



Associação Brasileira Técnica de Celulose e Papel

**Buckman**  
LABORATORIES

# **Working Safely With Enzymes**

presented by

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## Presentation Topics

- ▼ Information on Enzymes
- ▼ Current Common Uses of Enzymes
- ▼ Benefits of Using Enzymes
- ▼ Proper Handling of Enzymes
- ▼ Safety Information on Enzymes

## **OUR SAFETY MISSION**

Recognizing that excellence in safety is critical to our long-term success, we insure that research, manufacturing, administrative, and marketing activities will be accomplished without harm to our associates, to our customers, to the public, or to the environment.

# What are Enzymes?

- ▼ Enzymes are special proteins found in all living things
- ▼ Enzymes function as catalysts to ease chemical reactions in living things
- ▼ Enzymes play a key role in both natural and industrial processes
  - Work within your own body to process nutrients
  - Are used in many industrial processes

# You are using Enzymes

- ▼ In your body - every function of any living thing is operated by enzymes
- ▼ In your home - enzymes are commonly used in laundry detergents e.g.
- ▼ Enzymes play a key role in industrial processes
  - used in manufacture of textiles
  - used in preparation of foods
  - used in animal feeds

## Commercial Enzymes

- ▼ Enzymes have been used since the early 1900s for enhanced cleaning action
- ▼ Enzymes have been widely used in detergents since the 1960s



# People Like You Are Using Enzymes Safely In -

- ▼ Papermaking
- ▼ Leather Processing
- ▼ Textile Production
- ▼ Food Processing
- ▼ Brewing
- ▼ Industrial & Home  
Cleaning Products



## **Current uses of Enzymes in the Paper Industry**

- ▼ Starch conversion
- ▼ Cleaning products
  - for system boilouts, cleaning
- ▼ Biodispersant products - slime removal
  - widely used for slime treatment
- ▼ Stickies control
- ▼ Pitch control
- ▼ Fiber modification



## Some Benefits of using Enzymes

- ▼ Enzymes provide the next level of **WORKING SAFELY**
- ▼ In some cleaning applications, can replace dangerous acids, caustic e.g.
- ▼ Typical HMIS / NFPA Health Rating: 1
  - range is 0-4 -- 0 is the best rating
  - most chemical products are rated 2-3

## **Additional Benefits of Using Enzymes**

- ▼ Enzymes do not leave harmful residuals that require further clean-up
- ▼ Many enzymes are effective in mild conditions
  - near-neutral pH
  - warm, not hot temperatures (35-60°C)
- ▼ So (for example) it is possible to work around the machines during an enzyme boilout

## Example: Enzymatic Cleaning of a Starch System



Picture shows  
“Before” cleaning

Note: typically starch  
systems were cleaned  
out with caustic

# Enzymatic Cleaning of a Starch System



Picture shows  
“After” cleaning  
with enzyme

Note: no dangerous  
caustic used; results  
are *better* than with  
the caustic

# What We Know About Enzyme Based Products

- ▼ Generally NON - TOXIC
- ▼ Can be safer alternatives to more dangerous chemistries
- ▼ Proven to work very effectively
- ▼ Have a history of NOT causing health problems in industrial use environments

# ENVIRONMENTAL EFFECTS

## *COMPARING AQUATIC TOXICITY*

<u>Product</u>	<u>48-hour EC<sub>50</sub> [daphnia]</u>
Microbicide A	0.011 mg/L
Microbicide B	0.16 mg/L
Protease Formula	32,450 mg/L

# Proper Handling of Enzymes



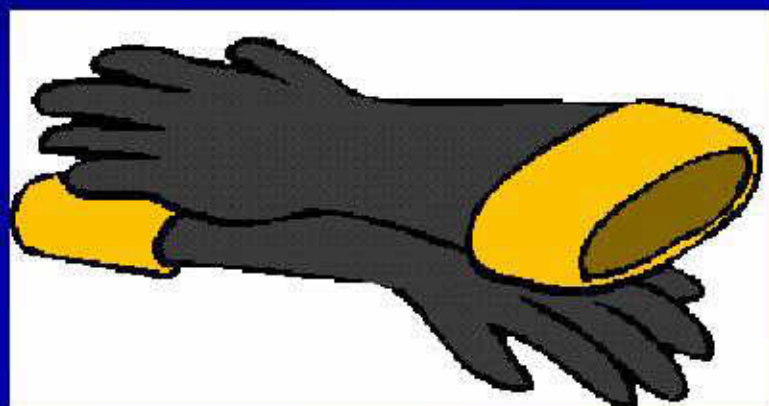
- ▼ Understand potential adverse effects
  - Refer to MSDS
- ▼ Use recommended protective measures

## What are Potential Health Effects with Enzymes?

- ▼ Enzymes typically have a health rating of “1”
- ▼ In some cases enzymes may cause skin and eye irritation
- ▼ In a few cases, inhalation of enzyme particles may cause allergic type reactions or sensitization
  - This is primarily an issue in the manufacturing, packaging, or use of dry enzyme products.



## Protection Against Irritation



- ▼ Use proper PPE to prevent contact with eyes and skin
- ▼ Clean pumps, valves, lines, etc. before working on them
- ▼ Throw away, or completely clean, used PPE that might have contacted product

# Personal Hygiene

- ▼ Persons working with or around enzyme products should use basic industrial personal hygiene practices.

- Wash hands after handling product containers, feed equipment, etc
- Avoid rubbing face and eyes
- Change work clothes



## Limit Inhalation of Enzyme Particles

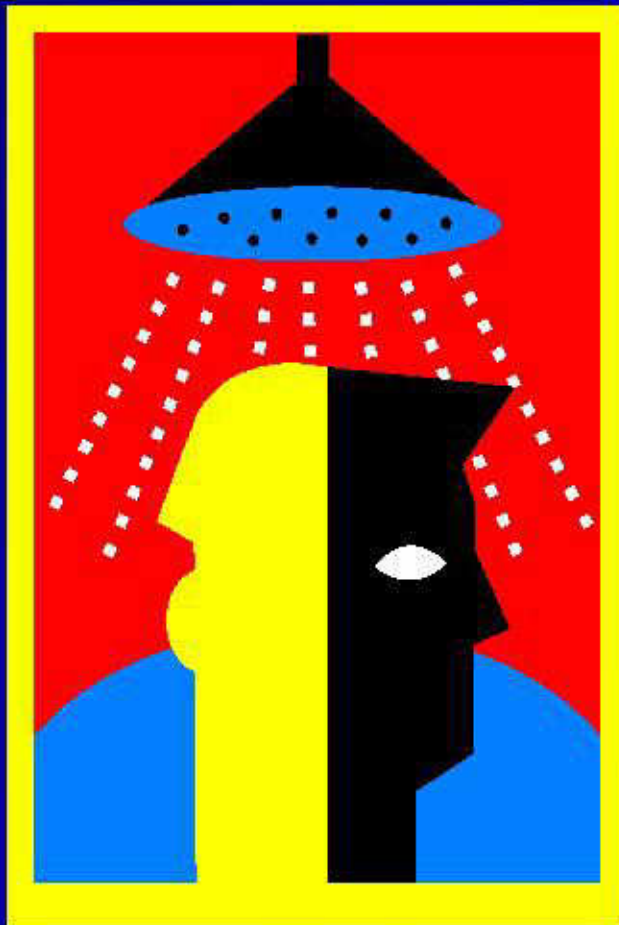
- ▼ Before allergic reactions could occur or develop (sensitization), individuals would have to inhale a significant number of enzyme particles
- ▼ The Buzyme Product Line is made up of liquid products which greatly reduces this potential
- ▼ Working around machinery, undergoing enzyme cleaning, is acceptable

## Spill/Leak Response

- ▼ Clean up immediately, do not allow to dry
- ▼ Flush with low-pressure water line



# First Aid



- ▼ Skin or Eye Exposure
  - Flush with water
- ▼ Inhalation
  - Move to fresh air
- ▼ Remove and wash any contaminated clothing
- ▼ Seek attention of health care professional if symptoms develop or if in doubt

# Ecotox Information on an Enzyme Formula

Aquatic Toxicity: <i>L96-hour LC<sub>50</sub> (Danio rerio)</i>	<i>707 mg/L</i>
BOD/COD ratio: <i>biodegradable</i>	<i>0.66 -- "easily</i>
Activated Sludge Respiratory Inhibition Test (3-Hr EC <sub>50</sub> )	<i>&gt;1 g/L at that level this product <u>increases</u> respiration by 13+%</i>

# Analysis for Enzyme in paper mill

- ELISA method used
  - in tissue mill (Europe)
  - ELISA = Enzyme-Linked Immunosorbent Assay
- Samples taken of whitewater, paper, & air (near machine)
- NO protein activity found
  - detection limits 1.5 ppb

## Supplier Support

- ▼ The supplier of the enzyme product should work with your Safety, Health, & Environmental groups
  - should provide clear MSDSs
  - should provide safety audits
- ▼ Supplier should provide medical and environmental information for all products



## SUMMARY

- ▼ Enzymes are a Safer Alternative
- ▼ Enzymes have been used for years in home and industry
- ▼ Avoid contact with neat material and inhalation of particles
- ▼ Use common safe work practices



*Thank You For Your Attention*



Questions?