CAUSTIC DIGESTER UNITS

ALKALINE HYDROLYSIS for
DISPOSAL OF BIOLOGIC
and INFECTIOUS WASTE

ALKALINE HYDROLYSIS

- A natural process – animal carcasses buried in the earth are degraded by alkaline hydrolysis, expedited by the soil bacteria – a slow process
- Food in the intestine is digested to usable nutrients by alkaline hydrolysis, expedited by enzymes that operate at pH 7-8 at body temperature – a moderately fast process for relatively small amounts of tissue

ALKALINE HYDROLYSIS

Uses strong alkali (pH 14) to solubilize and hydrolyze tissue, expedited by heat in a pressurized vessel – ***a very fast process for large amounts of tissue***

Digests and sterilizes in one operation

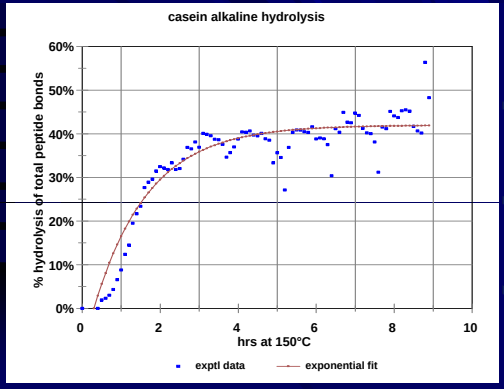
Generates an EPA neutral solution of amino acids, peptides, sugars, soaps, and electrolytes that is suitable for release to a sanitary sewer or for use as fertilizer or as feedstock for biogas or biodiesel production

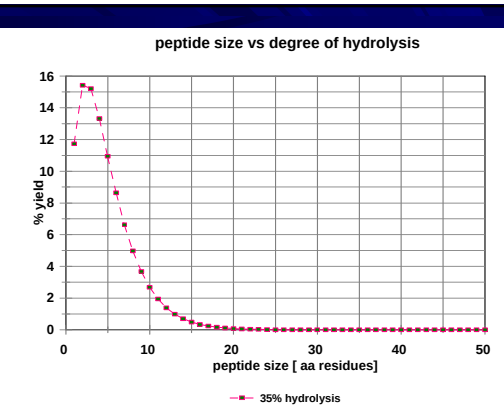
ALKALINE HYDROLYSIS

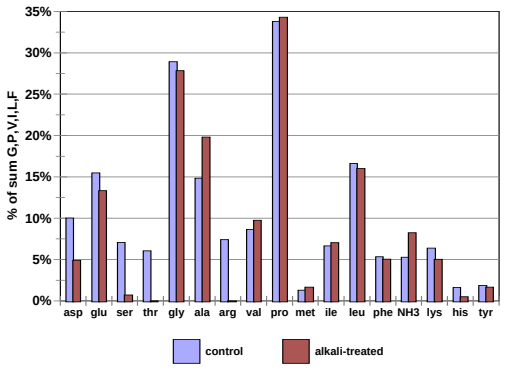
Proteins: Hydrolyzed to amino acids and small peptides by breaking of amide (peptide) bonds; carbohydrates clipped from glycoproteins; specific amino acids destroyed

Fats: Ester bonds between fatty acids and glycerol hydrolyzed, yielding soaps; glycolipids and polyunsaturated fats also "destroyed"

Nucleic acids: Phosphodiester bonds of nucleotide chains hydrolyzed, RNA rapidly, DNA more slowly







CAUSTIC DIGESTION

- Can reduces volume and weight of biologic waste by as much as 97%
- Treats fresh, frozen, and fixed tissue equally well
- Sterilizes any non-biologic materials present in waste

The result of digestion:

330 g rat and its littermate (in dish) after caustic digestion

CAUSTIC DIGESTION

- **Destroys all pathogens, *including prions***
- Converts fixatives, cytotoxic agents, and other toxins to harmless, biodegradable derivatives
- Releases radionuclides from tissue into an aqueous solution suitable for release to a sanitary sewer under 10CFR20

Efficacy Testing Results

Biological Indicator	Before Digestion	After Digestion
Aspergillus fumigatus	9.0×10^2 CFU/ml	zero per ml tested
Bacillus subtilis (vegetative)	6.0×10^7 CFU/ml	zero per ml tested
Pseudomonas aeruginosa	2.3×10^8 CFU/ml	zero per ml tested
Giardia cysts	2.0×10^5	zero per ml examined
Mycobacterium bovis BCG	4.0×10^7 CFU/ml	zero per ml tested
Giardia muris	89% excystation	cysts completely destroyed
MS-2 bacteriophage	1.0×10^9 PFU/ml	zero per ml tested
Staphylococcus aureus	4.0×10^8 CFU/ml	zero per ml tested
Mycobacterium fortuitum	6.0×10^7 CFU/ml	zero per ml tested
Candida albicans	1.4×10^8 CFU/ml	zero per ml tested
Mycobacterium terrae	3×10^8 CFU/ml	zero per ml tested
Bacillus stearothermophilus	3M spore strips	no spores detected

All *Select Agents* as well as protein and non-protein toxins, are destroyed by alkaline hydrolysis at elevated temperature (i.e., Caustic Digestion)

CAUSTIC DIGESTERS

Prototype -1993 Albany Med

Development - 1994-2006 WR^2

Re-engineering and improvement - 2006--- PRI-BIO

Here is the picture I had sent to you

Original Albany Med Unit- i.e.,Prototype
300 lb Capacity
Hand Valved
No Automation
Only Thermostat-Controlled Steam Valve
1993

Still In Use

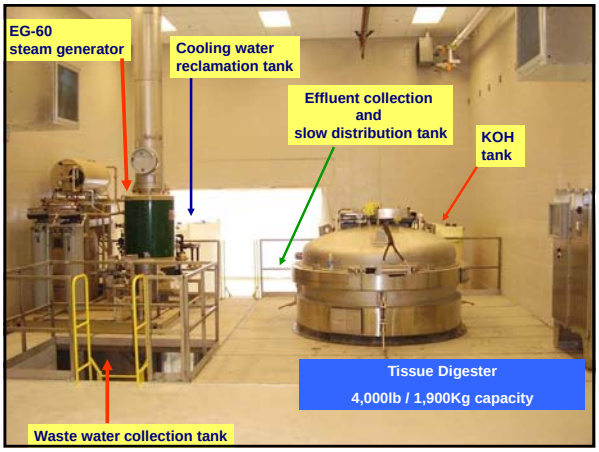
Human Cadaver Unit, Florida State Anatomical Board 1996

Early Design for a 3500 lb Capacity Unit

Loading partial bovine carcass into the Tissue Digester

30 lb Capacity for Small Laboratory

First Very Large Digester with Automated Lid
3175 kg processing capacity per cycle
Used to dispose of "Vermont Sheep"



PRI-BIO CDU

- Engineering Improvements:
  - Industrial Grade Components and Parts
  - Direct Steam Injection Heating and other options
  - High-Temp Magnetically-Driven Pumps
  - Hydraulic Ring Closures Mounted on the Vessel
  - Full Insulation of External Piping
  - External Heat Exchanger Cooling or other options
  - Automated pH and Odor Reduction
  - Automated Batch Reporting and Record Keeping
  - Effluent BOD Reduction Option
  - ***All Manufacturing Done at PRI Plant***

Paired 500 lb Capacity CDU for NIH

500 lb Capacity CDU for NIH

5,000 lb Capacity CDU for Cornell CVM in PRI Plant

Vessel for Cornell CDU Without Insulation or Skin Note Locking Lugs for Hydraulic Closure And Dimple Wall For Heat Maintenance

Delivery and Installation of Cornell CDU

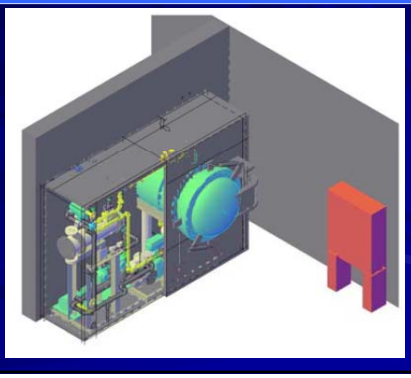
Building Will Now Be Completed Around the CDU

Lifting Vessel from Flatbed Truck

Sliding Skid Into Place on
PRI-Engineered Rail System

Lowering Vessel Onto Skid

Digester/Sterilizer Combo Pass-Through



80 lb Capacity CDU for Tufts University

Manual Latching Heavy Flat Lid

Tufts CDU With Basket Lifted

Tufts CDU With Safety Insulation Jacket Over Lid

All External Piping is Safety Insulated

PRI-BIO CDU are matched to the needs of the customer in sizes ranging from 80 lb to 10,000 lb capacity.