

The Science Behind Cleaning

Caleb Power – Exec Area
Technical Support Coordinator

June 2023

ECOLAB[®]



Agenda

- Overview of chemistry vs soil
- Deeper dive into chemistry
 - Alkaline detergents
 - Surfactants
 - Acids
 - Enzymes
- Question



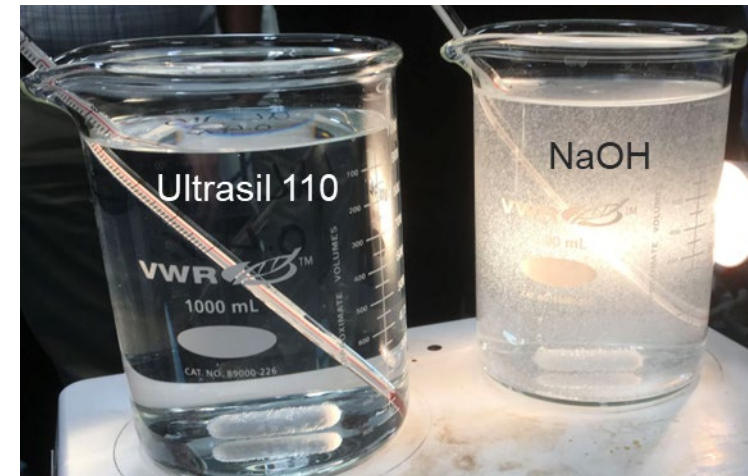
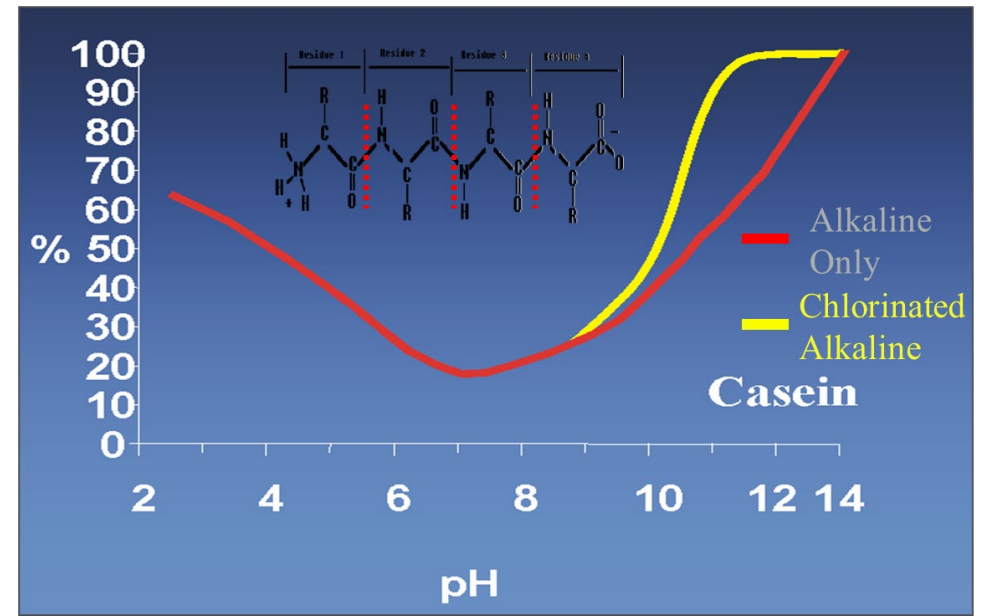
Overview of Chemistry vs. Soil

Product	Fat	Protein	Carbohydrate	Minerals	Microbial
Alkaline (Ultrasil 10, Ultrasil 11, Ultrasil 110, Ultrasil 91, Ultrasil 131, Ultrasil 22, Ultrasil 25)	X	X	X		
Acid (Ultrasil 75, Ultrasil 76, Ultrasil 78)				X	
Enzyme (Ultrasil 63, Ultrasil 67)		X			
Surfactant Additives (Ultrasil 02, Ultrasil 09, Ultrasil 83, Ultrasil 84)	X				
Oxidizers (Ultrasil OP, XY-12)		X			
Soak/Preservative (Ultrasil MP, Ultrasil 205)					X
Anti-Microbial (Oxonia Active)					X

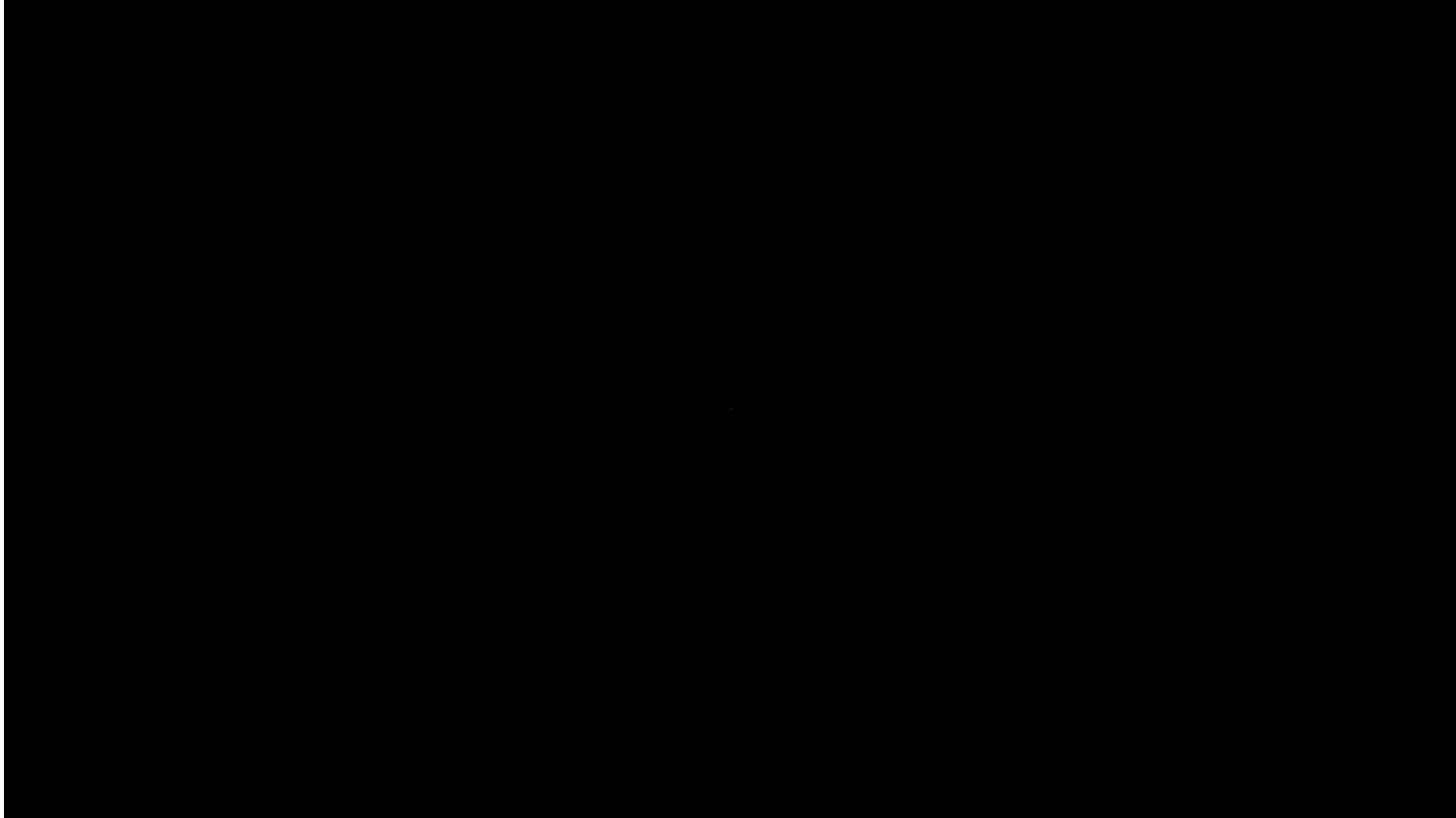
Alkaline Detergents

Notes on Alkaline Detergents

- Choosing the right alkaline product is important.
- Caustic can react with Calcium tying up the cleaning power
- Builder in built caustics will tie up the Ca so it does not react with the caustic
- It is better to clean protein on the alkaline side due to isoelectric point.
- Chlorine can be added to increase solubility of proteins



Alkaline Detergents



Surfactants

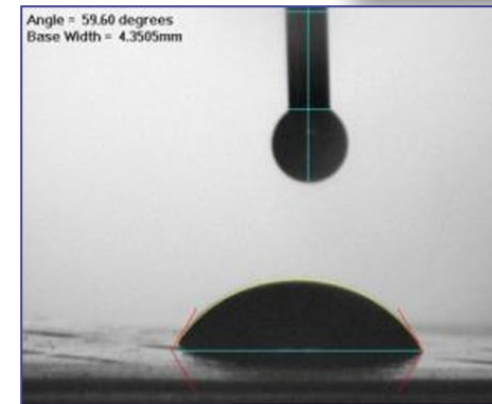
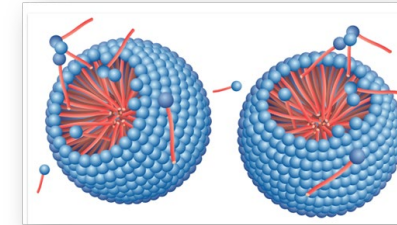
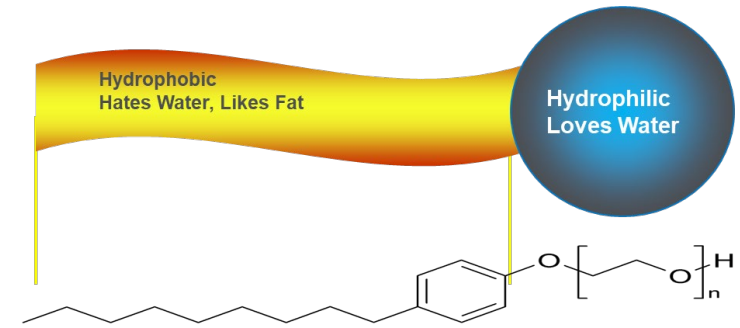
Two main functions.

1. Fat removal

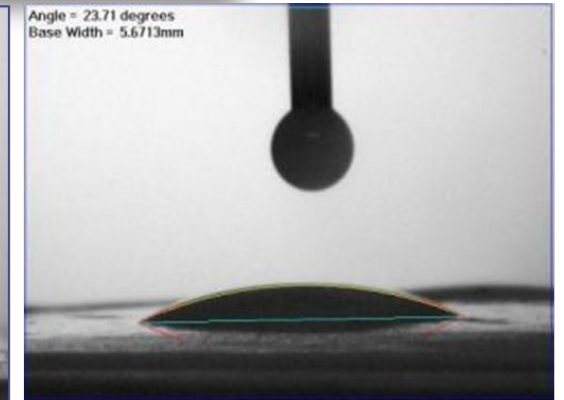
- The removal of fat is more difficult on a hydrophobic surface – such as an organic polymer compared to that of a stainless-steel surface.
- The hydrophobic character of the fat molecule allows it to absorb to the membrane surface.
- Due to high melting points surfactants are used which emulsify that fat into the cleaning solutions which is then flushed to drain.

2. Wetting

- Surfactants also help wet the membrane and get cleaning solution to the small crevices within a system.
- Helps membrane to be more hydrophilic and not hydrophobic



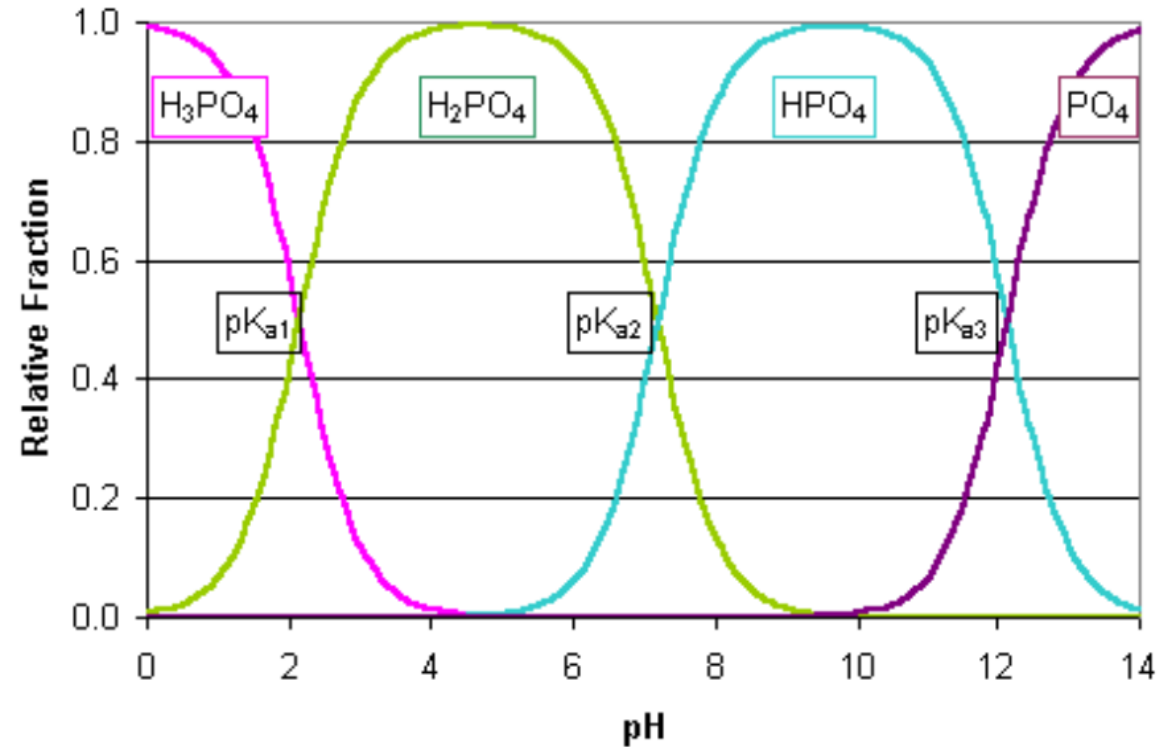
DI water
Contact Angle=59.60
Poor wetting



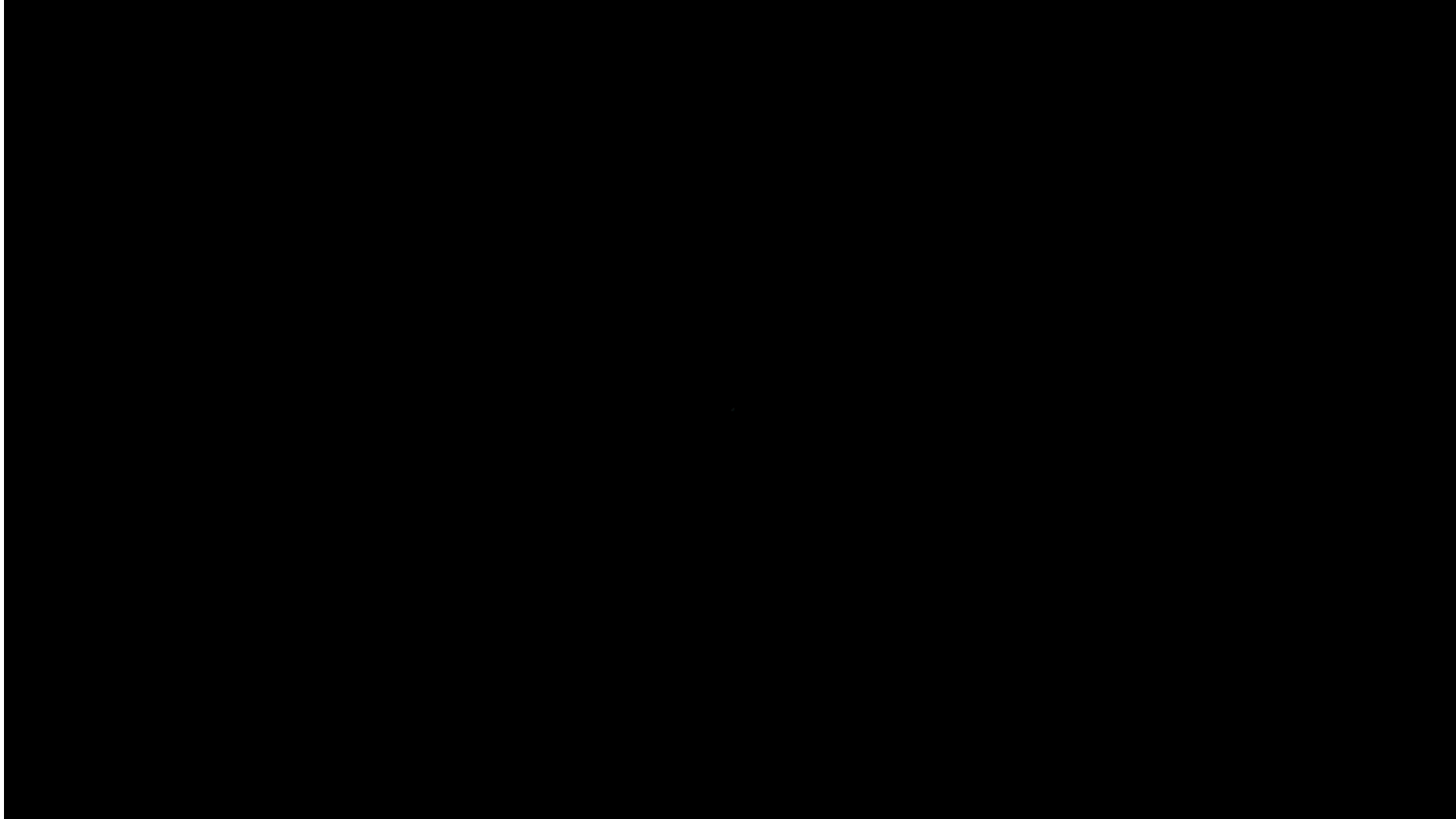
Current Product
Contact Angle=23.71
Good wetting

Acid Detergents

- Use of Acid to dissolve the minerals deposited on the membrane surface.
- Maintain pH during the wash step – if unable to maintain dose back into proper pH range or dump and refresh solution.
- Calcium Phosphate ($\text{Ca}_3(\text{PO}_4)_2$) – 310 Da
- Reverse solubility, e.g. hotter solution results in precipitation
- Solubility greatest at $\text{pH} < 2.1$

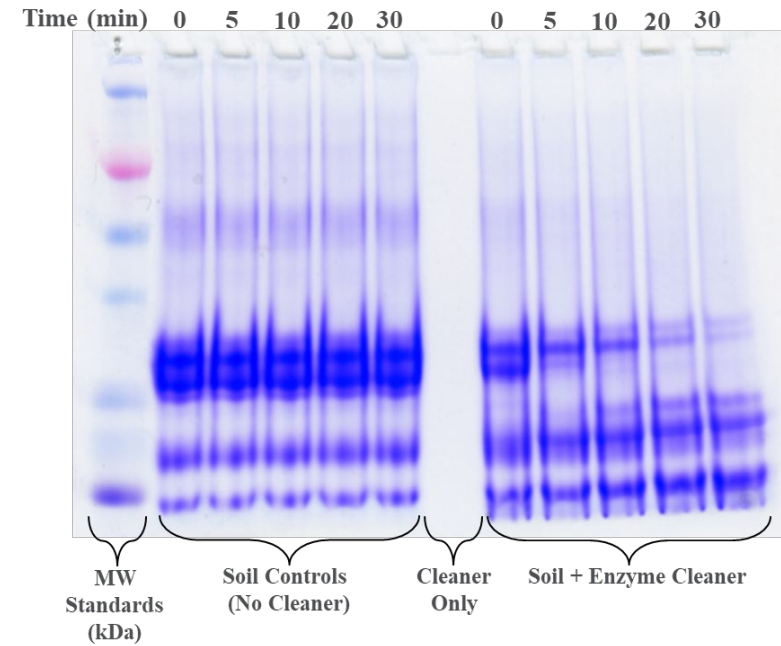


Acid Detergents



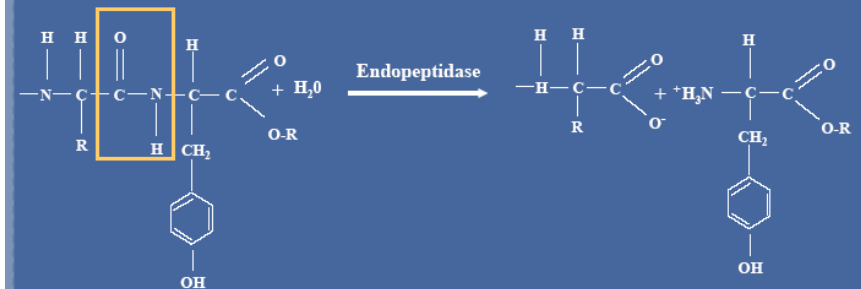
Enzyme Detergents

- Biological catalysts – little goes long way
- Active on many types of proteins
- Does not degrade a membrane like chlorine does
- Requires specific temperature and pH for optimum activity
- Readily deactivated by chlorine



Enzyme mechanism Proteases Hydrolyze Peptide Bonds

→ Peptidase (=Protease)



Enzyme Detergents



ECOLAB[®]
PROTECTING WHAT'S VITAL[™]

