

# BEACON

From plants to products  
O blanhigion i gynhyrchion

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# IBERS

**Institute of Biological, Environmental and Rural Sciences**



# **IBERS – staff**

**Plant breeders**

**Agronomists**

**Molecular geneticists**

**Biochemists**

**Physiologists**

**Rumen/silage expertise**

**Enzymes/microbiologists**

**Other sources**

# Phenomix Centre



# Platform for non-destructive dynamic imaging of plant growth & development



**Controlled environment  
conveyor based system  
radio-tagged plants**



**state-of-the art  
imaging stations:**

- visible
- near IR
- Thermal IR
- fluorescence
- laser scan 3-d
- both canopy and root imaging
- DNA sequencing for rapid phenotypic associations

# BEACON and what it will do

- Welsh European Funding Office (WEFO) funded initiative with a value of £20m
- Partnership between Aberystwyth, Swansea and Bangor Universities to develop biorefining R&D expertise in Wales
- Enable academic and a wide range of industrial partners to develop and demonstrate scale-up processes for economically viable industrial applications

# WEFO Metricated Objectives

## Outputs

- **202 enterprise assists**
- **25 R & D collaborations**

Enterprise has to be in Wales  
(or have a registered office)  
If leading to inward investment then  
outside companies can also be counted

## Results

- **67 Jobs Created**
- **3 Enterprises Created**
- **Profit Benefit £1,680,000**
- **Investment Induced £3,360,000**
- **7 Products, process or services registered**
- **16 New/improved products, processes or services launched**

# BEACON

Facilities and equipment for  
development of biorefining expertise  
and process scale-up

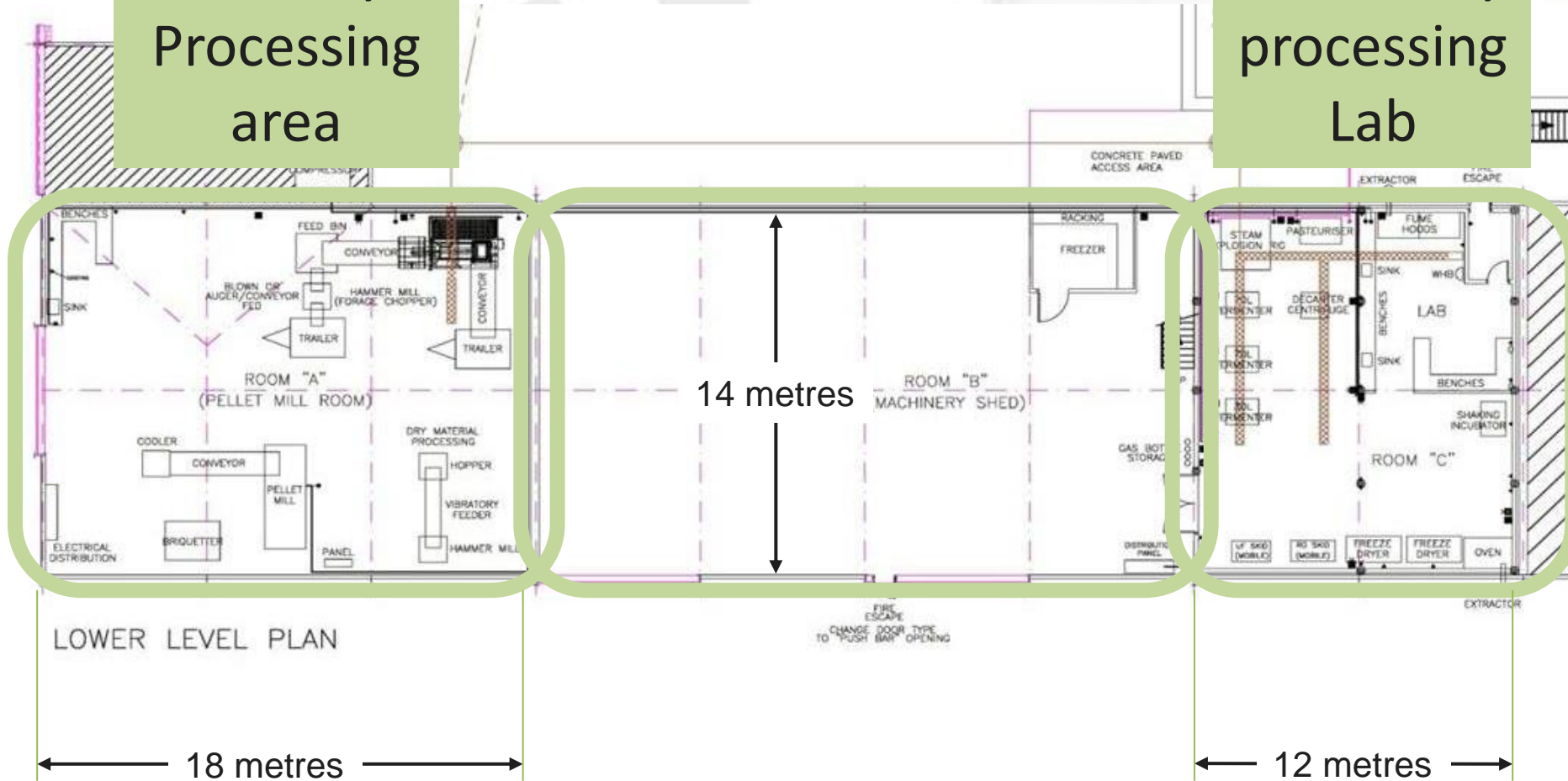
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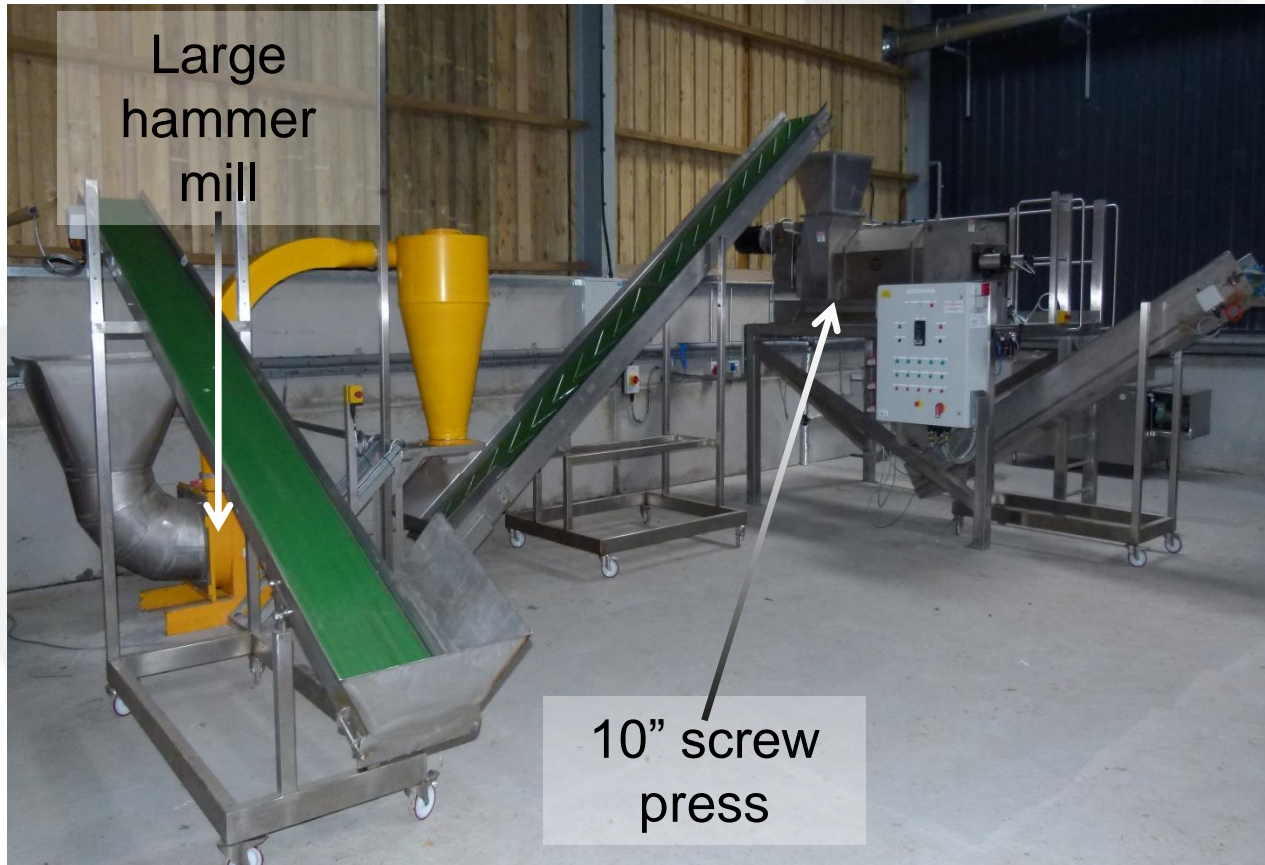
# Biomass treatment and fermentation pilot facility lay-out

Primary Processing area

Secondary processing Lab



# Primary Processing Area



Integrated wet processing line



Dry processing:  
Pellet mill

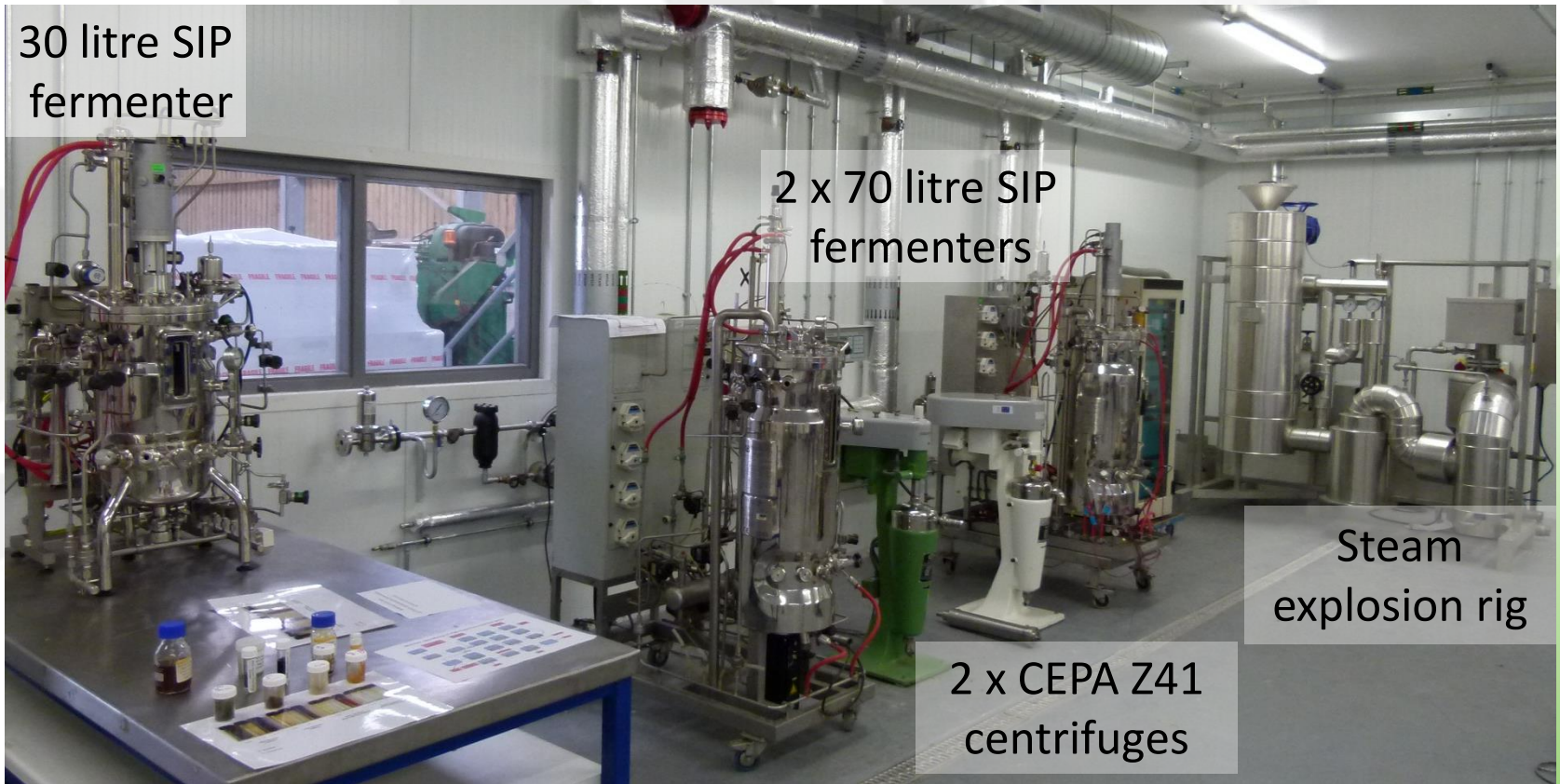


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# Secondary processing Lab

## Fermentation and pre-treatment



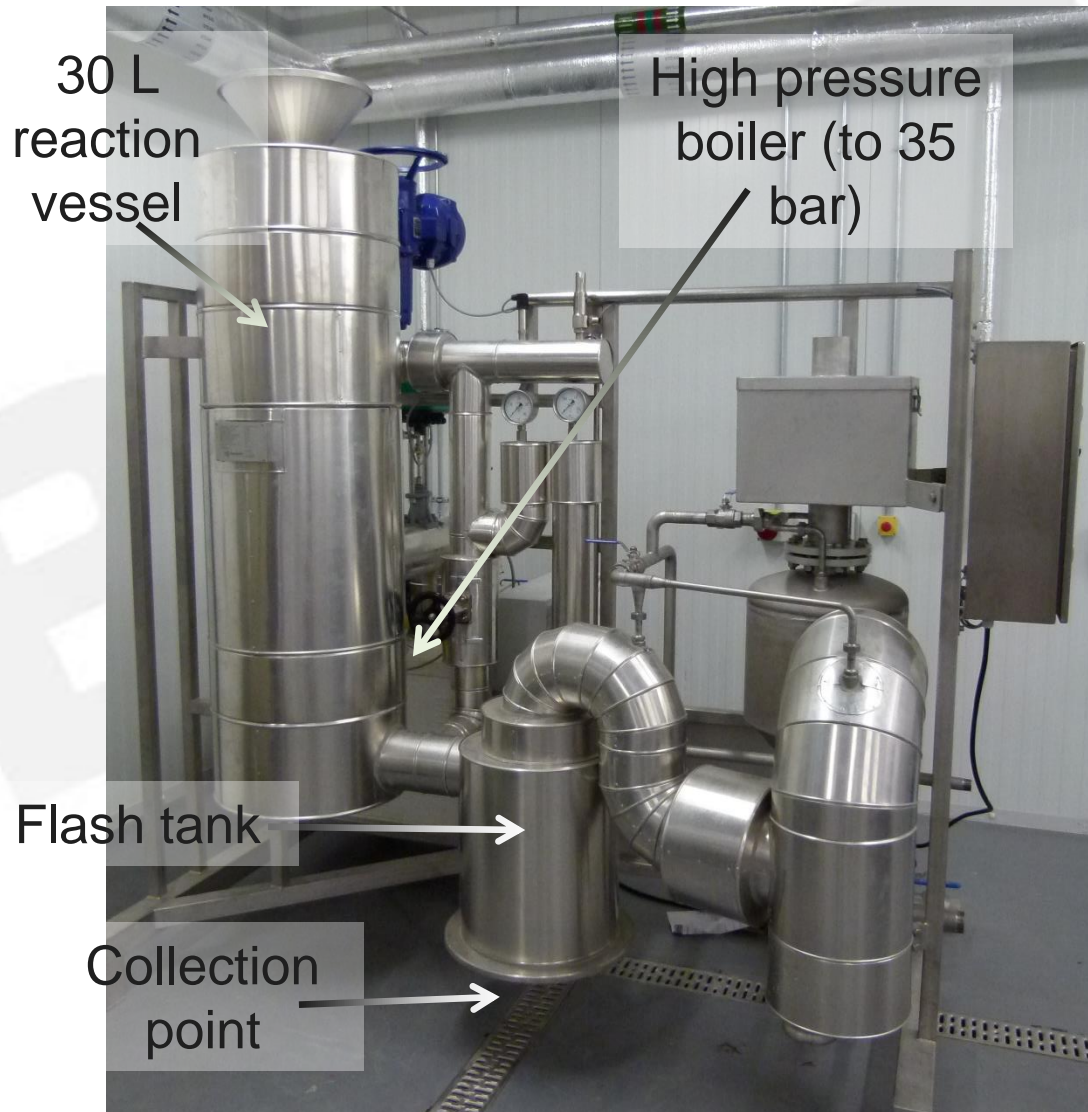
30 litre SIP fermenter

2 x 70 litre SIP fermenters

Steam explosion rig

2 x CEPA Z41 centrifuges

# Steam explosion rig by Cambi



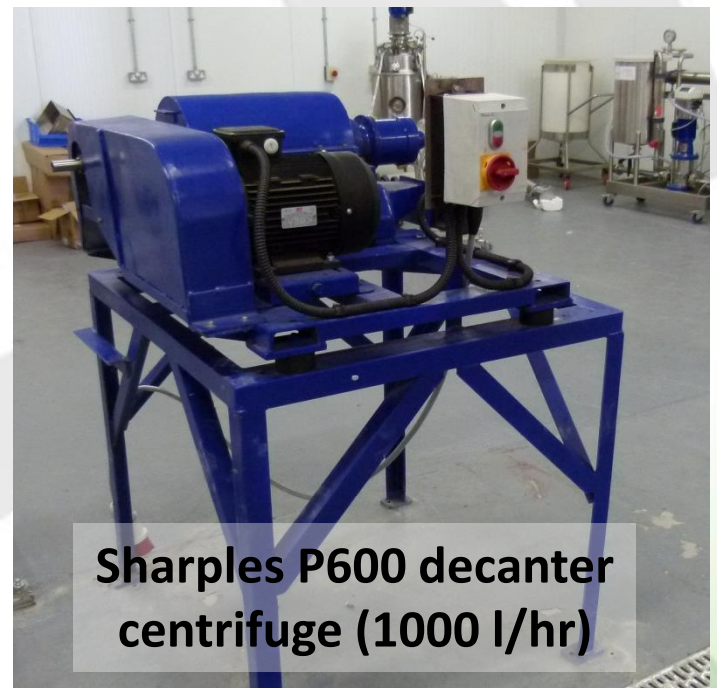
Pre-treated biomass from the flash tank



SE is common scalable pretreatment for lignocellulosic biomass. Above material will liquefy in under 1 hour with standard cellulosic enzymes.



**Dual duty (50/500 litre/hr)  
pasteuriser**



**Sharples P600 decanter  
centrifuge (1000 l/hr)**



**100 litre  
reaction tank**



**NF/RO filtration skid**



**UF/MF filtration skid**

# Biochar Facility



**Oven**  
(500kg  
capacity)

Pre-heater

Hot gas  
recirculation

Condenser for  
pyrolysis oils

From *pyrolysis*  
© *blan*



20 Litre rotary evaporator



Wet chemistry laboratory with walk in fume hood



50 Litre jacketed glass reactor



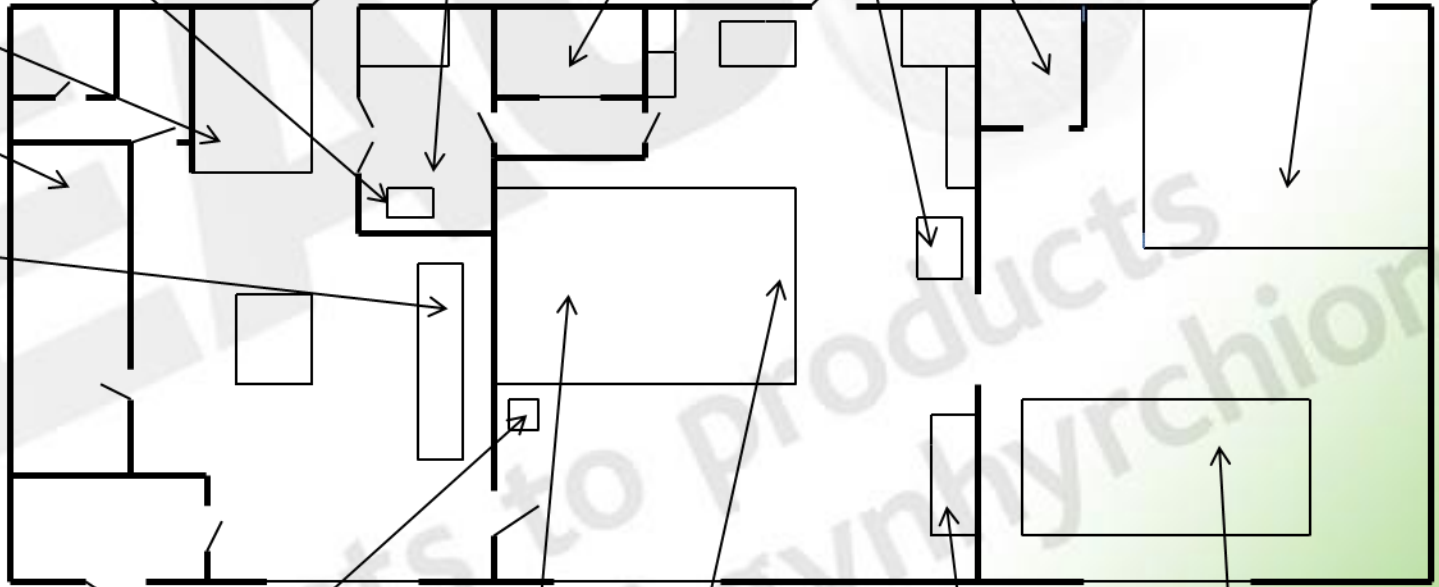
1000 litre drum blender



Pressurised refining of biomass



Steam boiler



Pulp and Paper equipment



Office



Twin screw extruder and film forming line



Two deck vibrating sieve



Hot press for biocomposites production



Pre press



Fibre collection and mattress forming station

Wet fractionation line – Summer 2012

# Climate-KIC



## About Climate-KIC

- News
- Events
- Case Studies
- Our Community
- Newsletters
- Media Inquiries
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## National Centres

- Paris, France
- Berlin, Germany
- The Netherlands
- Zurich, Switzerland
- London, UK

## Regional Centres

- Valencia, Spain
- Central Hungary
- Emilia Romagna, Italy
- Lower Silesia, Poland
- Hessen, Germany
- West Midlands, UK

## Themes

- Greenhouse gas monitoring
- Adaptation services
- Making transitions happen
- Sustainable cities
- The built environment
- Land and water
- Resource efficiency
- Developing a bio-economy

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# Climate-KIC

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[Climate-KIC > NL > Innovation and Pathfinder projects 2012](#)

## Innovation and Pathfinder projects 2012

Final decisions about the Innovation and Pathfinder Projects for 2012 are made; Dutch partners are well represented.

Tuesday 25th October

### Our Next Event

[View all](#)



31 May 2013, Netherlands

[Seminar: Innovative financial arrangements](#)

### Climate-KIC News

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22nd May 2013

[Climate-KIC entrepreneurs win](#)

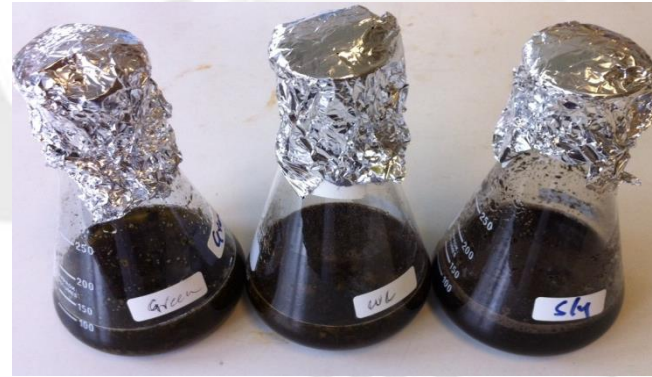
# Samples from university of Stirling

- aquatic plant material
- composted Elodea, pondweed (Lemna sp) and Water Lily

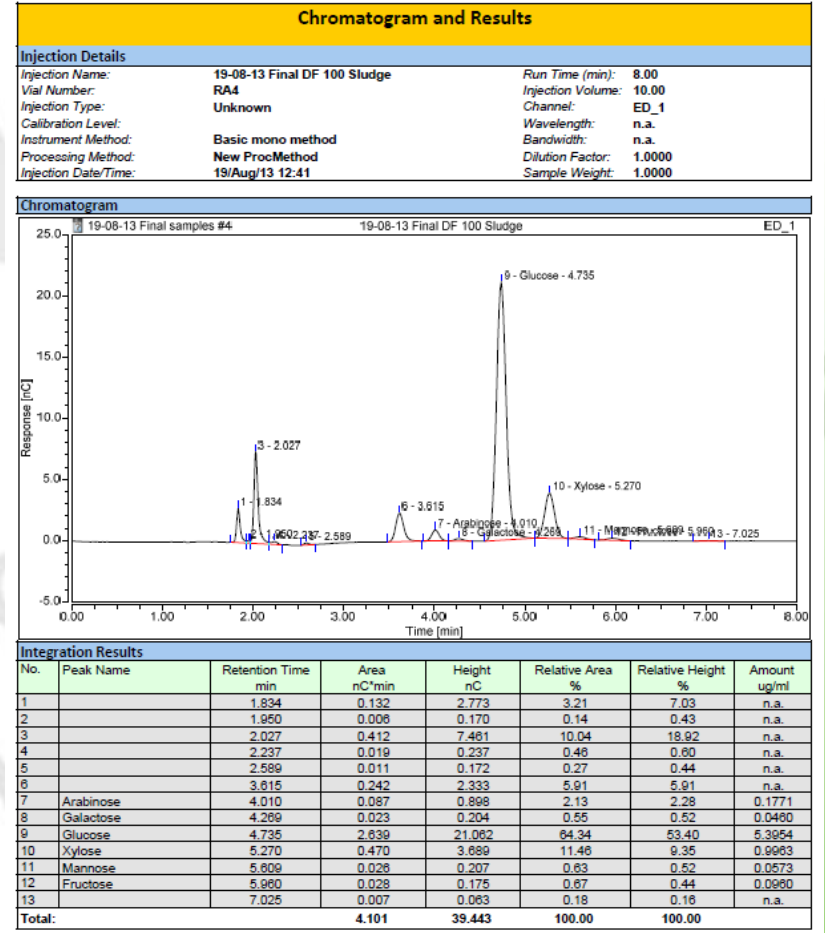
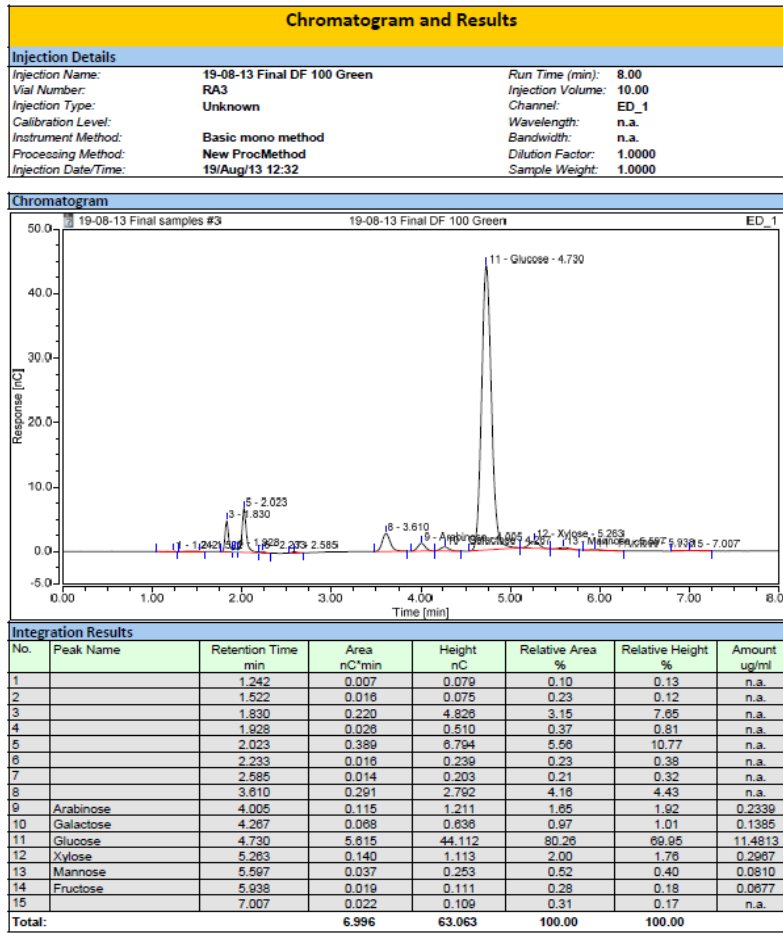


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# Enzymatic hydrolysis



# Hydrolysis results

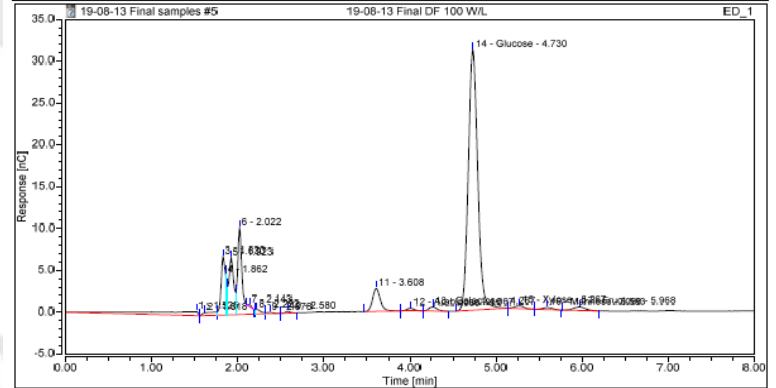


### Chromatogram and Results

#### Injection Details

|                      |                           |                   |        |
|----------------------|---------------------------|-------------------|--------|
| Injection Name:      | 19-08-13 Final DF 100 W/L | Run Time (min):   | 8.00   |
| Vial Number:         | RA5                       | Injection Volume: | 10.00  |
| Injection Type:      | Unknown                   | Channel:          | ED_1   |
| Calibration Level:   | Unknown                   | Wavelength:       | n.a.   |
| Instrument Method:   | Basic mono method         | Bandwidth:        | n.a.   |
| Processing Method:   | New ProcMethod            | Dilution Factor:  | 1.0000 |
| Injection Date/Time: | 19/Aug/13 12:50           | Sample Weight:    | 1.0000 |

#### Chromatogram



#### Integration Results

| No.           | Peak Name | Retention Time min | Area nC*min  | Height nC     | Relative Area % | Relative Height % | Amount ug/ml |
|---------------|-----------|--------------------|--------------|---------------|-----------------|-------------------|--------------|
| 1             |           | 1.525              | 0.352        | 0.490         | 5.37            | 0.74              | n.a.         |
| 2             |           | 1.618              | 0.061        | 0.326         | 0.93            | 0.49              | n.a.         |
| 3             |           | 1.830              | 0.380        | 7.018         | 5.50            | 10.54             | n.a.         |
| 4             |           | 1.862              | 0.104        | 4.783         | 1.58            | 7.18              | n.a.         |
| 5             |           | 1.923              | 0.434        | 6.827         | 6.62            | 10.25             | n.a.         |
| 6             |           | 2.022              | 0.702        | 10.377        | 10.71           | 15.58             | n.a.         |
| 7             |           | 2.143              | 0.010        | 0.263         | 0.16            | 0.39              | n.a.         |
| 8             |           | 2.222              | 0.044        | 0.532         | 0.68            | 0.80              | n.a.         |
| 9             |           | 2.378              | 0.015        | 0.163         | 0.23            | 0.24              | n.a.         |
| 10            |           | 2.580              | 0.014        | 0.198         | 0.21            | 0.30              | n.a.         |
| 11            |           | 3.608              | 0.287        | 2.733         | 4.39            | 4.10              | n.a.         |
| 11            | Arabinose | 4.007              | 0.031        | 0.321         | 0.48            | 0.48              | 0.0632       |
| 12            | Galactose | 4.267              | 0.052        | 0.488         | 0.80            | 0.73              | 0.1066       |
| 14            | Glucose   | 4.730              | 3.942        | 31.090        | 60.20           | 48.69             | 8.0597       |
| 15            | Xylose    | 5.267              | 0.041        | 0.327         | 0.63            | 0.40              | 0.0875       |
| 16            | Mannose   | 5.580              | 0.033        | 0.237         | 0.50            | 0.36              | 0.0722       |
| 17            | Fructose  | 5.968              | 0.067        | 0.416         | 1.02            | 0.83              | 0.2321       |
| <b>Total:</b> |           |                    | <b>6.548</b> | <b>66.567</b> | <b>100.00</b>   | <b>100.00</b>     |              |

| <b>Dry samples</b>  | Sample ID | Mass (g) | %C    | %N      |
|---------------------|-----------|----------|-------|---------|
| Water Lily 1        | 31        | 0.1006   | 42.13 | 3.975   |
| Water Lily 2 (NaOH) | 32        | 0.0988   | 34.41 | 2.6203  |
| Green 1             | 33        | 0.0961   | 39.91 | 2.3742  |
| Green 2 (NaOH)      | 34        | 0.0892   | 35.67 | 0.91706 |
| Sludge 1            | 35        | 0.0957   | 26.84 | 3.6663  |
| Sludge 2 (NaOH)     | 36        | 0.09     | 16.26 | 0.95165 |

| <b>Wet samples</b> | Sample ID | Mass (g) | %C    | %N      |
|--------------------|-----------|----------|-------|---------|
| Green Fresh 1      | 37        | 0.2367   | 2.115 | 0.17489 |
| Green Fresh 2      | 38        | 0.24     | 2.091 | 0.17537 |
| Green Fresh 3      | 39        | 0.2047   | 2.171 | 0.19118 |
| Water Lily Fresh 1 | 40        | 0.2378   | 4.121 | 0.33406 |
| Water Lily Fresh 2 | 41        | 0.2511   | 4.56  | 0.35738 |
| Water Lily Fresh 3 | 42        | 0.2199   | 3.911 | 0.33194 |
| Liquid Sludge 1    | 43        | 0.2406   | 2.971 | 0.27358 |
| Liquid Sludge 2    | 44        | 0.2404   | 2.798 | 0.28151 |
| Liquid Sludge 3    | 45        | 0.2634   | 3.079 | 0.28861 |

All samples measured using a C/N elemental analyser  
At Bangor



|                    |           |             |                     | After ashing      |                     |          |
|--------------------|-----------|-------------|---------------------|-------------------|---------------------|----------|
| <b>As received</b> | Sample ID | Vial wt (g) | Fresh wt sample (g) | Vial + sample (g) | ashed sample wt (g) | mg / l P |
| Green 1            | 1         | 13.5564     | 0.1999              | 13.5837           | 0.1726              | 11.44494 |
| Green 2            | 2         | 13.446      | 0.202               | 13.4982           | 0.1498              | 12.99388 |
| Water Lily 1       | 3         | 13.6023     | 0.1994              | 13.6249           | 0.1768              | 8.519168 |
| Water Lily 2       | 4         | 13.4388     | 0.209               | 13.5354           | 0.1124              | 4.991028 |
| Sludge 1           | 5         | 13.4354     | 0.1953              | 13.513            | 0.1177              | 16.00571 |
| Sludge 2           | 6         | 13.6957     | 0.1535              | 13.7865           | 0.0627              | 19.70595 |

|               |           |             |                     | After ashing      |                     |          |
|---------------|-----------|-------------|---------------------|-------------------|---------------------|----------|
| <b>Liquid</b> | Sample ID | Vial wt (g) | Fresh wt sample (g) | Vial + sample (g) | ashed sample wt (g) | mg / l P |
| Green         | 7         | 13.4447     | 6.8777              | 13.5662           | 6.7562              | 35.53956 |
| Water Lily    | 8         | 13.4572     | 8.5389              | 13.7665           | 8.2296              | 48.36134 |
| Sludge        | 9         | 13.4291     | 6.8319              | 13.6735           | 6.5875              | 74.00489 |

0.2 g of sample (as received) was ashed at 450oC for 16 hours

or

6.5-9 g of liquid sampe was ashed at 450oC for 16 hours.

1 ml of 20% HCl was then added to the ashed sample, and 9 ml of H2O added.

Concentration in column G is the final concentration of total P (after analyser dilution has been taken account of)

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Thank you

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