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Improved Mill Performance and Wastewater Treatment with new COD Monitoring Technology

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PAPER*matters* 2018!

The Presentations

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Improved Mill Performance and Wastewater Treatment with new COD Monitoring Technology

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COD - Chemical Oxygen Demand

- COD is the amount of oxygen required to fully oxidize organic matter
  - Used as a measurement of the oxygen-depletion capacity of a sample contaminated with organic waste
- COD is significant to the bleaching process
  - Impacts the required chemical dosage used for pulp bleaching
- High COD = greater consumption of chemicals
  - Excess bleaching chemicals added to the process to compensate

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Pulp and Paper Mills - COD

- At mills the impact of dissolved organics can have a large influence
  - Cost and performance especially when targeting aggressive discharge targets
- Reasons for reducing water usage
  - Costs
  - Regulatory compliance
  - Environmental performance
  - Security of supply
- Here to present summary of recent international work on **novel rapid COD method** and use with new water treatment technologies and methods at various stages of the pulp and paper wastewater treatment processes

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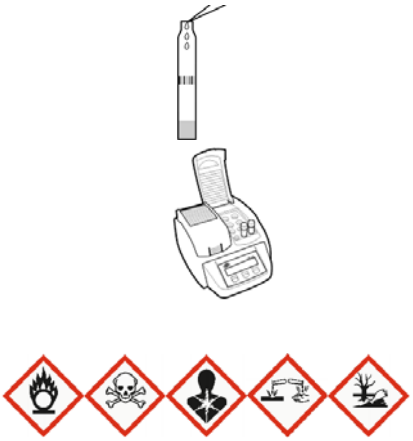
Traditional Dichromate COD Method



- Hazardous chemicals used
- Concentrated Acid, **Potassium Dichromate** & **Mercury**
- Heat chemicals to 150°C
- 2-3 hour process
- Lab based only
  - COD_{Cr}

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PeCOD® Method

- Results in less than **15 minutes**
  - final effluent in <7 minutes
- A patented technology that measures COD by oxidising organic matter by **photoelectric method**
- PeCOD eliminates the use of **mercury and potassium dichromate**
- **Safe** for both the environment and the analyst
- **Accurate** method with a detection limit of 0.7 mg/L, and upper range of 15,000 mg/L
- Allows for direct feedback
  - **"Turn the Dial" response**

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PeCOD® COD Analyser Components

- Consumable Items:
  - Calibrant Solution - COD Standard
  - Electrolyte (for dilution)
  - Nano Sensor

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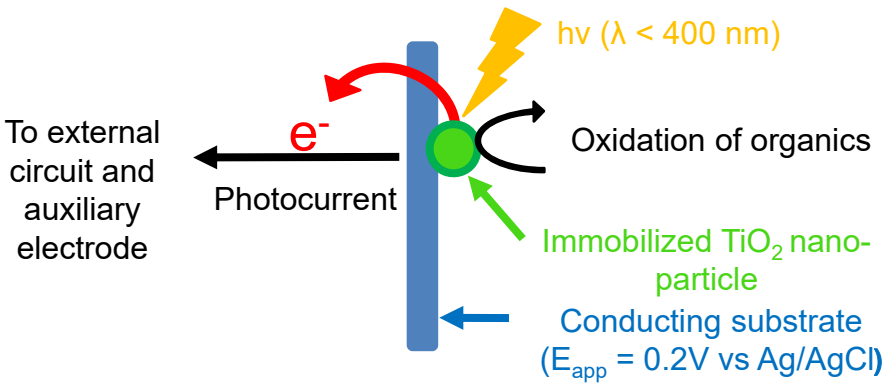
A Nanotechnology Based Approach



Roughly 2 times the oxidizing power vs. dichromate

i.e. Benzene: 1.8 by COD_{Cr} and 2.6 by PeCOD®

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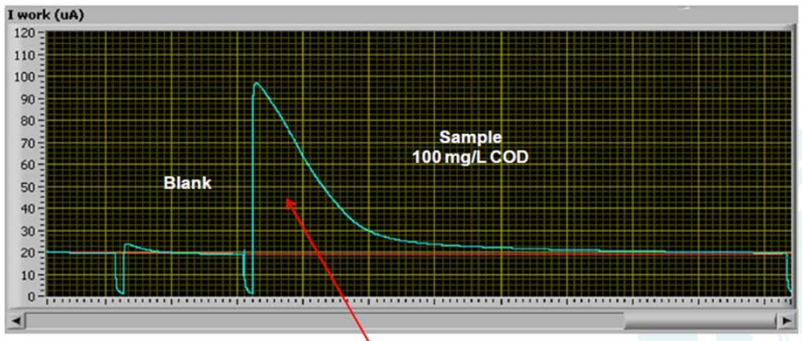
Electrons to COD



Area under curve = Q_{net}

COD = $k \cdot (Q_{net} - Q_{blank})$

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PeCOD Configurations

Benchtop L100

Online L100

Automated L100

Online P100

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Case Study

- Chilean Mill
- Global company that produces many types of wood products
- Previously using SCAN-C 45:00 COD method
- Total 7hr test time meant deficiencies and improper dosing
- PeCOD allows operators to respond to events

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Chilean Mill's Findings

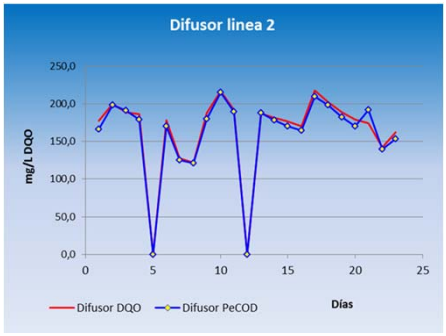

Figure 1: peCOD (blue) versus traditional method (red) for COD analysis at Diffusor Line 2.

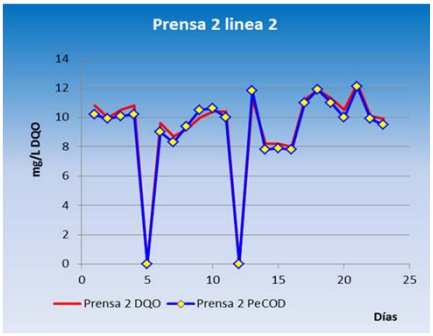

Figure 2: peCOD (blue) versus traditional method (red) for COD analysis at Press 2, Line 2.

Validated the PeCOD with respect to the standard SCAN method

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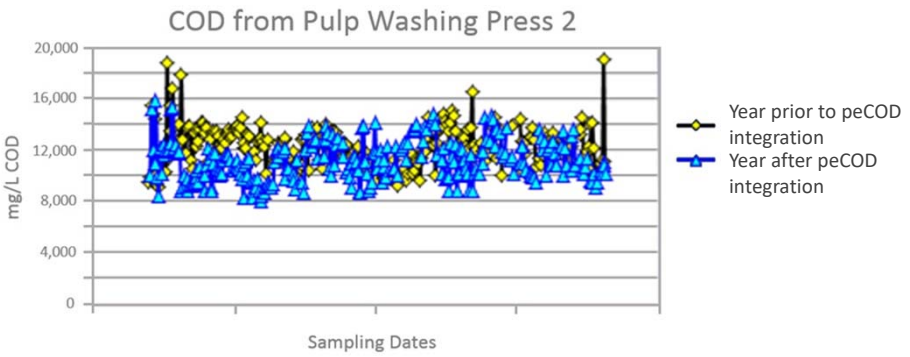
Chilean Mill's Findings



The graph shows a decrease in COD events for blue (peCOD integrated) compared to yellow (pre-peCOD integration)

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Chilean Mill's Summary

- Safety:
  - Decreased risk from significant to tolerable
  - Improved health and safety for workers
- Environment:
  - Reduced contamination to the effluent
  - Eliminated hazardous waste, generated using the traditional COD method
- Savings:
  - COD analysis time reduced by 95%
  - Consumption of chemical reagents for COD analysis decreased by 66.4%
  - Also results in lower organics in waste water plant and further reductions in chemical and energy used
  - Total savings over 12 months were **$3 million dollars**

National award for improving Sustainability Health & Safety, and Profit

They now have 5 PeCOD units in 2 mills

Engineers can ALWAYS have a result within 15 min, sampling from any point

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Industrial & Municipal

- Feb. 2016 Ontario approved peCOD method for use with domestic and surface waters
  - Replaces the standard dichromate methods E3170 and E3246 in Ontario
- Actual cost per sample compared to dichromate
  - Can be 50% less
  - Includes hazardous waste disposal for dichromate
- Major benefits in faster, more frequent sampling:
  - Real time incoming load monitoring
  - Quick and simple investigations for discharge
- Wide range of case studies
  - Municipal, Brewing, Wastewater treatment, Aluminium Manufacturing, etc.

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CORECOD Project

Joint Finland and Canada Project

- Novel concepts for Recalcitrant COD reduction in Pulp and Paper industry
- PeCOD chosen as the COD testing solution as **rapid** test results with **true COD** method required
  - Not selected COD_{Cr}, TOC, UV254
- A comparison of methods for many different effluents from kraft and mechanical pulp mills.

Primary Kraft: 3 mills, 8 effluents
Primary Kraft spiked with condensate or weak black liquor: 5 of each
Secondary Kraft: 4 mills, 10 effluents
Primary Mechanical: 1 mill, 4 effluents
Secondary Mechanical: 3 mills, 9 effluents

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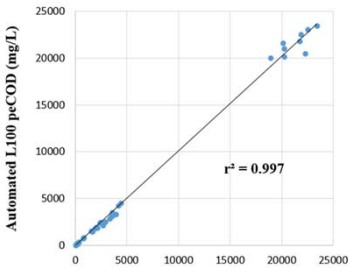
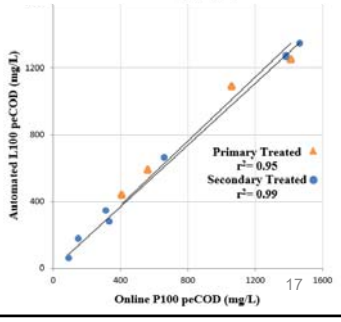
Key Experimental Findings

- peCOD method is applicable to Pulp & Paper wastewater
- peCOD method is the first method in 60 years to be an alternative, true oxidation method for COD
- H_2O_2 is NOT an interference for the peCOD method
  - H_2O_2 is a positive interference for the COD_{Cr} method
  - Critical finding for bleaching and advanced oxidation processes in general
  - Can be used to optimise bleaching process and provide correct, trusted results in the influent





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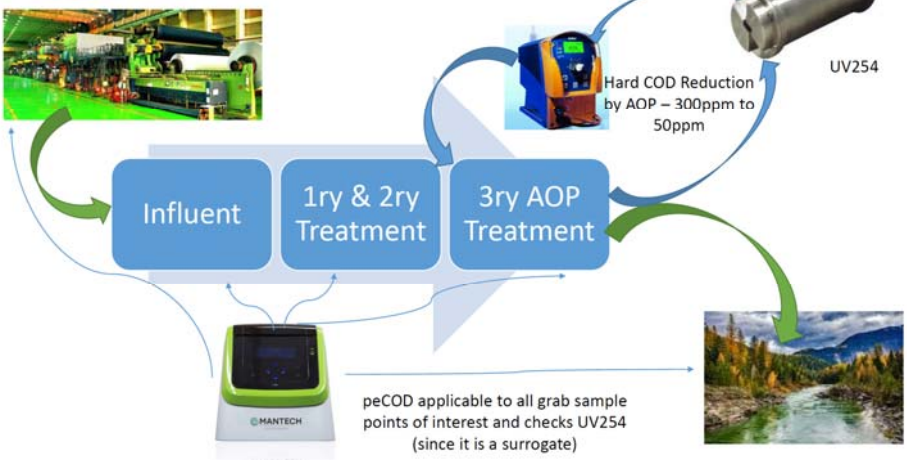
CORECOD Project Outcome Utilisation 1



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CORECOD Project Outcome Utilisation 2

COD_{Cr}
- Laboratory, PPE, 8hrs/day, 5 days/week
- Operators operating "blind" at other times

PeCOD® Analyser
- In plant, 24/7
- Operators do the analysis and get COD when they want and need it
- From paper machines, bleaching control, wastewater treatment optimization, nutrient control and effluent compliance
- Used in both laboratory and plant environments

Matrix Specific Alternate COD Method Approval by PeCOD Adoption in Multiple Countries Including Finland

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Opportunity for Pulp & Paper Mills

- Begin with PeCOD in Laboratory Operations
- Improve health and safety for everyone
- Rapid COD results delivered to operational engineers
- Impactful decisions made from fast COD results increases profit

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