

Sustainable Management of Organic Residuals & Agricultural Soil:

Diffused Pollution Control & Resource Recovery

Asst. Prof. Kerem Güngör

Environmental Engineering Department

Abant İzzet Baysal University

Bolu TURKEY

EDUCATION:

2001-2006 (PhD): *Biological Systems Engineering*
University of Wisconsin-Madison (USA)

1994-2001 (BS & MS): *Environmental Engineering*
Middle East Technical University (TURKEY)

WORK EXPERIENCE:

2009-Current: *Assistant Professor* (Environmental Engineering, AIBU)
Honorary Fellow (Biological Systems Engineering, UW-Madison)

2007-2009: *Research Associate* (Biological Systems Engineering, UW-Madison)

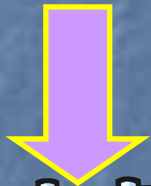
2006-2007: *Postdoctoral Associate* (Biological Systems Engineering, Virginia Tech)

2001-2006: *Research Assistant* (Biological Systems Engineering, UW-Madison)

1998-2001: *Teaching Assistant* (Environmental Engineering, METU)

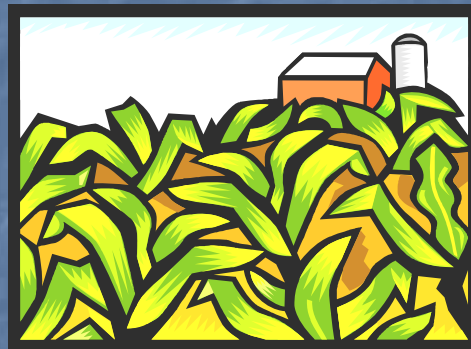
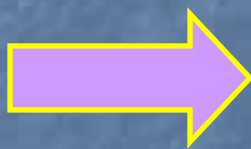
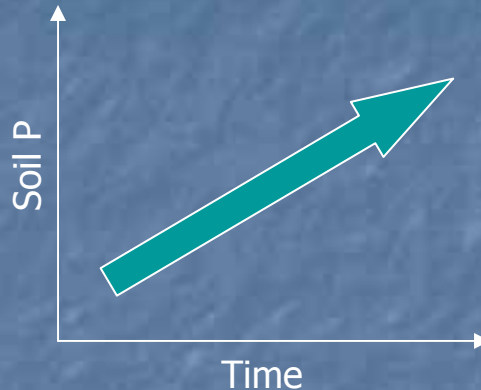
Agricultural Diffused Nutrient Pollution

*Animal
Feed Import*

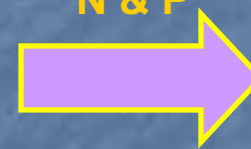


CAFO

*5 % of AFOs
50 % of animals
65 % of excess nutrients*



**Manure (N:P): 3:1
Crop (N:P): 8:1**



**Excess
N & P**

*Infiltration
&
Runoff*

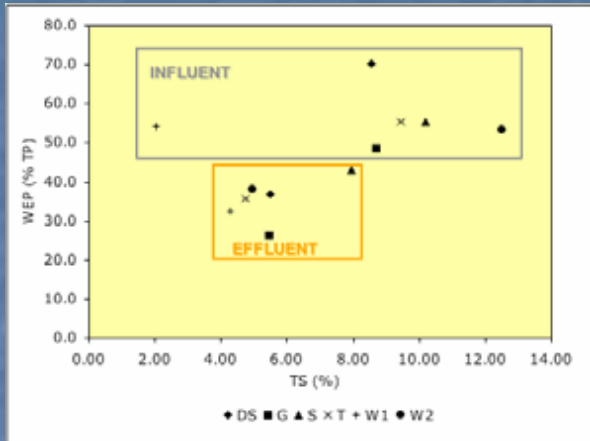


Eutrophication!!

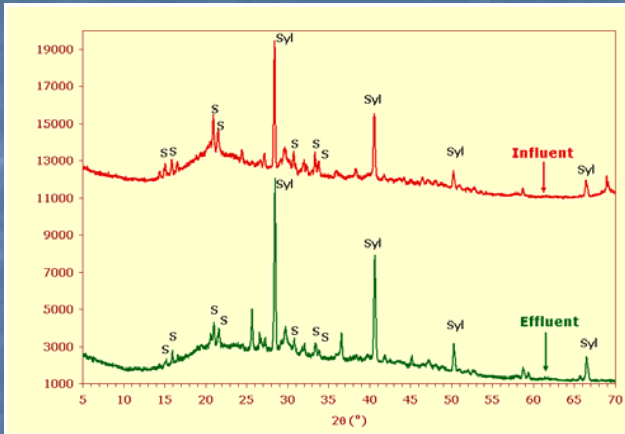
Research Activities: PhD

Method Toolbox

What are the dairy manure P solid phases dissolving into agricultural runoff?

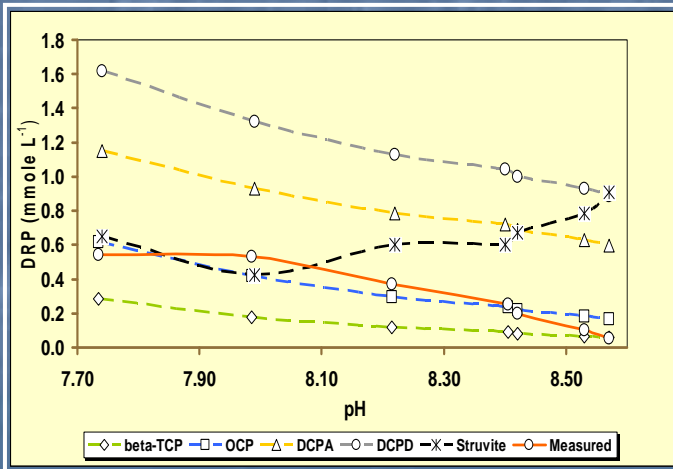


Water Extraction

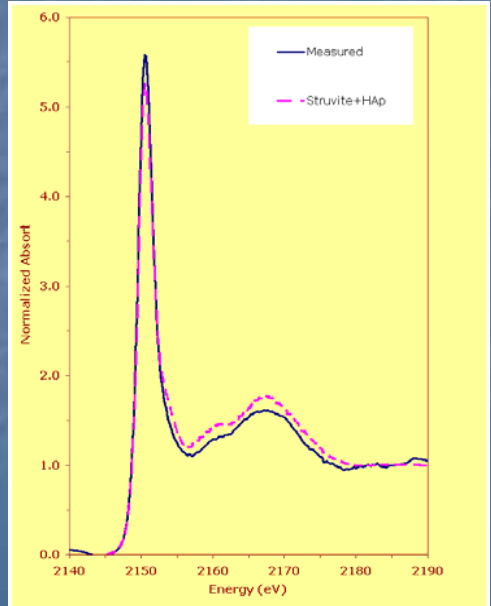


X-ray Diffraction

How anaerobic digestion influences short-term runoff availability of the manure P?



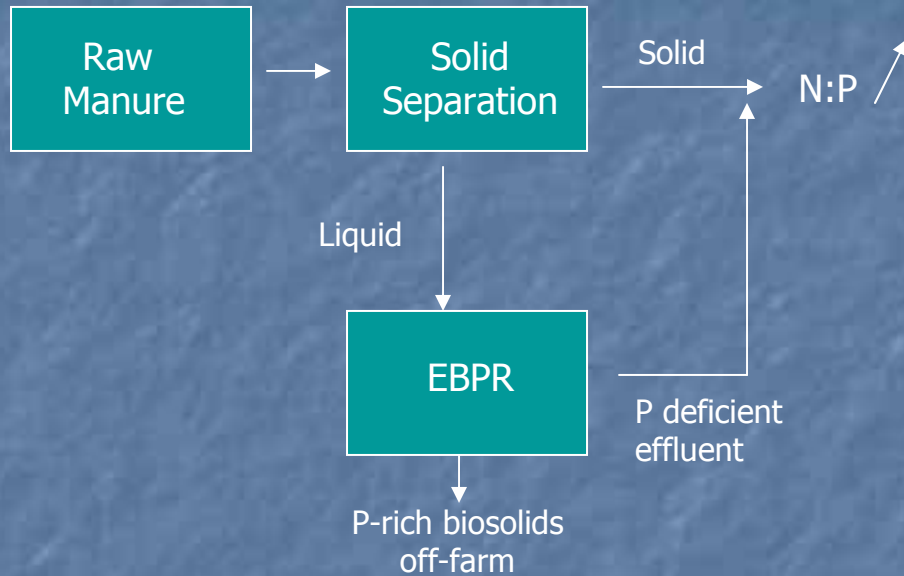
Chemical Equilibrium Modeling



X-ray Absorption Fine Structure

Research Activities: Postdoctoral

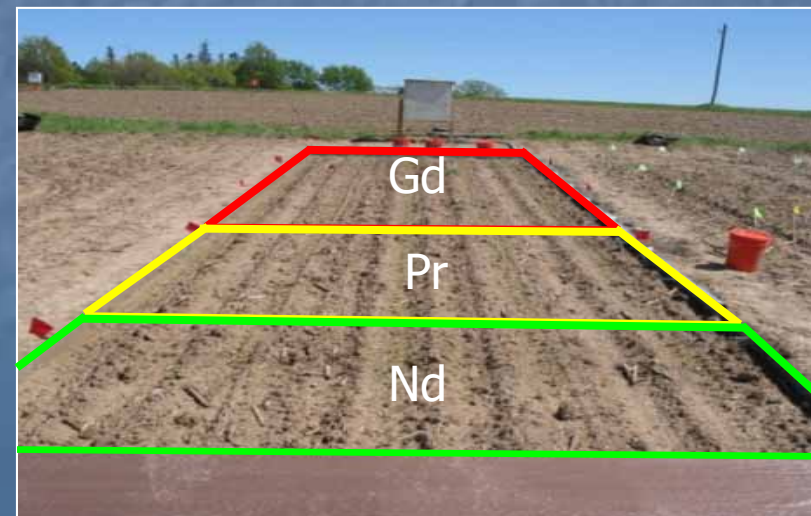
On-site Liquid Manure Treatment: Enhanced Biological Phosphorus Removal



Pilot-scale EBPR System (Virginia, USA)

Erosion: Spatial and Temporal Patterns of Sediment Movement

Method: Rare-earth element tracer



Experimental Field Plot



Abant İzzet Baysal University

- **Established in 1992**
- **Academic Staff (2008): 835**
85% (26-50 yr age)
- **Student Body ('07-'08): 16,500**
- **Budget (2008): 45 million \$**
- **Research Project Budget (2008): 3 million \$**
- **International Articles (2008): 194**

College of Engineering-Architecture:

- Food Engineering
- Mechanical Engineering
- Environmental Engineering
- Electrical & Electronical Engineering
 - Architecture
- City and Regional Planning

Major Research Infrastructure Project:

€ 7 million



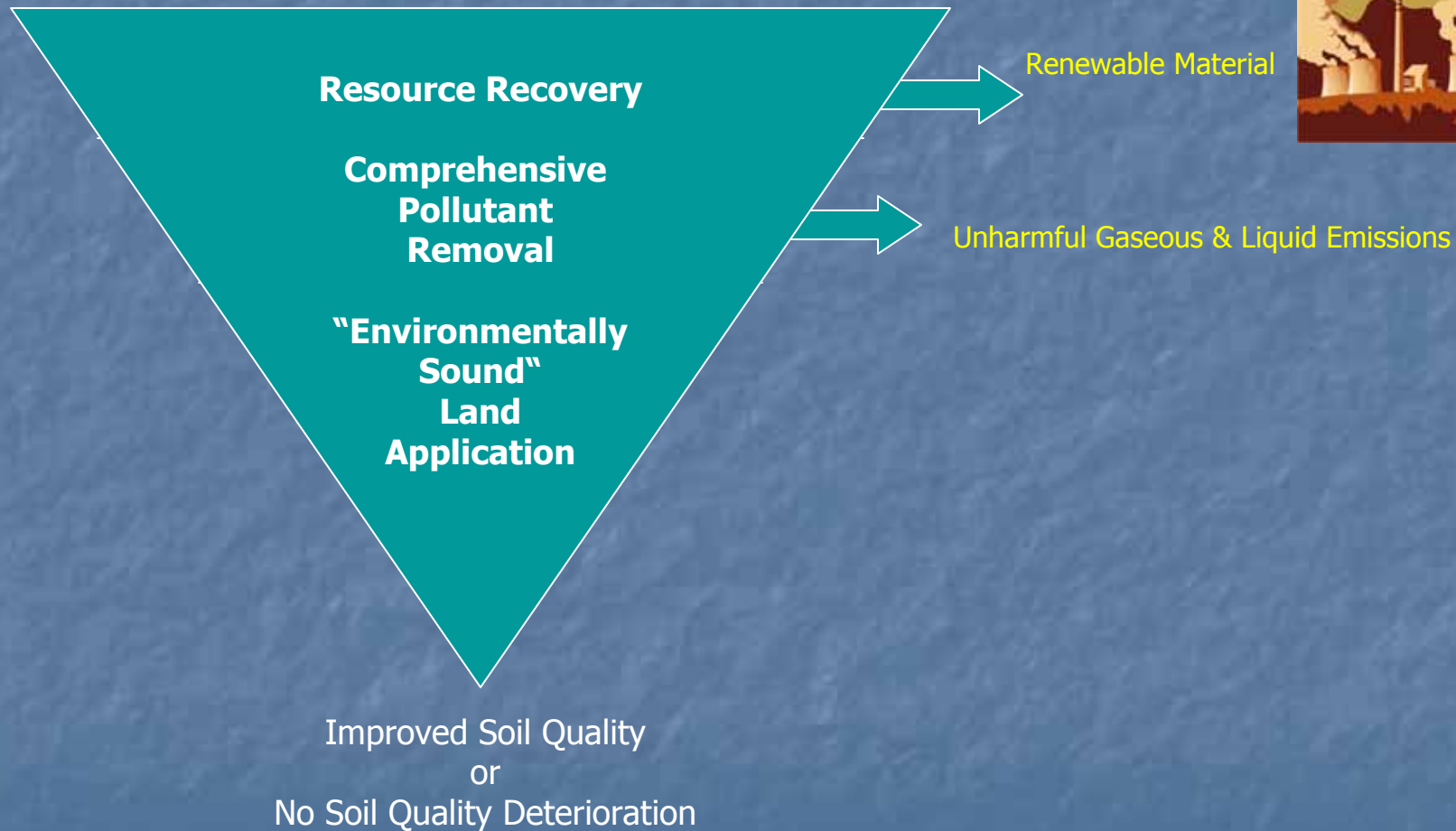


Environmental Engineering

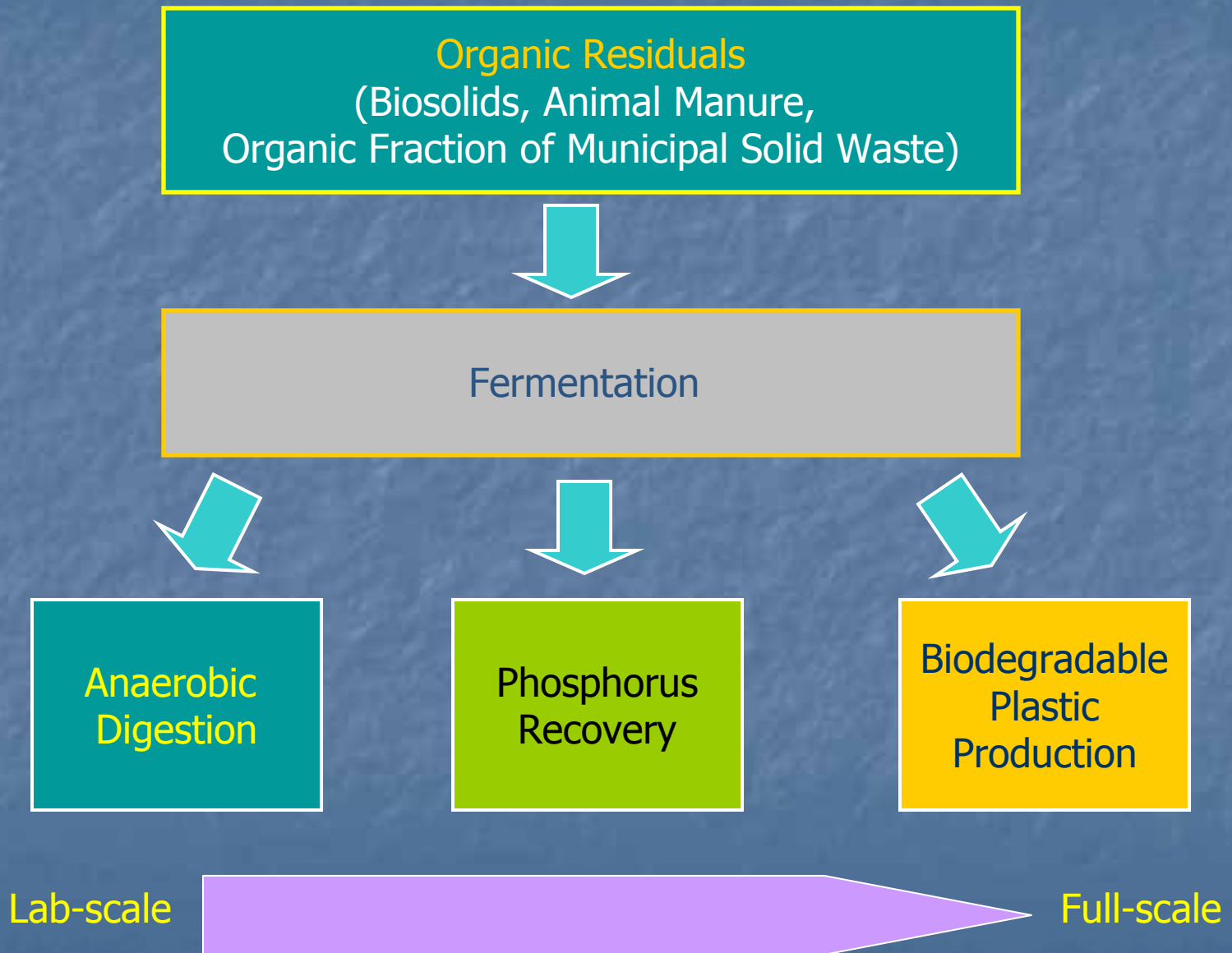
Major Research Activities:

- Established in 2007
- Faculty Body:
2 associate, 4 assistant professors
- Academic Support Staff:
3 research assistants (PhD students)
- Degrees Offered:
Undergraduate
- Laboratories:
1 teaching, 1 research
- ERASMUS Exchange Program Member
- Modeling C, N, H₂O Cycles Using Flux Towers and Remote Sensing (COST)
- Assessing Climate Change and Land Use Impacts on Groundwater Systems (FP7)
- Monitoring Surface Water Quality Using Remote Sensing
- Improving Biosolid Conditioning
- Treating Agroindustrial Wastewaters Using Constructed Wetlands
- Determining Organic Pollutants in Wet Deposition

Research Vision: "Sustainable Organic Residual Management"



Resource Recovery from Organic Residuals





Evaluation of Enhanced Fermentation for Integrated and Value-Added Manure/Wastewater Treatment

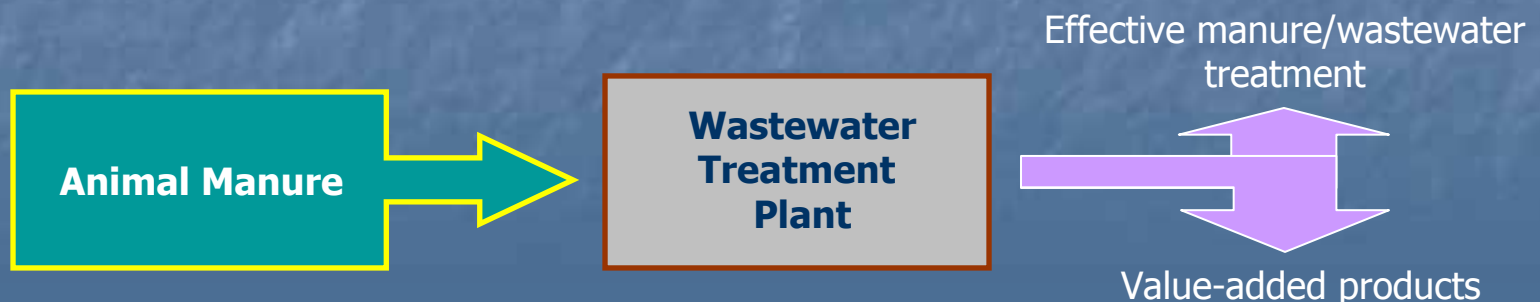
Problem: Environmentally unsound management of animal manure,
Technical and economical limitations hindering on-site manure treatment.

Example: Bolu province of Turkey houses **10%** of the national broiler stock,
Environmental problems associated with est. **110K tons/yr** broiler litter.

Hypothesis: Animal manure

organics can be processed into electrical energy and biodegradable pl.
phosphorus can be converted into high-grade phosphate minerals
via enhanced fermentation at WWTP.

Project Goal: Evaluate the value-added manure/wastewater treatment approach that exploits enhanced fermentation.





Evaluation of Enhanced Fermentation for Integrated and Value-Added Manure/Wastewater Treatment

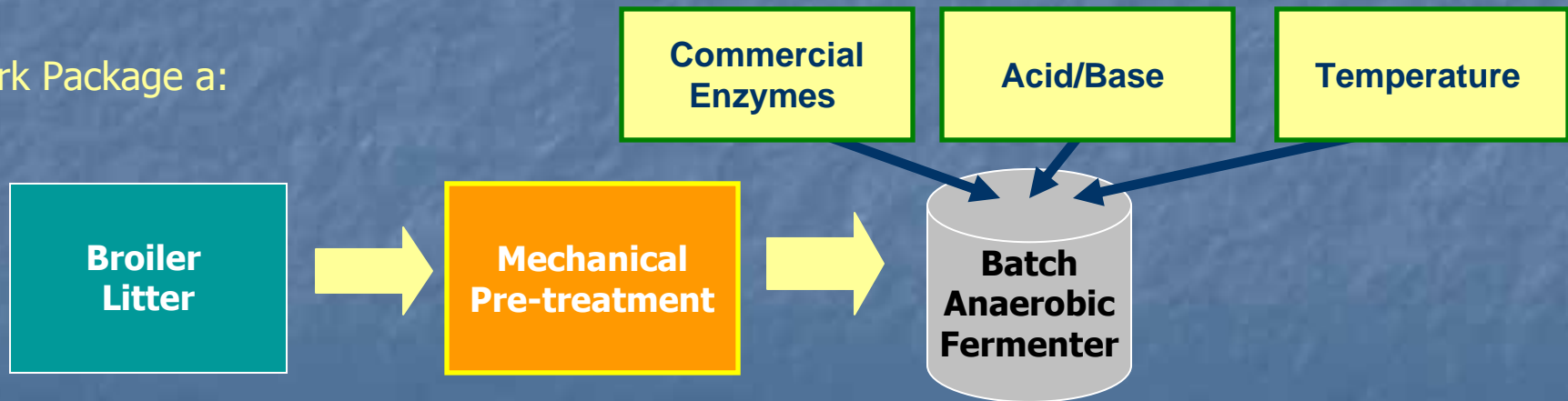
Subject: Design a fermentation reactor (fermenter) and evaluate the probable value-added process configurations including the fermenter.

Work Packages:

- Determine the manure pretreatment and fermenter operational conditions,
- Model the value-added manure/wastewater process configurations,
- Evaluate cost-effectiveness of the novel process configurations.

Methods: Experiments using lab-scale reactors, fermentation model development, WWTP simulation model utilization

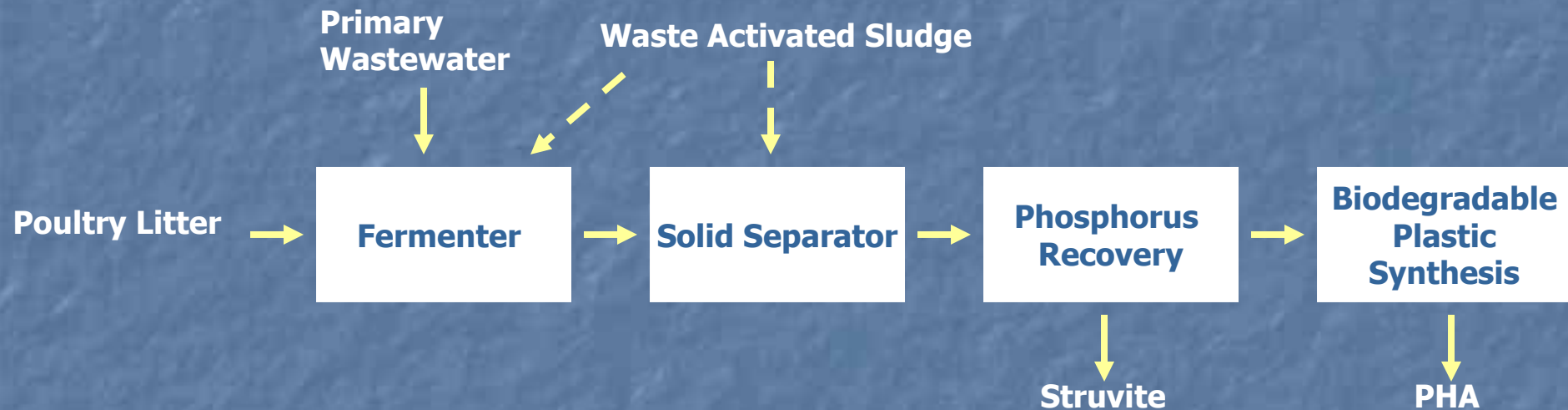
Work Package a:





Evaluation of Enhanced Fermentation for Integrated and Value-Added Manure/Wastewater Treatment

Work Package b: Modeling value-added side stream configurations. Utilize WWTP model.



Work Package c:

- Evaluate feasibility of implementing the novel side stream configurations at the full-scale
- **Two types of WWTP**: secondary and biological nutrient removal
- Different scenario conditions: wastewater and manure loads
- Determine `cost-effectiveness` and compare the configurations

Questions & Comments

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