Commercialisation of an Autonomous Phosphate Analyser

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Overview

• Motivation
• Prototype System
• Commercial System
• Communications Platform
• Field Trials
• Conclusions
Motivation

• Phosphates

• Manual collection and sampling

• Limited spatial & temporal resolution

• EU Water Framework Directive¹

• Widespread autonomous sensors

• Real-time monitoring

• Low cost per measurement

Prototype System

- **Portable system**
  - Fluid handling
  - Microfluidic technology
  - Colorimetric detection
  - GSM communications

- **Yellow method for phosphate detection**

- **UV LED and photodiode detector**

- **Two-point calibration**

<table>
<thead>
<tr>
<th>Prototype System</th>
<th>Commercial System</th>
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</thead>
<tbody>
<tr>
<td>Component Cost: € Thousands</td>
<td>Component Cost: € Hundreds</td>
</tr>
<tr>
<td>Internal Volume: 15L</td>
<td>Internal Volume: 2.3L</td>
</tr>
<tr>
<td>System Mass: 12 kg</td>
<td>System Mass: 1.7kg</td>
</tr>
<tr>
<td>Battery: 12V Lead Acid</td>
<td>Battery: 3.6V Lithium</td>
</tr>
<tr>
<td>Battery Life: 2 months</td>
<td>Battery Life: 12 months</td>
</tr>
<tr>
<td>Comms: GSM Modem</td>
<td>Comms: ZigBee Radio</td>
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<tr>
<td>Delayed Reporting</td>
<td>Real time ‘sensor to database’</td>
</tr>
<tr>
<td>No Sensor Control</td>
<td>Remote Sensor Control</td>
</tr>
</tbody>
</table>
System Design

- Sheet Metal Frame
- Reagent & Standard Bags
- Dual Channel Pumps
- Control Board
- Detection System
- 3.6V Battery
- Sample Inlet (0.45um Filter)
Detection System

- Injection Moulded Microfluidic Chip
- UV LED and Photodiode
- Absorbance Measurement
- Waste Storage
- 100ml Reagent, 15ml Standard per 1460 measurements

LED and Photodiode Detector
Microfluidic Chip
Wireless Platform
System Performance

• Limit of Detection: 0.1mg/L
• Minimum sample interval: 20 minutes
• Linear response range: 0-50 mg/L orthophosphate
• Point source identification
• Wireless chemical sensor platform
• Ongoing Research into other detection methods
Field Deployment

Broadmeadow Water Estuary,
Swords, Co. Dublin
Field Trial Data

Phosphate Concentration (mg/L)

- PO₄ Sensor
- Validation Samples

Date Range: 25/09/09 to 01/10/09
Conclusions

- **Phosphate Analyser for Water**
  - Compact
  - Long battery life
  - Real time monitoring
  - Remote sensor control
  - Low cost per measurement

- **Wireless chemical sensor platform**

- **Legislation driven market**
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Thank You