



Production of biopolymers

Scale up from pilot to industrial volume

Journey of an entrepreneur



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Murcia 23/10/2015



Overview

- Background
- The challenges and context for finding solutions
- The solutions – Technology and scale up
- Starting a company – the easy part
- Surviving the valley of Death – the hard part



Background



- University College Cork, Ireland - BSc PhD
- Postdoctoral scientist
 - Wageningen Agricultural University, NL
 - ETH Zurich, Switzerland
- Joined University College Dublin (UCD) 1999
- Undertook a “campus company development programme in ‘08 and founded Bioplastech ‘09



The Grand Challenge



- **Moving away from** dependence upon a finite depleting resource (fossil)
 - Energy Polymers Chemicals
 - UN 1987 - **global agenda for change**
 - **Sustainable development of society**
Social and economic advances for the current generation do not compromise the ability of future generations to meet their own needs



The Grand Challenge



- **Sustainable use of resources**

- Water, crops (biomass), minerals, fossil oil and gas

- **Human behavior**

- Travel, energy consumption, waste generation

- **Environmental protection**

- Water quality, land management, air quality,, Green house gas (e.g. carbon dioxide, methane) emmissions



The Grand Challenge - Waste



Modern society is generating more waste than it can handle

600 kg of waste per person per year

Landfilling waste is an easy option – low cost

Landfill running out – expanding population, unsustainable practices (throw away/disposable society)

Exportation of waste is not recycling – passing the buck



The Grand Challenge redefined



- How to sustain life on earth?
- Planning for an uncertain future
- Achieving a sustainable Society
 - Reducing the impact of human activity on the environment
 - Solutions for waste management
 - Resource management
 - Biobased products
 - Biodegradable products



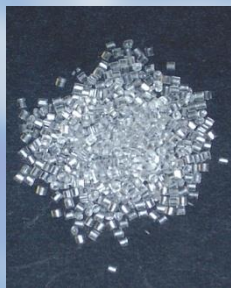
Addressing an aspect of the Challenge



- Converting waste to biodegradable polymer
- Developing applications for the polymer
- Developing technology that will scale
- Scaling technology –
 - Process engineering
 - Physical limitations
 - Biological capability



New solutions for plastic waste

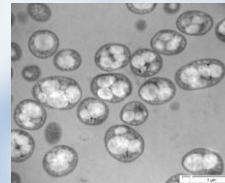


Plastics

→
Chemistry



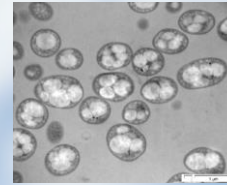
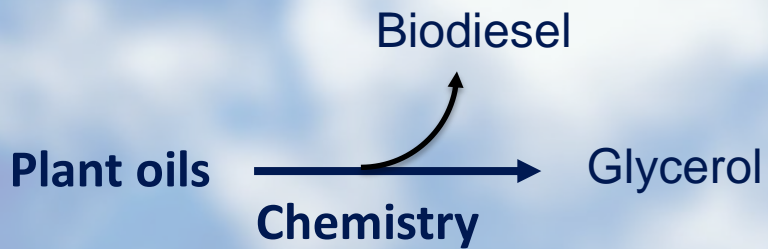
**Fermentable
Oil/solid**



→
Microbiology



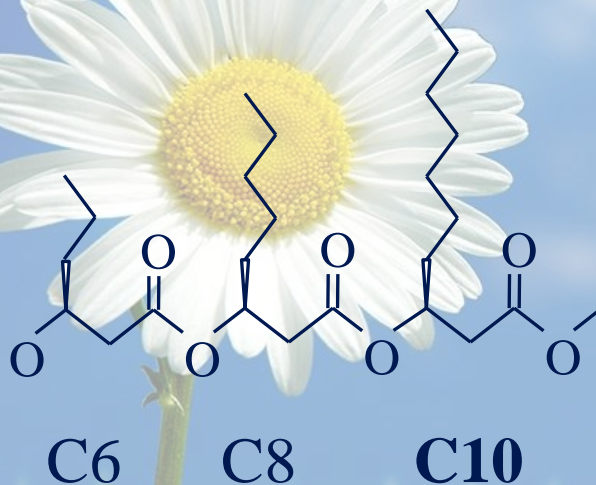
New solutions for industrial byproducts



Microbiology



Polyhydroxyalkanoate (PHA)



PHB hard brittle
Tm 160 Tdeg 170°C

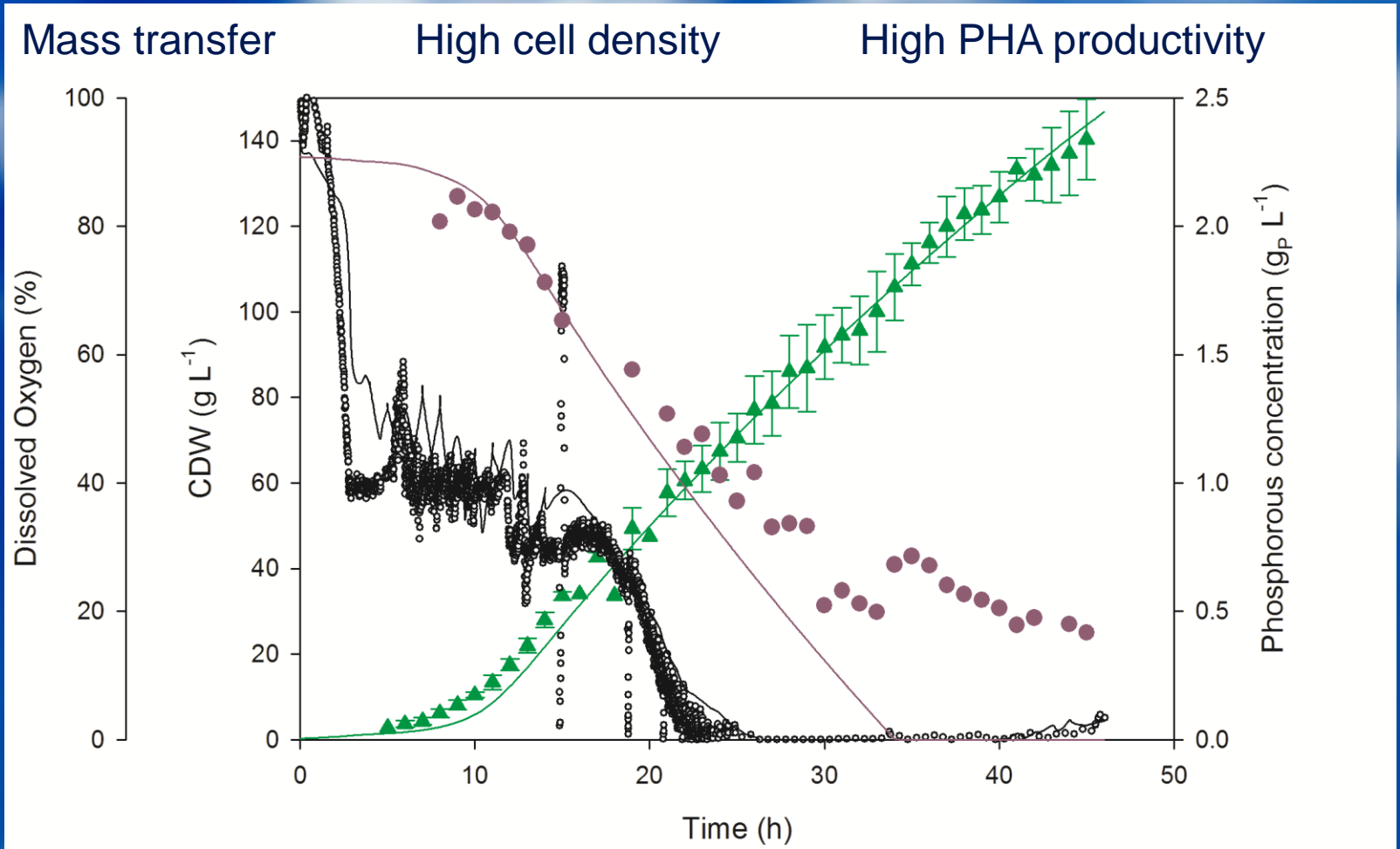
PHO soft rubber
Tm 50°C Tdeg 300°C

Bioplastech



- **Team**
- Multi-national, Multi-disciplinary
- Microbiologists, Material scientists, Business specialists
- **Technology**
- Converting residues to biodegradable polymers
- Developing applications for the polymers
- **Business plan**
- 2009 Plastics - Films/composites
- 2012 - Adhesives

Bioprocess development



Sticky Solutions



Adhesives – €22.5 billion market

- Pressure sensitive adhesives (PSA) (€2.5 billion)
- Hot melt adhesives (HMA) € 5 billion)

Packaging

- Biodegradable glue for packaging
- Cardboard, paper, plastic
- Re-sealable packaging
- Labels on packaging
- Tapes

Market

Currently testing products with end users

Bioplastech sticking to a vision



- Biodegradable plastics and polymers
- Processes and products
- Imagine the possibilities but be realistic
- “...I dream things that never were; and I say, ‘Why not?’” (George Bernard Shaw. Back to methuselah -1921)



Challenges for a start up



Team

Broad set of skills beyond Science and technology
Technology is an enabler of a business but not a driver
Great technologies can fail great teams rarely fails

Reputation

Doing things right

Excellence is not a skill its an attitude

Competitors

Can drive your business but can also hamper the
general area if they are not credible



Challenges for a start up



Investment

Venture capital

Angel investors

Corporate investment

Contract for research and development

Consultancy

Chicken and egg

Investors want the technology scaled but start ups are looking for investment to scale up

Cash flow

Payments linked to milestones

Challenges for a start up and others



Market entry

Need scale and market network.

You have to be much better and offer a game changing benefit to the customer

Market trends

Start ups are ahead of the market and this is often a disadvantage

Policy

Investors look at a business opportunity but are influenced by policy



Challenges for a start up



Policy distortions of the market

For every €1 spent supporting bioenergy €6 is spent supporting fossil based energy

No policy on biobased products

Policy focused elsewhere

Policy is focused on biomass, biofuels and bioenergy – land competition.

Biochemicals & biopolymers order of magnitude less land

Waste

Waste to energy policy exists

No policy on waste to biobased products

Conclusion



- Scaling technologies is exciting, stressful, hard work, lots of failure and some success
- Have to be realistic about what you can achieve
- Credibility with investors and the market is a huge challenge
- Scaling makes you a multi tasker
- Scale first or develop products first? Being ahead of the market is a huge challenge
- A start up has to adapt and pivot to exploit an opportunity





Thank you

