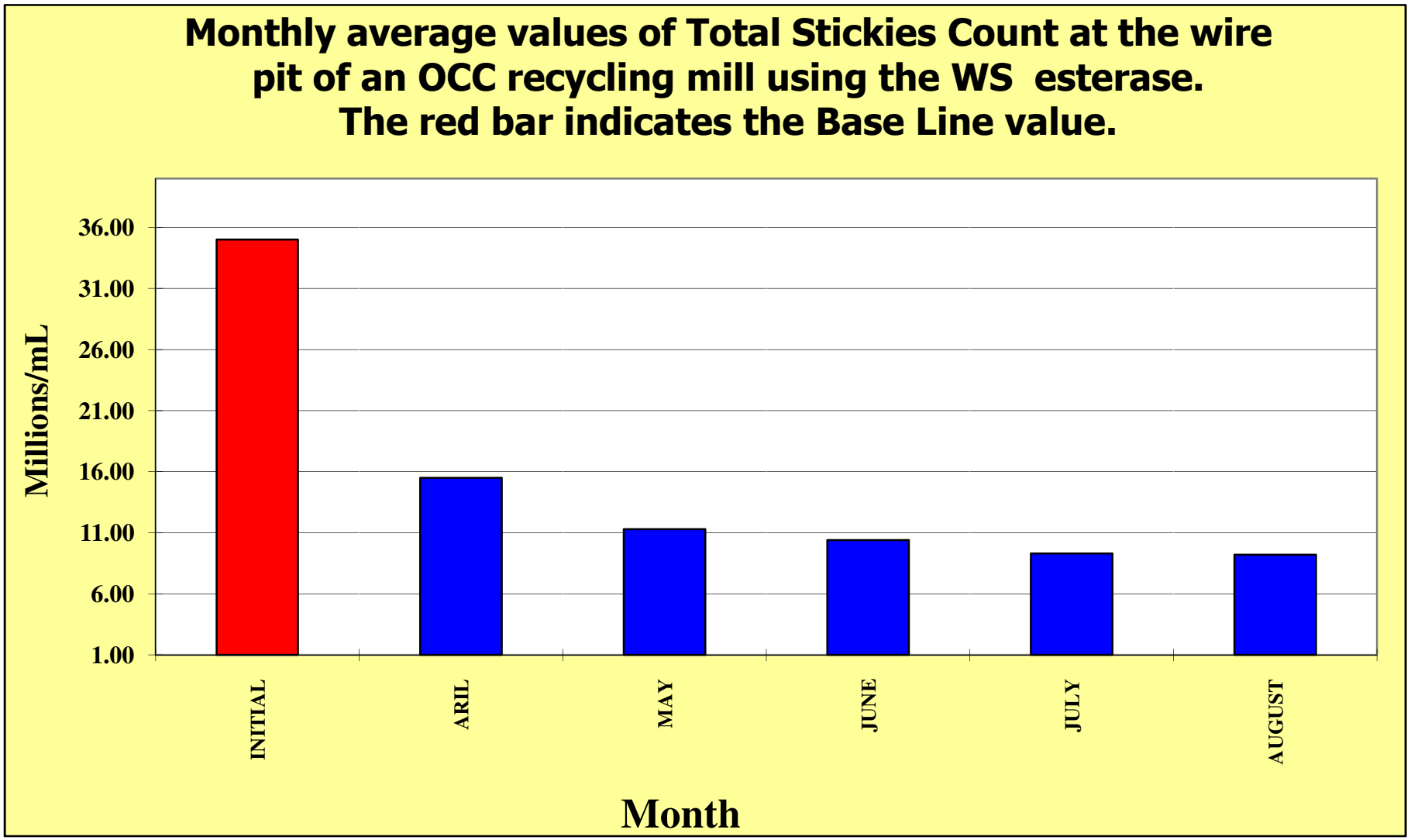
THE WS ESTEROLYTIC PRODUCT

CASE 1. Example in a tissue mill using the esterase product. Productivity at the converting section.

Normal production:	**14 ton/day**
Two days of product use:	**19 ton/day**
Three days of product use:	**24 ton/day**

Increased productivity by 70%

A WIDE SPECTRUM ESTEROLYTIC ENZYME



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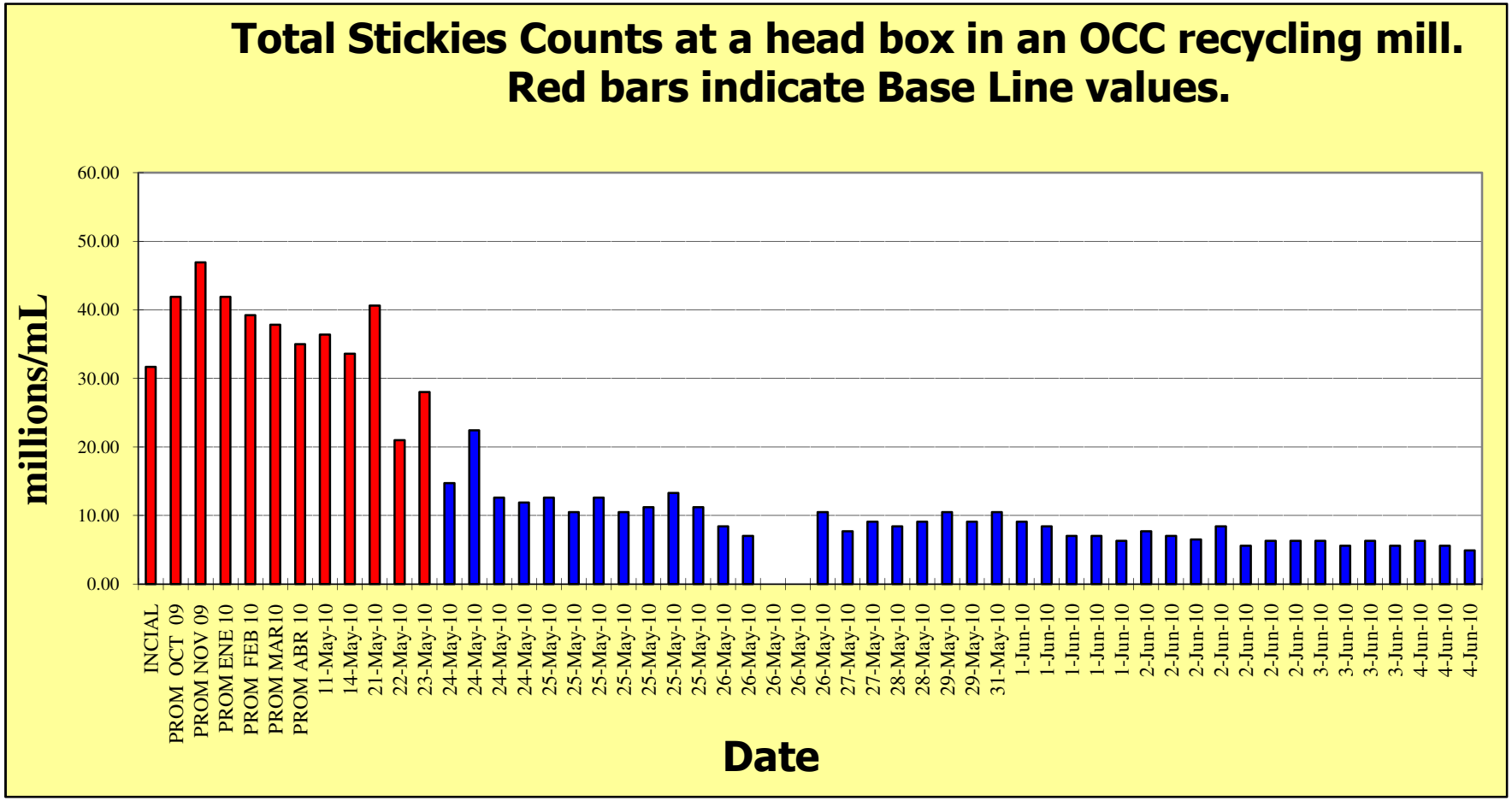


AN ENZYME FOR HYDROLYSIS OF WET STRENGTH RESINS

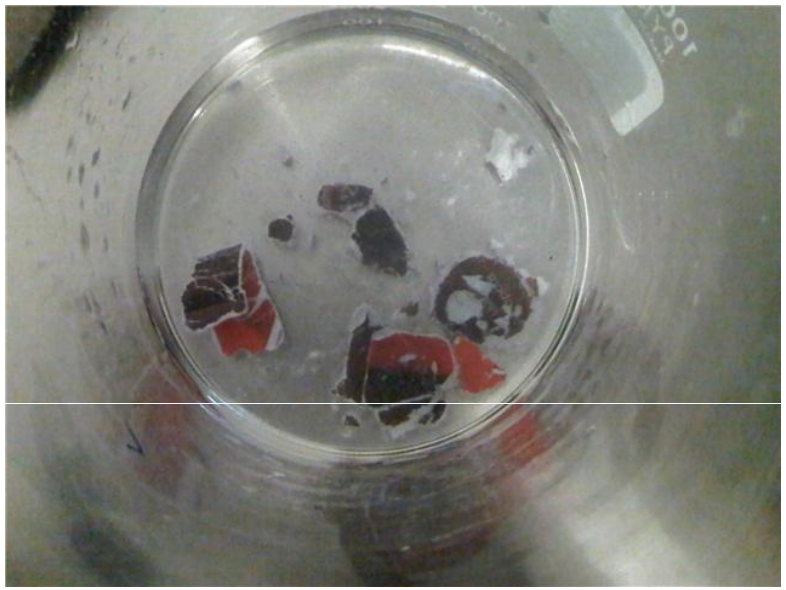
- Materials with wet strength resins are very difficult to repulp due to the structural stability of the polyamide chain.
- Actual methods for repulping fibrous materials with wet strength resins require extreme conditions:

  pH of 10 or greater

  temperatures of 70 °C or more

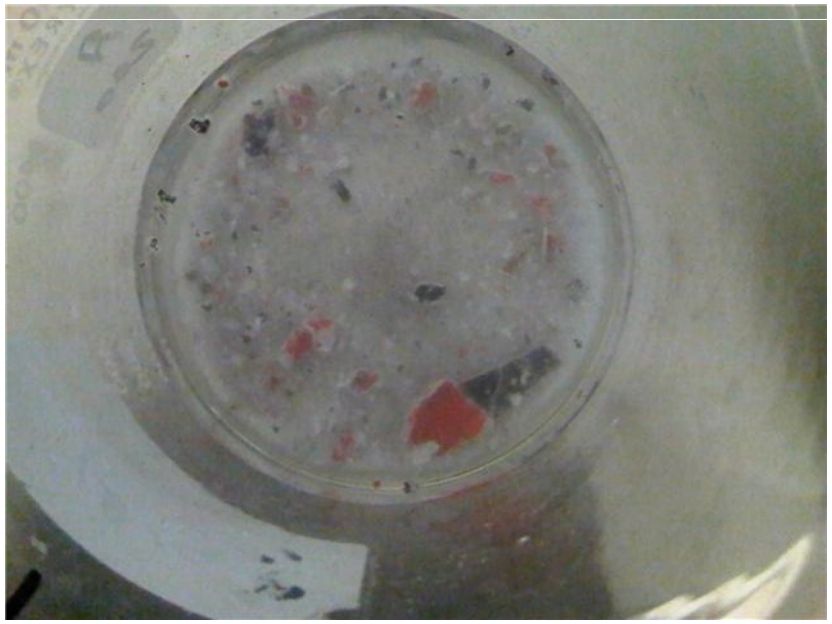
  presence of strong oxidizing agents.

AN ENZYME FOR HYDROLYSIS OF WET STRENGTH RESINS



MATERIAL PULPED DURING
8 MINUTES WITHOUT ENZYMES

EFFECT OF THE ENZYME:
MATERIAL PULPED DURING
4 MINUTES



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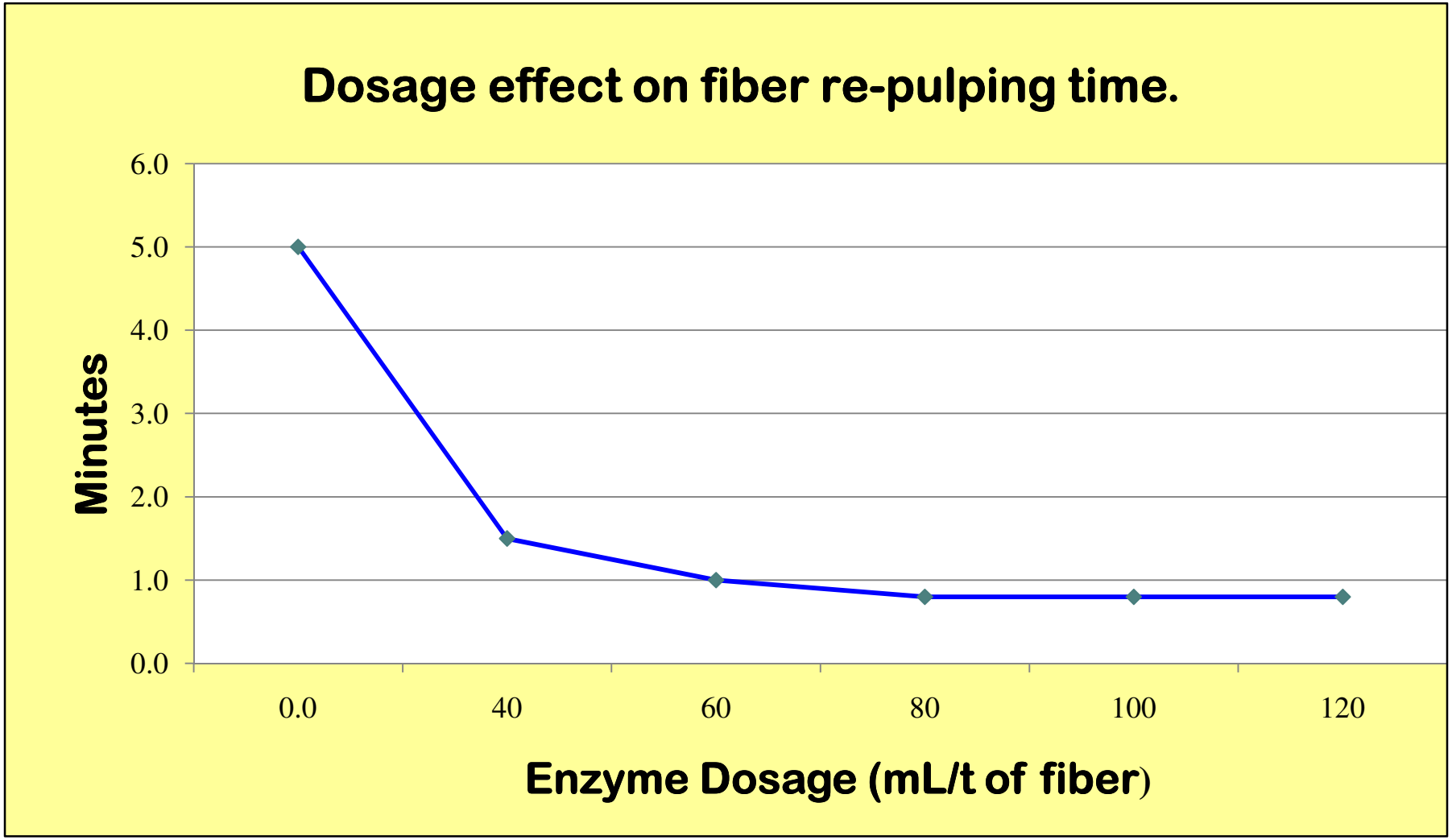

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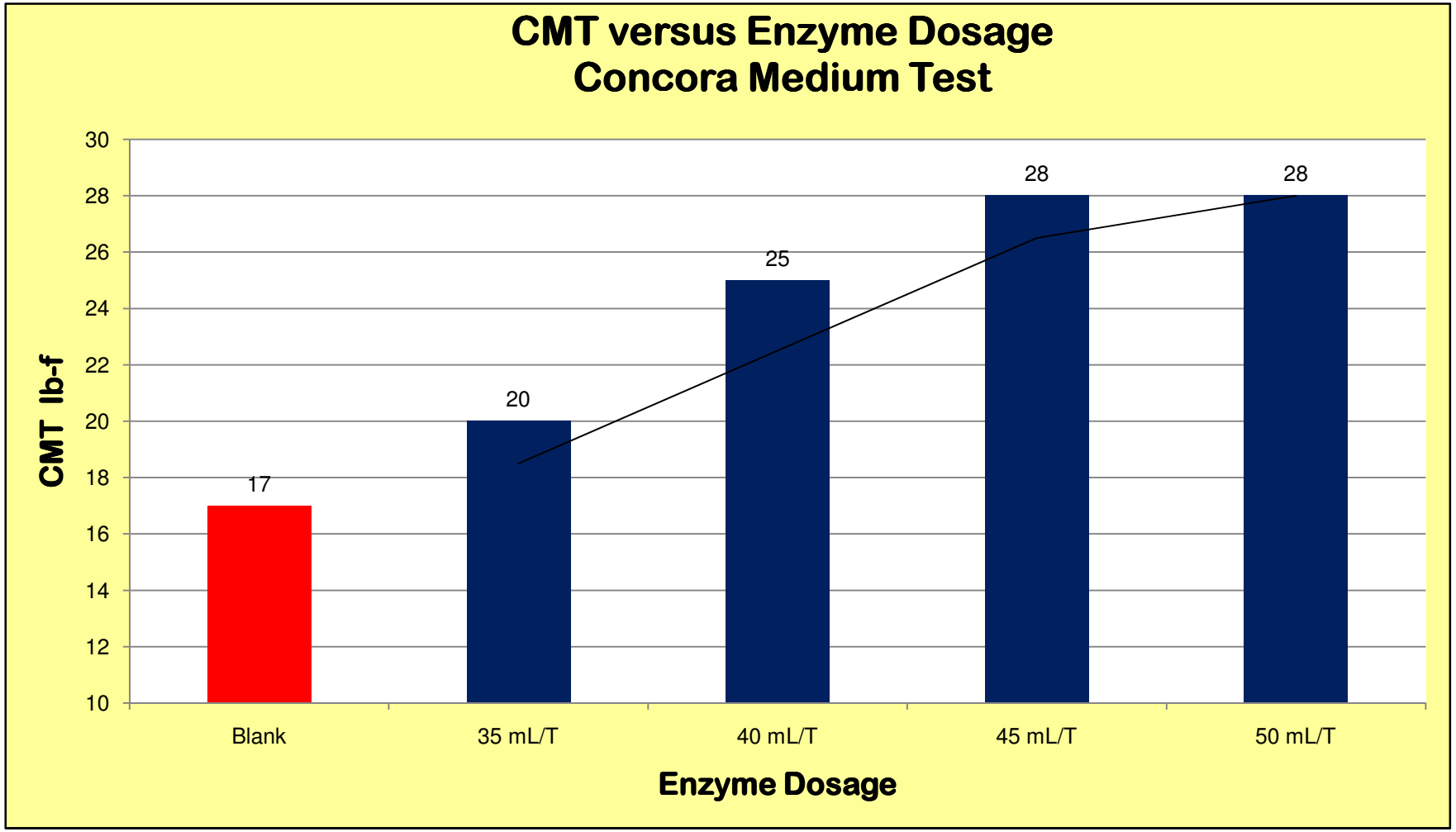

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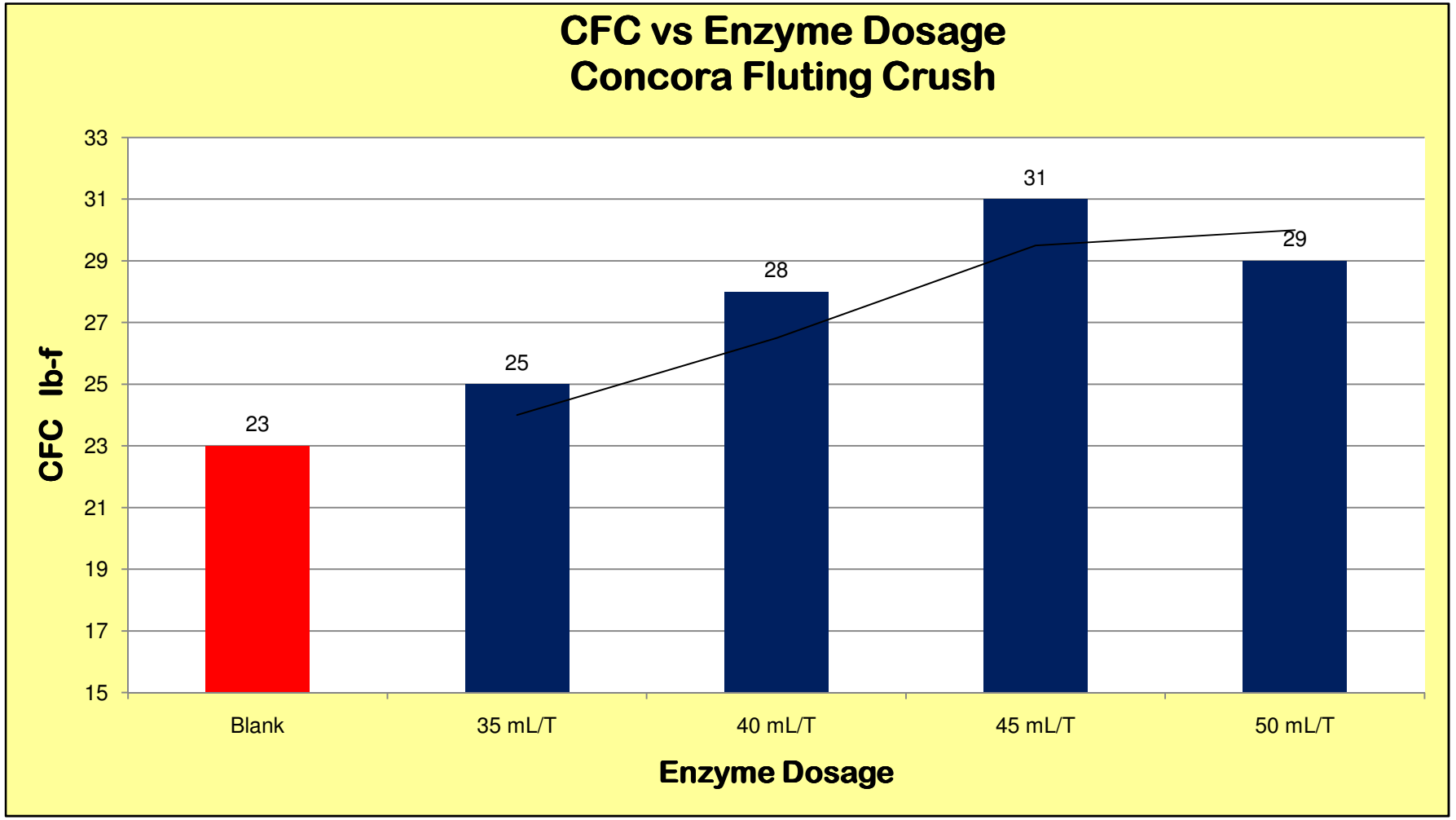


A COMPLEX ENZYME FOR CLEANING/DEINKING TISSUE FORMULATIONS

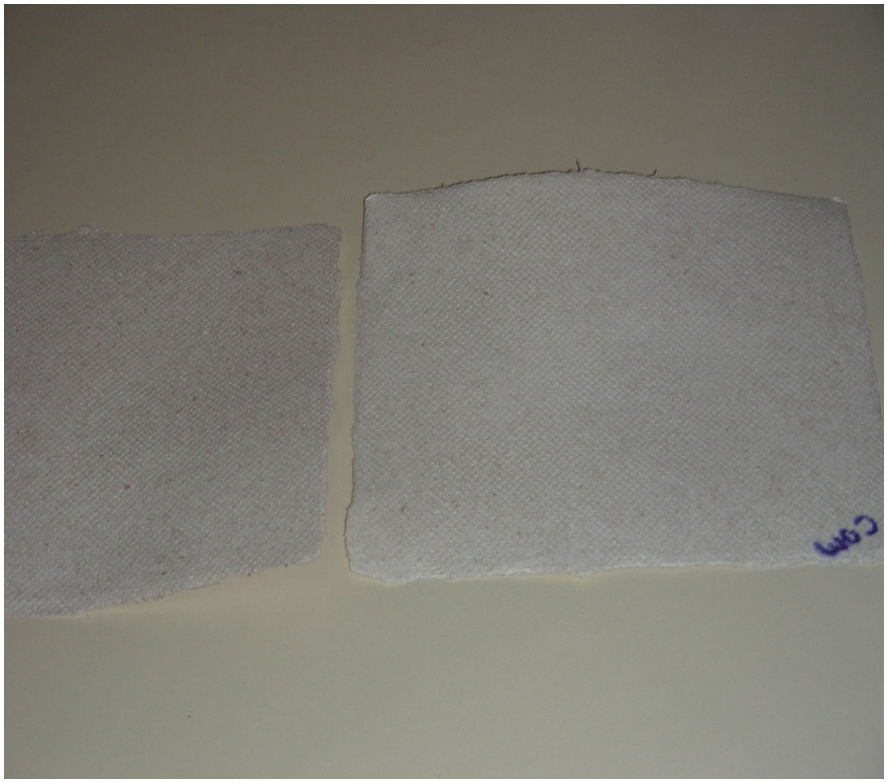
Deinking technology is based on cellulases for the most challenging problem of non-impact inks (xerox and toner).

However tissue formulations contain :

- mixed office wastes, computer print outs
- old magazines
- old newsprints
- box board cuttings
- colored ledgers

AN ENZYME FOR CLEANING/DEINKING TISSUE FORMULATIONS

The resulting pulps shows higher brightness and whiteness.



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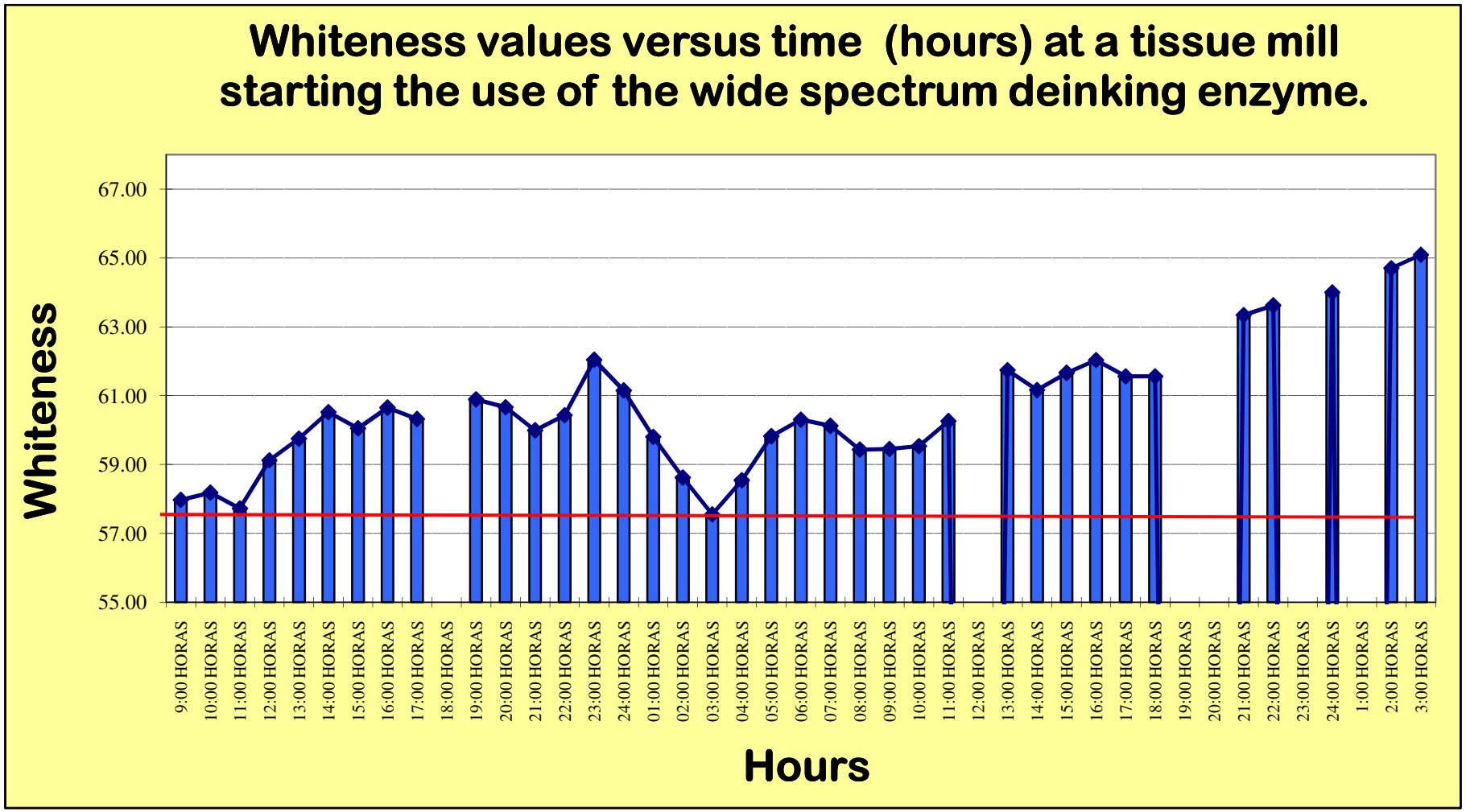
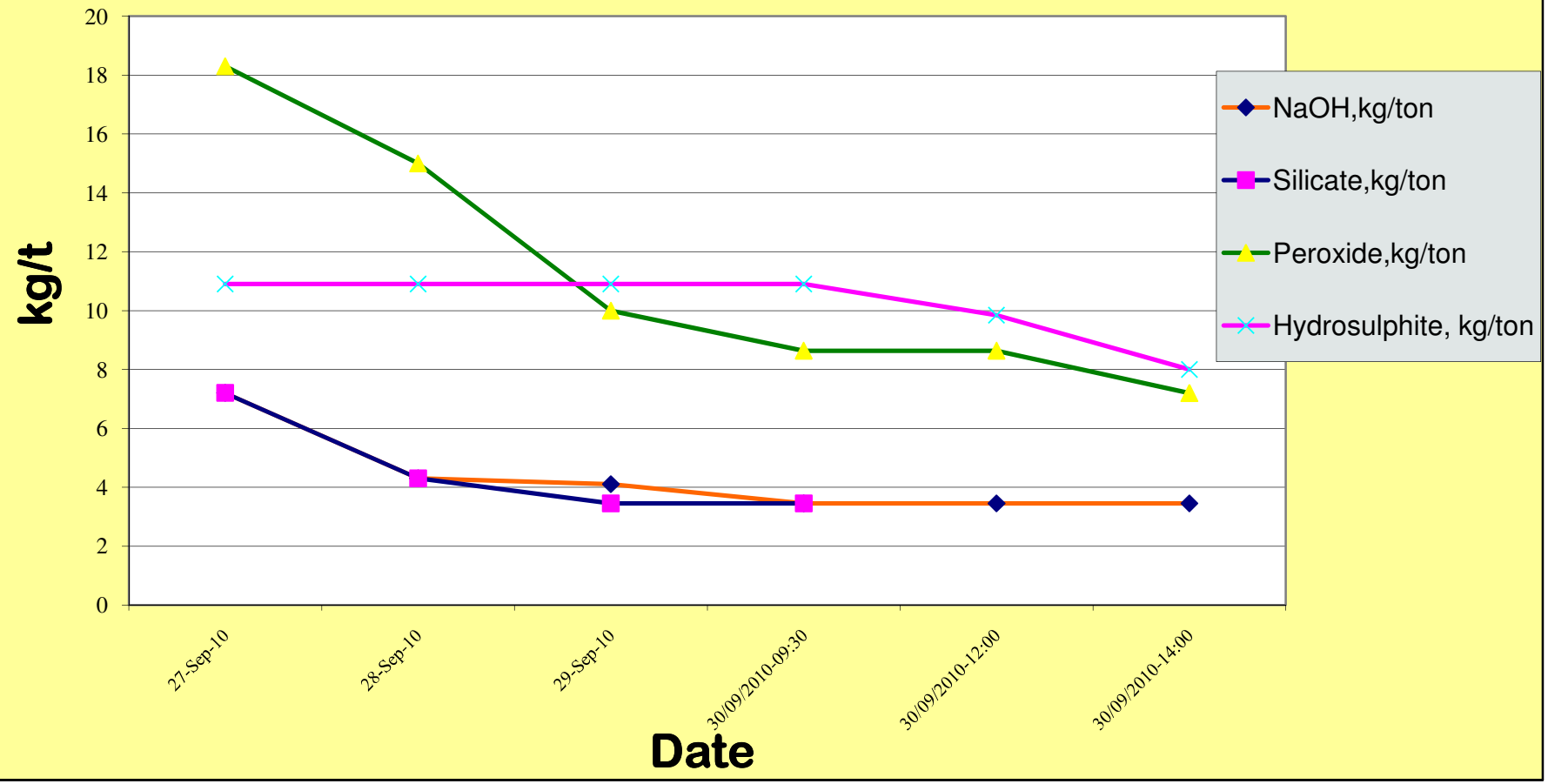


AN ENZYME FOR CLEANING/DEINKING TISSUE FORMULATIONS

Graph 7: Reduction in Chemicals Consumption versus Time in a tissue mill using the deinking enzyme.



CONCLUSIONS

- As pointed by TAPPI, paper companies have always recognized the environmental and economic benefits of recycling, as a way to protect our environment by reusing resources.

- Enzyme applications are helping paper recycling mills to do the job in an easier, environmentally and efficient way.

THANK YOU FOR YOUR ATTENTION !