

Innovations in wetlaid hydroentangling



Onur Cimen, general manager at Kansan Materials, explains how Kansan's innovations in the hydroentanglement process can help companies in the quest for more environmentally-friendly production of wipes.

The EU Single-Use Plastics Directive identifies wipes as one of the ten single-use plastic items mostly found on Europe's beaches and is promoting sustainable alternatives. This has presented significant challenges to the wipes industry.

Sustainability is a major factor for nonwoven wipes, with both legislators and end users demanding environmental improvements - in processes, materials and production.

A flushable wipe is a pre-moistened disposable cloth made for personal hygiene use. Flushable wipes are engineered to lose strength as they move through properly maintained plumbing and sewage systems. And they sink, not float, so are safe in septic tanks.

Materials and production methods are both coming under scrutiny: wet

Above
The KM Hydrojet represents innovation for hydroentangling as a critical part of the process for re-engineering wipes

wipe materials should be flushable, while processes need to be more efficient and environmentally-driven.

Kansan Materials, designer and manufacturer of a complete range of machines and equipment in wetlaid technology, has been specifically looking at the challenges in traditional hydroentangling bonding processes for nonwoven wipe manufacturing. These are largely related to chemical filtration and the economics of the process.

Wetlaid is a common process in dispersible wipes production, whereby fibres and cellulose are mixed, suspended in water in large tanks. This water-fibre/water-pulp dispersion is then pumped and continuously deposited on a forming wire, while the water is sucked away, filtered, and recycled.

Filtration innovation

The filtration process can be either chemical or mechanical. To bond these

fibres through a hydroentanglement process, high pressure water jets, through high pressure water pumps, penetrate the web, hit the conveyor belt, and bounce back - which causes the fibres to entangle.

Specific pressure values may vary dependent upon the types of raw materials involved and the characteristics required from the final product, but are typically 40-60-80-100bar pressure. As the water used passes through the jet nozzles, it must be clean - hence, filtration is a critical element of the whole production process. Once bonded, dewatering and drying processes are applied, protecting the final product.

There are elements of the conventional approach to the wetlaid/hydroentanglement processes that are problematic, from a futureproofing environmental, social and governance perspective. And this is where Kansan's new KM Hydrojet, made possible through the incorporation of Wanner's Hydra-

Cell Pump technology, introduces significant process innovations for greater efficiency and better environmental management.

One of the greatest challenges for hydroentanglement - and this is the option most commonly used in industry - comes from chemical filtration, through the combination of gravity strainer, float band filters, and a sand filter. Here, a coarse, porous filter is placed in front of the return water, and filters with 250µm filtration (the gravity strainer) are transferred to the broken fibre tank for reuse.

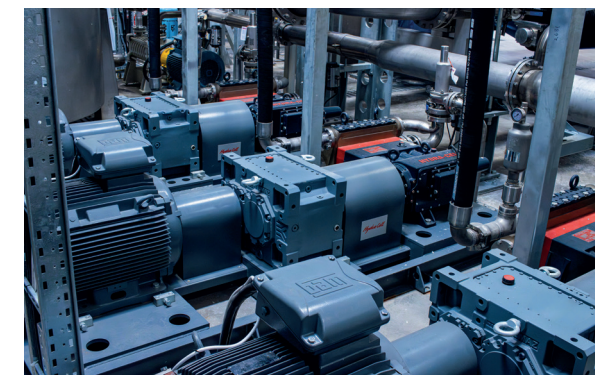
For solid particles worth 160mg/l - the majority of particles in the water - fibre parts are combined by adding flocculant and coagulant in the water. Coagulant ensures fibres clump together, while flocculant allows these clumps to float.

Creating micro air bubbles under the water helps ensure the fibre clumps remain on the surface until they are collected by a scraper made from a hydroentangled nonwoven floating tape. The remaining water must then be passed through a sand filter as it still contains fibre, and the sand filter must be backwashed to prevent layers forming over time, to keep the sand filter usable.

Since the water contains coagulants and flocculants, if the sand filter is not cleaned properly then it will clog, with the chemicals hardening the filter akin to concrete. The final stage of chemical filtration is to pass water through the sand filter, and 10µm 1,000ppm water is obtained. Without this filtration process, contamination occurs and unfiltered fibres impact the operation of the water jet pumps. And the water cannot be reclaimed.

Fibres collected from the water during chemical filtration are not suitable for reuse as they are saturated with chemicals and collect sediment. By contrast, when the return water is cleaned by mechanical filtration the collected fibres can be re-introduced into production, and raw material recovery is ensured.

Left
The Hydra-Cell incorporates seal-less pump technology, with pistons operating in lubricating oil



Right
The KM Hydrojet addresses critical issues for efficiency and sustainability

While the levels of filtration are high for non-dissolved solids, filtration does not avoid the issue of dissolved solids. After filtration, there are still microfibrils in the water. In conventional wetlaid-hydroentanglement set-ups, over time these fibres can get between the piston and the liner in the plunger pumps, causing damage to pumps and potential issues in the valve group.

There are clear challenges with conventional hydroentangling: high pressure pumps are sensitive to suspended solids; there is an obligation to work constantly to avoid clogging in the water filtration system; cellulose cannot be recovered in the process, and energy consumption is high, as are the costs of filtration chemicals and consumables.

Pump up the volumes

The KM Hydrojet addresses critical issues for efficiency and sustainability. In our earlier work, we struggled to make a technically efficient and economically viable line due to pumping problems. When we were developing the technology, we needed a pump which could handle fibres, produce efficiently and be reliable day-in, day-out with no unplanned down-time for maintenance. We scoured the market and found two companies which solved all the critical issues - technical, environmental and economic: the Wanner team with the Hydra-Cell Pro process pump and Arpon, a local company specialising in industrial processing.

The Hydra-Cell incorporates seal-less pump technology, with pistons operating in lubricating oil. With no dynamic seals, seal wear and replacement are eliminated, compared to conventional plunger-type pumps which operate in water. With a hermetically sealed pumping chamber, the process liquid does not come into contact with the piston group directly.

This makes for lower maintenance costs and reduces the need for downtime for maintenance. Importantly it is also able

to handle solids; Hydra-Cell's unique, spring loaded vertically orientated check valves allow the 800µm solids to be reliably pumped, with no build-up and with no cavitation.

This means in the process we don't have to use adhesive chemical solutions. There is no need for the filtration system to work continuously - as there are no sand filters requiring continuous investment to avoid clogging; this equates to energy savings around 80%, compared to a sand filter solution.

By removing sand filters from the production line, Kansan is able to reduce the footprint of the equipment by up to 60%, achieving a far more compact structure and greatly reducing ancillary equipment acquisition costs. Similarly, without the need for coagulants and flocculants, fibres retained in the filter stages can be fed back to the headbox system, meaning far lower fibre wastage and a more environmentally-friendly production process.

The new KM Hydrojet represents real innovation for hydroentangling as a critical part of the process for re-engineering wipes: incorporating a production width of 3,600mm; machine speed of 400m/min; production rate of 5,000kg/h: fibre length of up to 60mm, and the jet heads can be configured to suit the application.

Ultimately, as with many innovations in the nonwoven wipes sector, the ubiquity of the process makes collaboration a natural and profitable course for technological improvement.

At the same time, environmental demands put the industry in the spotlight. Where collaborations - sharing of the benefits of R&D investment - can take place in the nonwovens space, then these can only benefit all concerned: the KM Hydrojet, including Wanner's Hydra-Cell, is a clear example of a novel production line and a new approach to conventional processes. ●

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