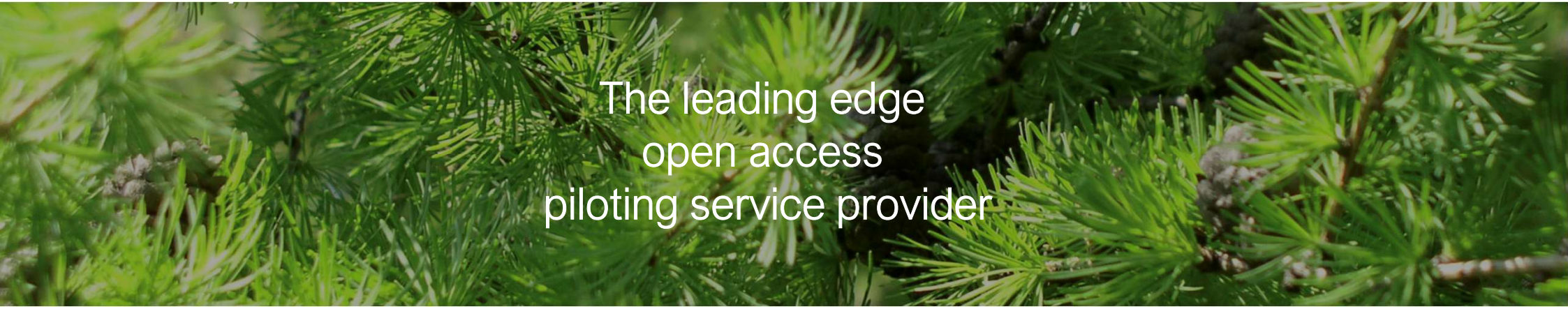
KCL
accelerating sustainability

Upscaling using extrusion and dispersion coating lines

Mikko Mensonen



100+ years in green transition pioneering

AGENDA

- KCL coating trial services
- BioHub support
- Case: Extrusion coating line

Inquiries
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KCL Coating trial services

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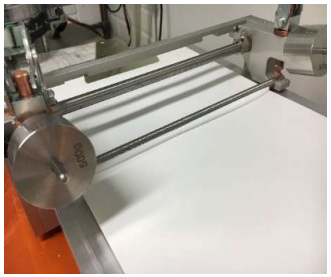
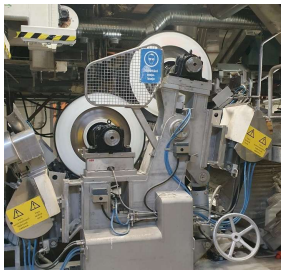
Dispersion coating
- Lab scale; 2-5 liters
- Semi pilot scale; 5-50 liters
- Full industrial scale; 200-400 liters


Draw down coating

Flexo, reel fed

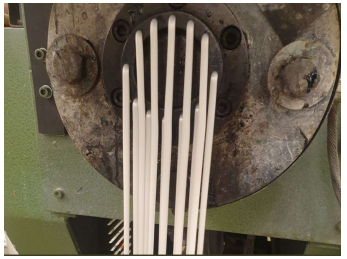

Film / Hard nip sizer / Spray

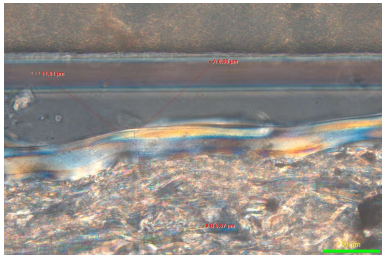

Curtain coating, 1-3 layers

Extrusion coating
- 4 extruders
- Compounding screws
- Special analyses

Extrusion coating


Corona pretreatment


Compounding


Cross section picture

Lamination
- Extrusion lamination
- Adhesive wet & dry lamination


Extrusion lamination


Adhesive lamination

Supported with
- Comprehensive laboratory testing
- Finishing: calendaring, slitting of reels, sheets in custom sizes, remoistening
- Printing

BioHub support

Dispersion coating

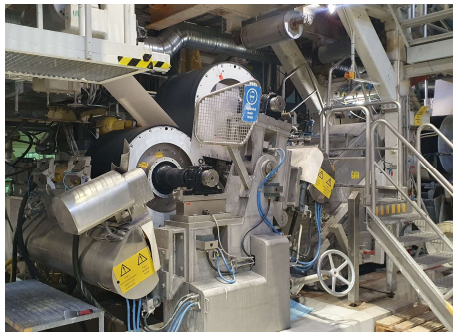
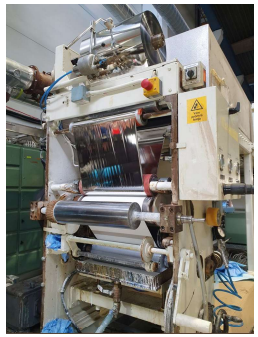
- **What was done**
  - Installation of hard nip sizer in industrial scale pilot coater
  - Upgrades in semi pilot scale dispersion coating platform
    - Installation of gravure and reverse gravure coating and lamination pilot line
    - Updating the line with spray coating technology

- **What was achieved**
  - Coating application technology to improve strength of recycled / low weight materials, impregnation of functional chemicals
  - Pre-screening of recipes with lower material quantities prior scaling up to industrial scale
  - Proof of concept using converters coating and lamination techniques

Extrusion coating

- **What was done**
  - Move and mechanical upgrade of extrusion coating and lamination pilot line

- **What was achieved**
  - Completely new pilot services for developing high-barrier materials and reducing the use of fossil-based plastics in packaging.

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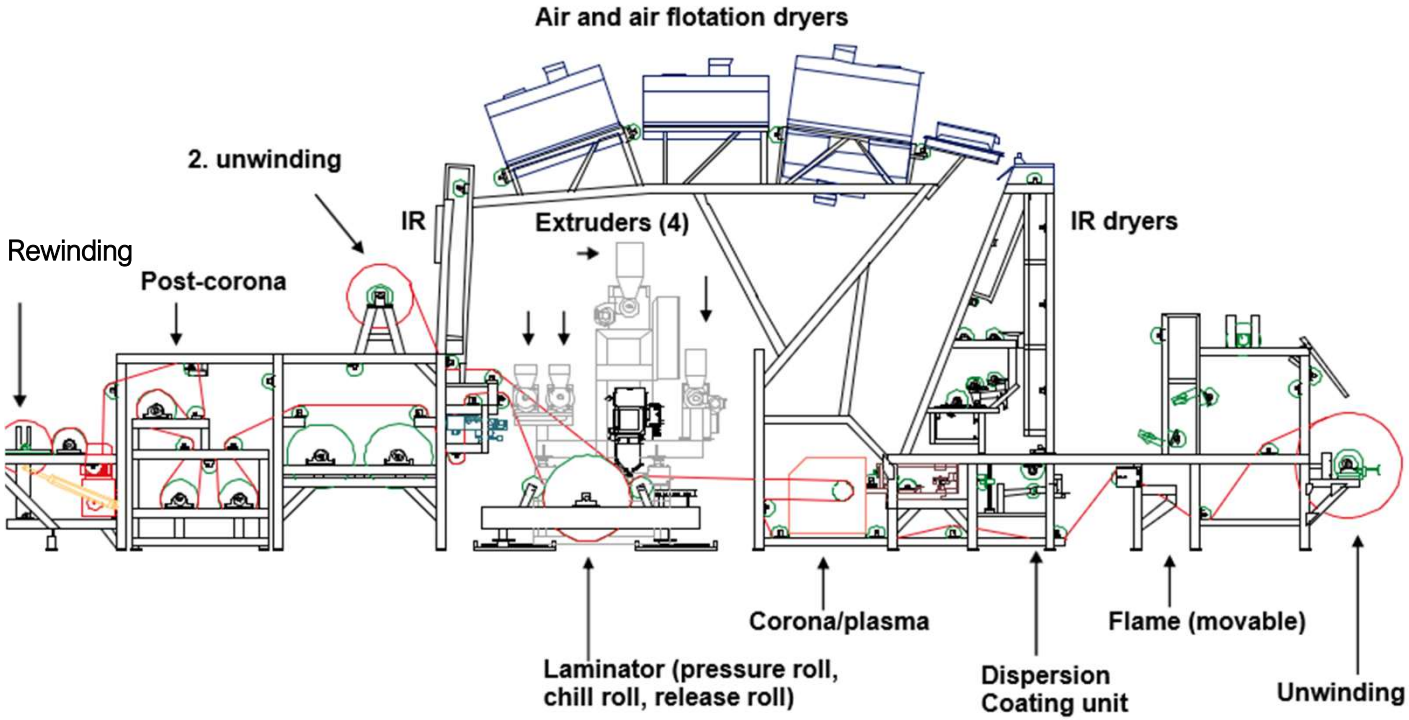
KCL Extrusion coating line



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For what and why?

- Speeding up biopolymers market entry
- Processability and operational windows of new polymer compounds
- Good enough barrier with the lightest possible plastic content
- Layered high barrier solutions with lamination
- Scale up from laboratory without disturbing customers production processes
- Problem solving cases
- Adhesion tests with different pre-treatments

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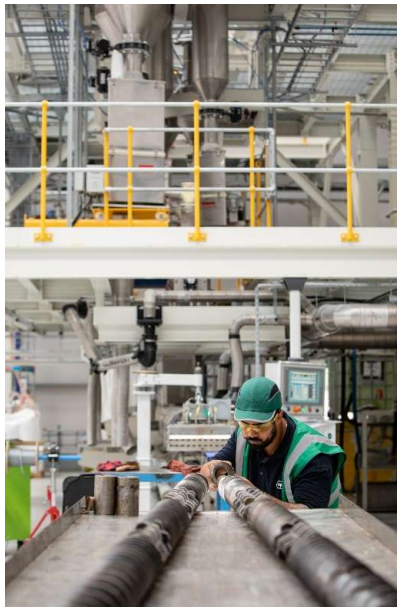
Who are Aquapak?

A science-led company based in the UK developing revolutionary new materials for planet-friendly packaging across multiple sectors and applications.

Aquapak UK overview

Manufacturing, R&D and Tech Support HQ



- 4700m^2 compounding facility in Birmingham, U.K.
- Production capacity 10-30,000MT capacity
- 2 full scale & pilot lines operational

- 30+ polymer patents filed
- World class R&D capabilities and resource
- Global supply & distribution

aquapak

Hydropol™

Our patent-protected polymer offers the functionality and performance of conventional plastic without contributing to the growing plastic pollution problem.

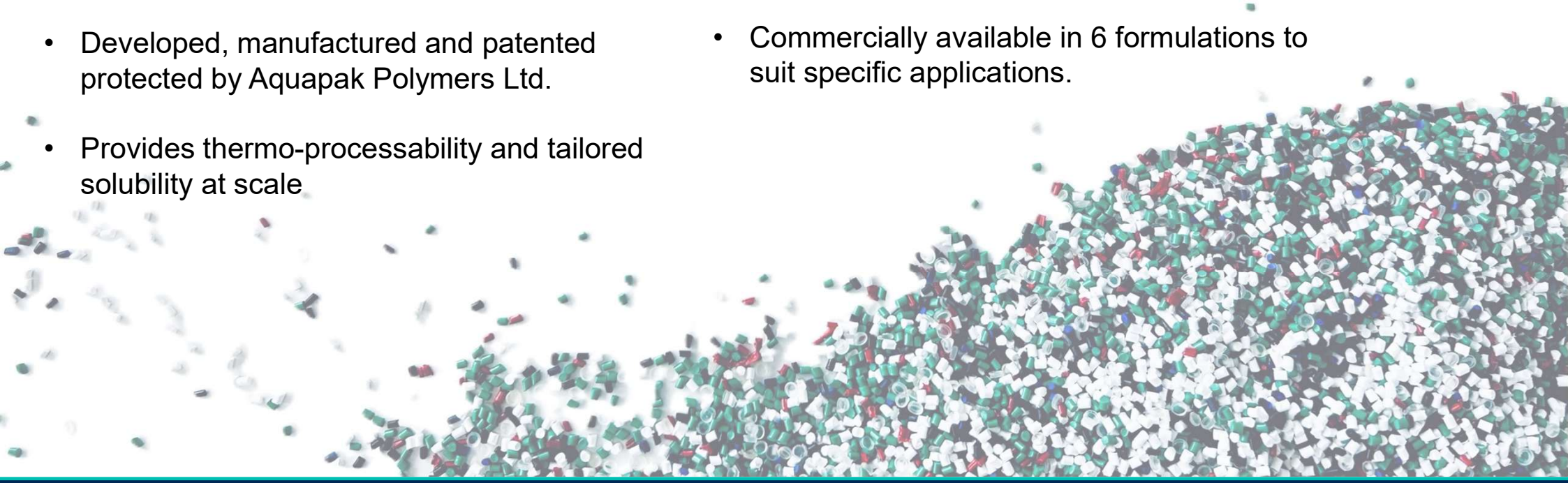
NEW PLASTICS ECONOMY Global Commitment

Hydropol™ Polymer Technology

The missing link in the circular economy

What is Hydropol™ ?

- Unique highly functional specialty polymer resin based on PVOH (Polyvinyl Alcohol)
- Developed, manufactured and patented protected by Aquapak Polymers Ltd.
- Provides thermo-processability and tailored solubility at scale
- Combines high functionality with low environmental impact ***#leavenotrace***
- Commercially available in 6 formulations to suit specific applications.

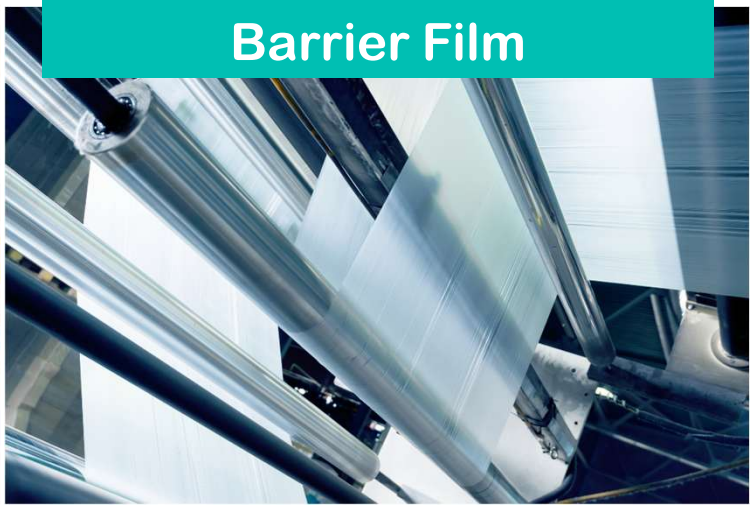


Hydropol™ Polymer Technology

Easily integrates into existing conversion processes

Extrusion to Barrier Paper & Board

Monofilm & Co-extrusion Barrier Film



Fibres & Non-Wovens for Healthcare

Other potential applications

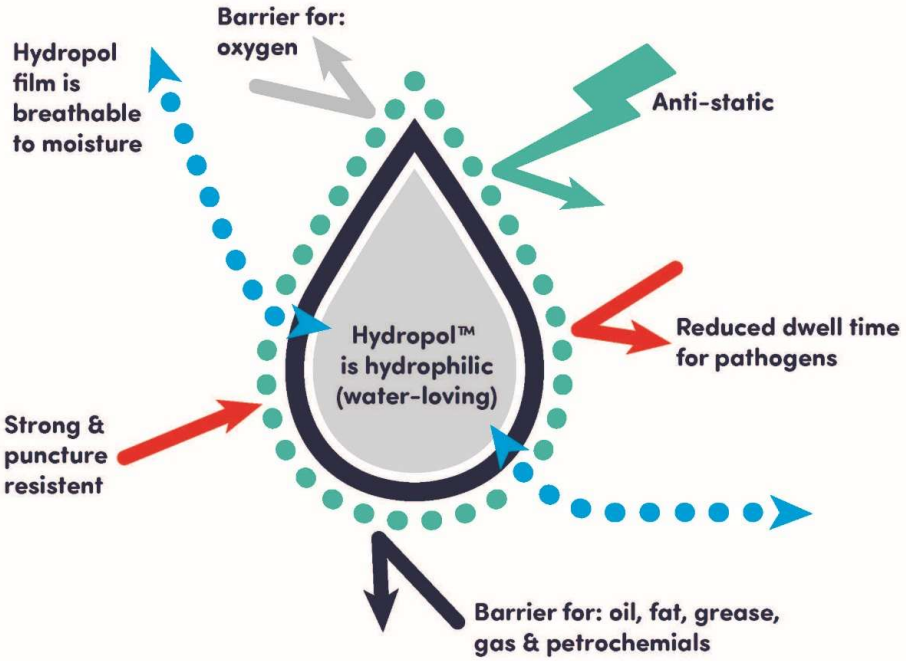
- Injection Moulding
- Blow Moulding
- Thermoforming

No major capital investment required

Uses existing supply chains

Hydropol™ Polymer Technology

Suitable for numerous packaging and product applications



Key Features

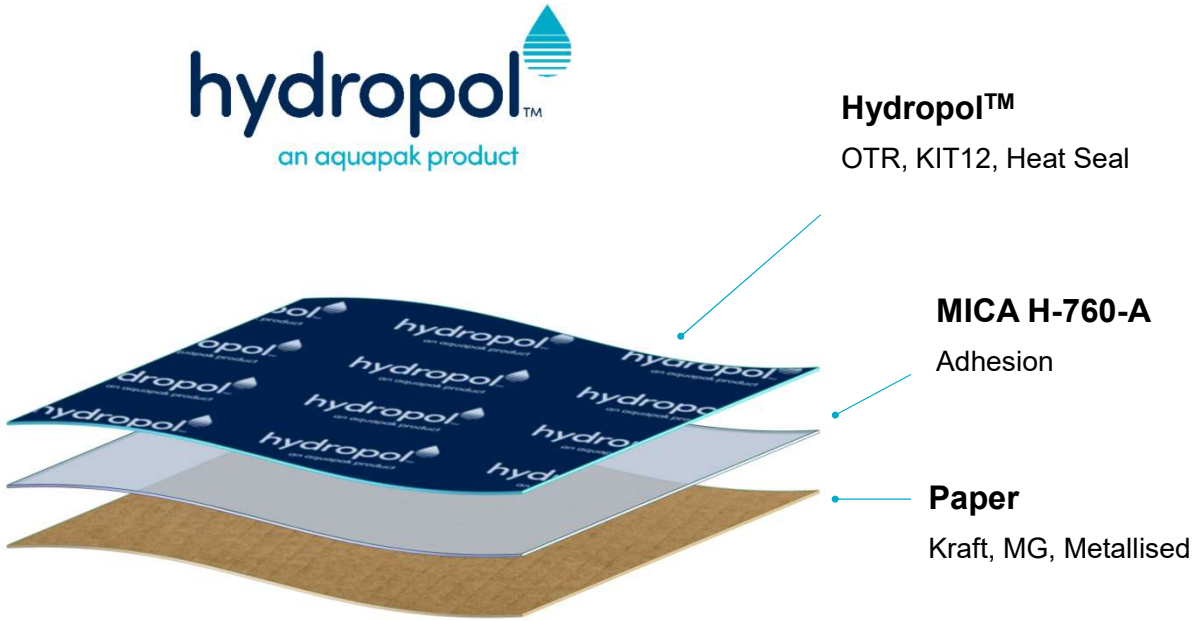
- ✓ Non-toxic
- ✓ Tailored solubility (10°C - 80°C)
- ✓ Biodegradable
- ✓ Marine-safe
- ✓ No harmful microplastics
- ✓ Compostable
- ✓ Suitable for AD plants

Paper-based solutions

Product protection with Hydropol™

Features & Benefits

- Oxygen barrier <1.0 23°C 50% RH
- Oil, fat and grease barrier – KIT 12
- Combine with other coatings for moisture barrier functionality e.g. metallised paper, or barrier dispersions
- Excellent dead fold
- Excellent heat seal



Hydropol™ in end-of-life

Supporting multiple safe disposal

Products made with Hydropol are **safe for existing recycling processes** and **fully biodegrade** should they enter the environment without creating toxins or harmful microplastics.

Recycling

- Integrates with existing recycling processes
- Fully dissolves in the recycling process
- Improves raw material recovery & separation

Composting

- Fully biodegrades in compost facilities
- Reduces release of methane from traditional end-of-life options

Anaerobic Digestion

- Fully biodegrades in dedicated facilities
- Bacteria break down Hydropol in the absence of oxygen
- Produces renewable energy in the form of biogas

Using KCL

Product Development

Using the KCL extrusion coating line since 2021 for the testing and development of Hydropol

- Discrete testing away from marketplace
- New formulation testing – Experimental and commercial
- Processability and performance – Stability, holes, gels
- Quality investigations – Comparative batch testing
- Experiments –
  - Pellet Drying – Effect on quality, voids, fisheyes
  - Pellet size study – output and stability
  - Adhesion – TIAG, Line Speed, Corona, Flame, Primer
- Data collection and readouts – Pressure, Power, Temperature, RPM, Speed, Coat Weight, Adhesion
- Collaborations with Customers

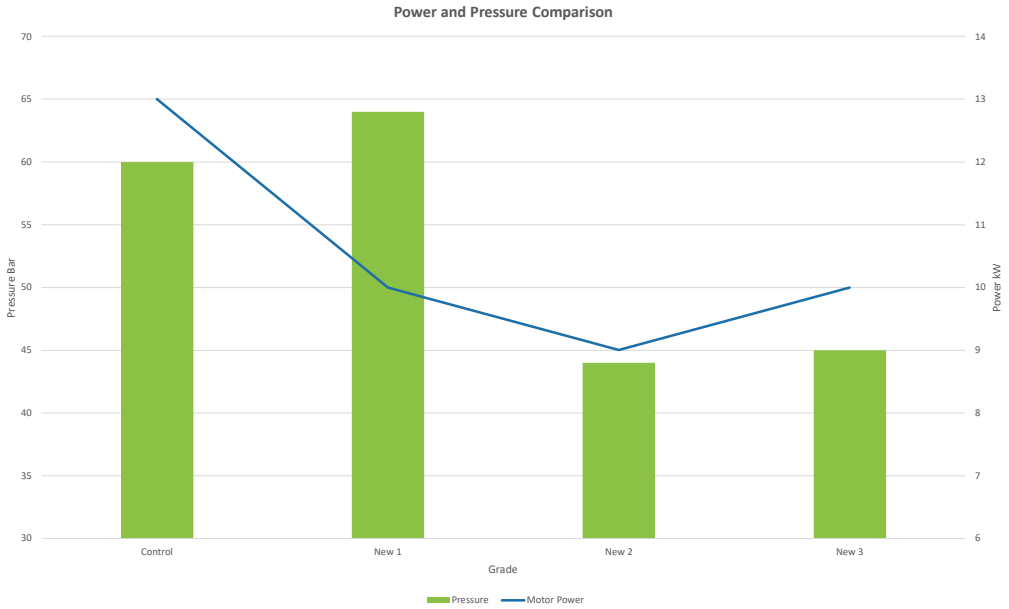
Output of testing used for research, testing, trials and technical guidance for customers

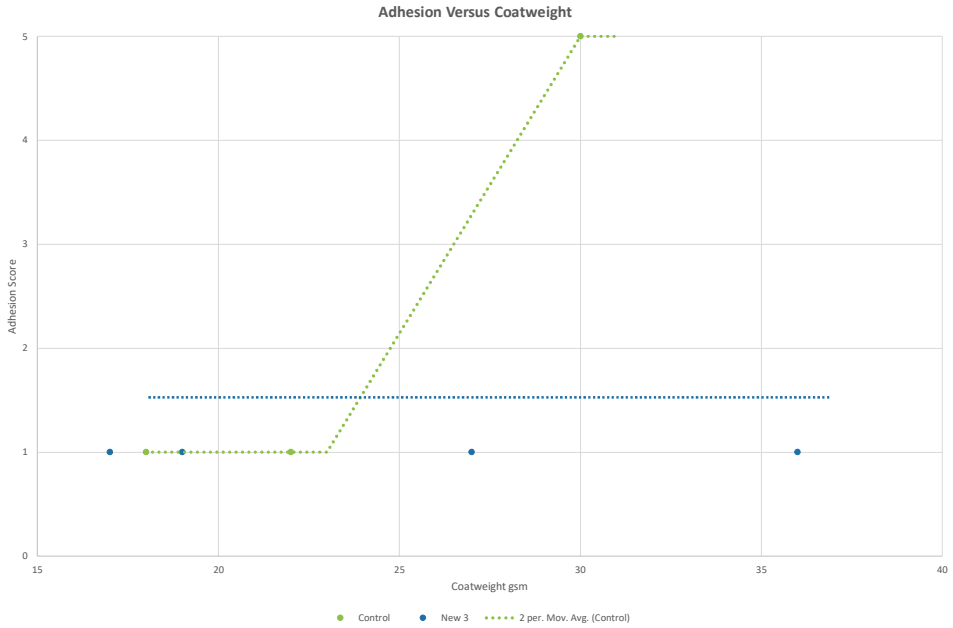
Using KCL

Case Study – New Product Testing

Aim – Test new formulations for reduced motor load and power consumption whilst assessing adhesion performance with reducing coat weight

- Increasing line speed to reduce coat weight (40, 60, 80, 100mpm)
- Fixed screw speed (70 rpm)





Hydropol Applications

Product Launches

Thank You!
Any Questions?

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www.aquapakpolymers.com