



AB PDU - Determining R&D Problems in Scale-Up and Resolving them by accessing National Lab Resources

Deepti Tanjore
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ABPDU: Enabling biofuel and bioproduct scale-up R&D

- 15,000 square foot Demonstration Lab established in 2009
- Managed by DOE EERE from the BioEnergy Technologies Office (BETO)



- A bio-process research incubator / accelerator – industry-friendly IP rights, cost-recovery project fee structure, experienced team, and Bay Area location

Facility at a glance – from bench to pilot



Over 30 industry partnerships to date

Biofuels & biomass

Materials & chemicals

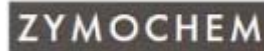
Food & health

Waste & water



Completed projects

Ongoing

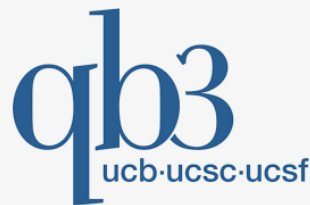
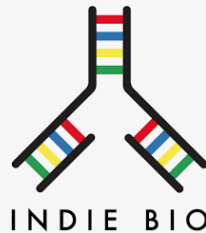


The bioprocess incubation ecosystem

DOE-funded capabilities at National Laboratories



Bay Area incubators

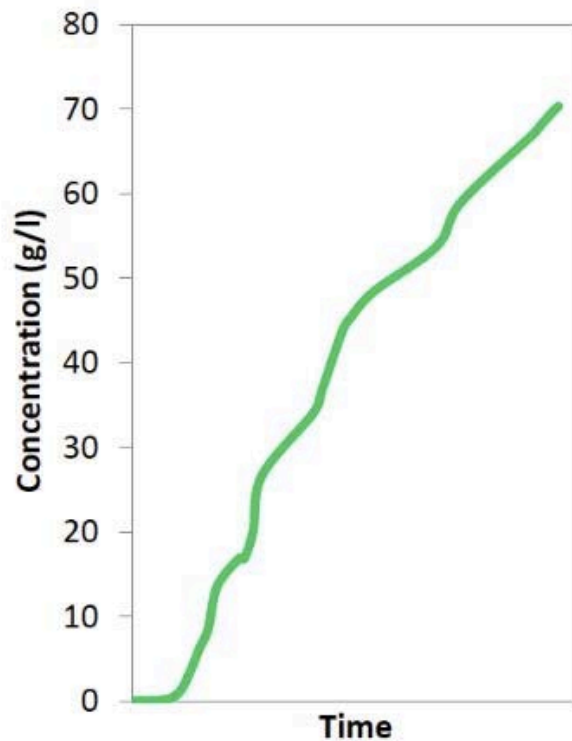


Non-dilutive federal funding



Case study: Visolis fermentation platform

Proven at 300lt pilot scale indicating 60-90c/lb production cost at scale



Parameter	Current	2017
Yield	60%	80%
Titer	70g/l	120g/l
Cost at scale	60-90c/lb	45-70c/lb
Average product value	\$2/lb	\$1/lb
Total addressable market	\$1 billion	> \$10 billion

cyclotronroad



**BETO Technology-
to-Market**

Visolis

Case study: Lygos malonic acid verification

3rd party validation of final project metrics was performed at the ABPDU (50-liter scale)



- Problems were encountered obtaining cellulosic sugars within allowed budget, limiting fermentation scale
- Demonstrated successful scaleup of fermentation process with real-world cellulosic sugars*

Parameter	As % of Control Fermentations
Yield	120%
Titer	99%
Productivity	99%



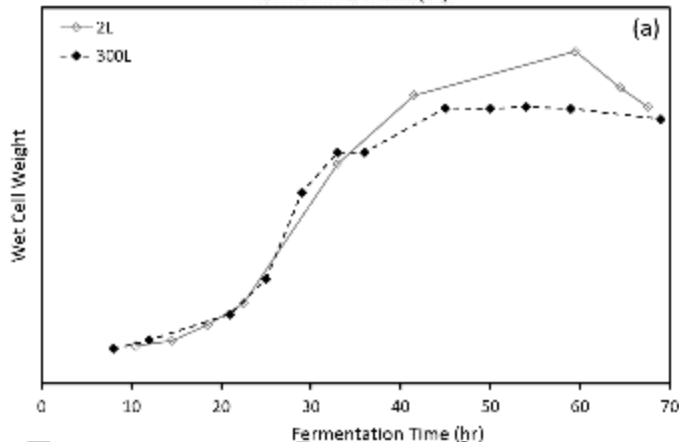
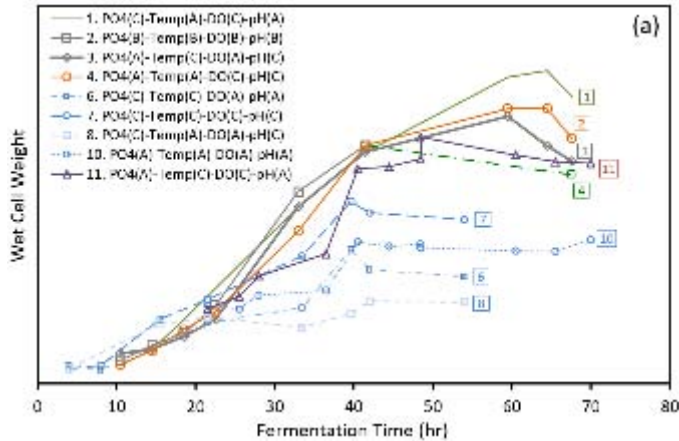
* Confidential commercial provider



Case Study: Perfect Day Studies for Low-Cost Carbon Sources for Protein Production

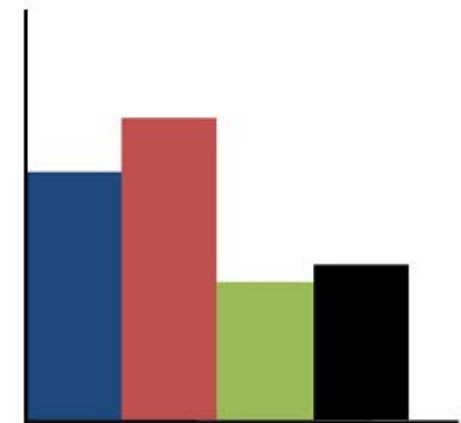


BETO Technology-to-Market



Dry cell weight

[g L⁻¹]



- A5 - CS Hydrolysate
- A6 - CSL
- A7 - Industrial glucose
- A8 - Glucose control

Fermentation Process Optimization and Scale-Up

2L Fermentation to study cheaper C-sources

Case Study: Heliobiosys Cyanobacterial Polysaccharide study with Sandia

BETO Technology-to-Market

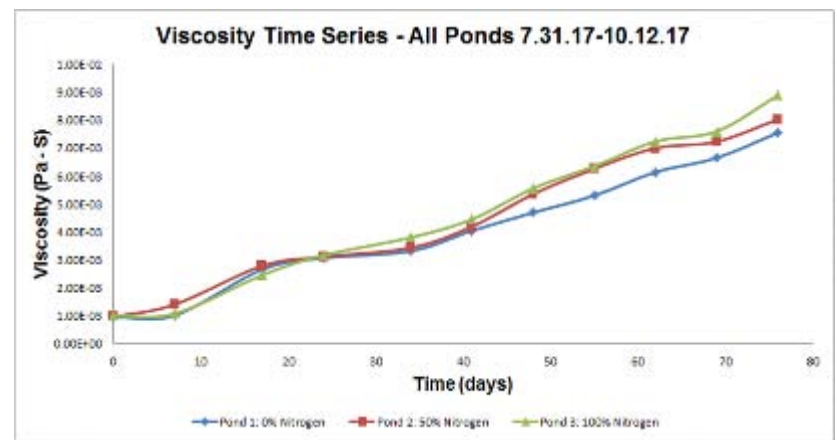


(a) Hydrogel behavior

(b) Microscopic View



Raceway Ponds at Sandia



Correlation of viscosity with Polysaccharide production



Providing a critical resource and direct support of several DOE / EERE / BETO programs and consortia



Key outcomes for private sector collaborators

- Several competitive awards as preludes or follow-ons to sponsored projects



- Numerous partners have set up their own labs or pilot plants and secured private financing while / after working with ABPDU



RIPPLE FOODS

- Product launches and commercial / pre-commercial scale-up & scale-down



RIPPLE FOODS



<http://www.biofuelsdigest.com/bdigest/2016/12/14/chief-pilot-the-abpdu-where-the-elite-meet-to-defeat-petroleum/>

ABPDU: Enabling bioprocess scale-up research

- Leveraging national lab resources to understand and resolve problems in scale-up research
- Improved R&D capabilities in this subject
- Cross-pollinate ideas with subject matter experts
- Exposure to industry-wide problems that can be addressed through BETO funded consortia programs



Thank you!



Dr. Todd Pray, Ph.D., MBA
PROGRAM HEAD



Dr. Deepti Tanjore, Ph.D.
RESEARCH SCIENTIST -
FERMENTATION AND RECOVERY



Dr. Ning Sun, Ph.D.
RESEARCH SCIENTIST



Eric Sundstrom
SENIOR PROCESS ENGINEER



Dr. Mona Mirsiaghi, Ph.D.
POSTDOCTORAL RESEARCHER



Dr. Jipeng Yan, Ph.D.
POSTDOCTORAL RESEARCHER



Akash Narani
BIO-PROCESS/FACILITIES ENGINEER



Qian He
SENIOR RESEARCH ASSOCIATE



Chyi-Shin Chen
PROCESS ENGINEER



Ling Liang
PROCESS ENGINEER



Sarah Brown
RESEARCH ASSOCIATE



Katherine Schall
ADMINISTRATOR



Jan-Philip Prahl
FERMENTATION/RECOVERY PROCESS
ENGINEER



<http://abpdu.lbl.gov/>
tpray@lbl.gov
dtanjore@lbl.gov