AUTOMATED FILTRATION AND WASHING PLATFORM

Why study Filtration and Washing

- **Isolation and drying can account for more than 50% of process duration**
- Identify crystallization and isolation issues at an early stage - helps design of better processes
- Optimise wash protocol (quantities and time) to reduce cycle time and improve product quality
- Gain knowledge of filtration and washing time – helps in plant occupancy planning

Automated Filtration and Washing Platform

- Bespoke automated self-contained platforms installed in pharmaceutical industry
- Utilises imaging/vision technology for intelligent feedback and real time control
- Data systematically gathered and stored in secured database, with automated report generation

What does it do?

Filtration & Washing of....
- Up to 50mL slurry
- Up to 6 washes, with different wash composition
- Multiple samples

Variable Parameters:
- Pressure (0.2-1.8 Bar)
- Temperature of experiment (10-50°C)
- End-point selection – dryland or breakthrough
- Up to 15 solvent choices
- Pause for cake sampling
- Contact and "additional" time

Data collection:
- Settling test
- Online viscosity
- Filtrate mass with time
- Cake volume and depth
- Automated sampling and dilution of filtrates for analysis
- Segregation and weighing of all filtrate and retains filter cake

Heath and Safety
- Fully contained platform
- Automatic shutdown in events of ventilation failure
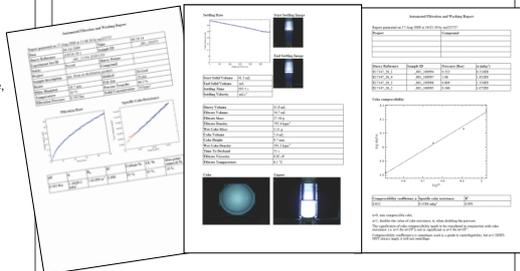- CE and UL marked

Images from the Platform
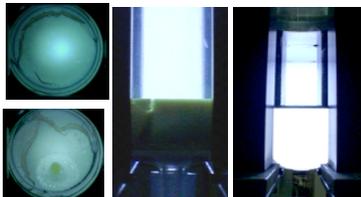
- Images of the filter cake and filtrate are captured
- Help understanding poor wash efficiency
- Early warning of tendency of cake cracking or pulling from the sides
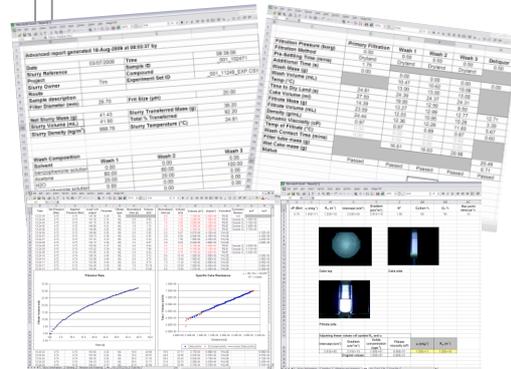
Automated Reporting System

- Searchable database with 3 types of reports
- Data manipulation is based on Darcy's law; cake resistance and cake permeability are calculated automatically ; PDF file generated; option to combine data to provide cake compressibility coefficient report
- Advanced report gives all additional data collected including calculations

Where AFnW adds value

- Filtration under controlled identical conditions to
  - Compare batches from different crystallization conditions
  - Compare batches prepared using different input source
  - Determine the effect of scale-up on product formed. (Lab versus scale-up versus pilot plant batches)
  - Benchmark plant equipment
- Predict filtration on scale up
- Determine optimum filtration and washing conditions
- Troubleshooting
  - Sub-sampling from plant to compare actual versus proposed conditions

Other Potential Uses

- Isolation and efficient washing of catalyst
- Removal of inorganics
- Characterisation of the removal of silica, alumina or charcoal from organic synthetic mixtures

Example # 1: Scale Up Calculations

- Cake resistance data can be used to select optimum process conditions and calculate filtration time at scale

seeded	Un-seeded
2.1×10^9 kg.m^{-1}	1.6×10^{10} kg.m^{-1}
0.5bar	0.5bar

- Plant scale-up predicted filtration time at 0.5bar (20kg batch, 0.2m^2):
  - 2 hours for non seeded crystallisation
  - 20min for seeded crystallisation
- The range of pressure was investigated (0.5-1.5bar) – low compressibility index
- **1.5bar selected,**
  - **15min expected filtration time on scale,**
  - **15-30min filtration time on plant observed**

Example # 2: Wash Efficiency Curves

- Wash efficiency curve gives an indication of the number of washes required to control key impurities

Wash Volumes Used for Wash Efficiency Curve

Original Process Volume	1st Process Volume		2nd Process Volume		3rd Process Volume	
Wash Volume on AFnW	1 Cake Volume	2 Cake Volumes	3 Cake Volumes	4 Cake Volumes	5 Cake Volumes	6 Cake Volumes
Mother Liquor	Wash 1	Wash 2	Wash 3	Wash 4	Wash 5	Wash 6

Final Product
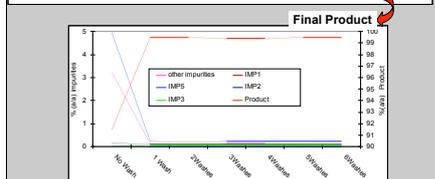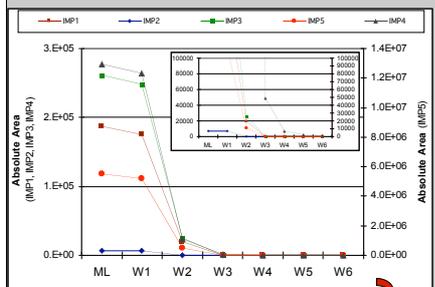
- Results show good removal of impurities during isolation process with 2 process volumes
- **Wash volumes can be reduced from 3 to 2 process volumes**