**TrumpJet® Flash Mixing Reactor challenges old practices**

Simultaneous mixing of starch and polymer brings significant cost savings

Exceptionally fast flash injection mixing of wet end additives questions old practices and opens possibilities to develop cost efficiency and sheet characteristics. Chaos type of immediate flash mixing of additives into stock flow of board, paper and tissue using In-Line PCC enables exploiting the additive efficiency with a maximal manner.

The technology makes it possible to mix a wide range of reactive additive and chemical component pairs efficiently. As an example, mixing of strength starch and retention aid polymer simultaneously shows remarkable improvements.

Premixing and practically simultaneous injection of starch and cationic retention aid polymer into stock flow increases reactivity of the additives. The same sheet strength and retention level can be achieved with much smaller chemical dosages. Typically much lower use of fluidification additives results to better sheet formation. The both chemicals are mixed just prior to the headbox. Fast response time speeds up grade changes.

**In-Line PCC™ with TrumpJet Flash Mixing technology cleans up process waters**

With With TrumpJet Flash Mixing technology, gaseous carbon dioxide and milk of lime slurry are dissolved instantly into process water, resulting in extremely fast PCC crystalization onto stock particles. PCC crystalization is completed in vertical flow through pipe reactor within one second.

Recent results from medium size fine paper machine in Europe producing high quality special grades, have proved that high speed PCC crystalization reaction binds effectively fine particles as well as dissolved and colloidal material from process water. This material is fixed to paper web resulting in cleaner process with excellent runnability and high optical paper qualities. The comparison between satellite unit produced conventional scalenohedral PCC and In-Line PCC paper shows much higher amounts of different metals. Especially very high adsorption of iron to In-Line PCC crystals causes the change in ash color. All these dissolved process water compounds together with colloidal and fine particle material are attached to paper web resulting in cleaner water circulation with better machine runnability and longer life time of machine fabrics due to extremely the high filter retention. The total saving of retention chemicals in this mill case is 87 %.

**MILL CASES**

**Fine paper line A, Europe**

Cationic polymer (CPAM) and bentonite were added practically simultaneously just one after the other before headbox. Starch and ASA were flash mixed simultaneously before retention aid flash mixing stations. Before, starch and ASA were added to thick stock and CPAM before the screen and bentonite immediately after the screen.

Results:
- **Good sheet quality, good runnability**
- CPAM saving at first 60%, later CPAM line was closed, saving 100%
- ASA saving 15%
- Starch saving 15%
- Additional conclusion: Once strength starch is brought to close reach of headbox, starch also operates as retention aid and replaces the more expensive CPAM completely.

**Large Fine paper line B, Europe**

Strength starch and cationic polymer are premixed and injected simultaneously. Bentonite and micropolymer are premixed in a separate mixing station close by. The cationic and anionic mixing stations are located close to headbox feed manifold.

Results:
- Starch saving 47%
- CPAM saving 10...15%
- Micropolymer saving 23%
- Fresh water usage eliminated in the application

The fast flash mixing reactor opens the opportunity to bring new and conventional wet end additives close to headbox and forming section. This makes system fast, responds control and retention. Typically lower use of flocculation additives results to better sheet formation. The both chemicals are mixed just prior to the headbox. Fast response time speeds up grade changes.

**Elemental EDS analysis of burned paper ash samples showed significant differences between the two samples. In-Line PCC paper ash contains much higher amounts of different metals. Especially very high adsorption of iron to In-Line PCC crystals causes the change in ash color.**

**In-Line PCC™, TrumpJet Flash Mixing Reactor with two mixing stations (for 2...5 different additives) in tandem position. Simultaneous mixing of strength starch and cationic retention aid brings the biggest savings.**

**Reduction rate of dissolved metals in process water (%)**

**Wetend News**

**Shaping technology to speed up bio-based business of clients**

Wetend TrumpJet Flash Mixing technology enables wide product portfolio and platform for next generation paper and board and tissue and non-woven production lines. Wetend has developed consistently core business to flash mix effectively additives into the process. Improved mixing reveals repeatedly new opportunities and applications to work with. The outcome without exceptions support the work of our clients to introduce new or improved bio based forest products to consumers and industries.

Consistent cooperation with customers and research organizations has resulted into several innovations that support the objectives. These are e.g. Micro Bubbled Foam Generation technology for foam forming process for board, paper, tissue and non-woven products/mixing technology for extra-long bio based or synthetic fibers; the unique and novel mixing technology for nano and micro fibers and also In-Line PCC reactor and process to produce calcium carbonate crystals loaded on fibers. Four installations have been supplied for In-Line PCC filler production. The developed technologies can be also applied effectively to other industries e.g. for water treatment processes of mining industry.

**Development and change in Wetend corporate ownership**

While the new technology shapes processes and industry, also our company faces changes and new challenges. Mr. Pekka Kotila and Mr. Jouni Matula established the company at 2001. Mr. Kotila is one of the skillful pioneers of the business and he owns more than 50 years’ valuable experience and knowledge in the industry. His retirement took place early 2017. To replace Pekka’s valued input Wetend ownership and board of directors has been updated to support the further growth, launch of new technologies and success of the company globally. Company is also looking forward to accept possible funding/investments with new shareholders.

Jouni Matula (left), Jouni Matula and Pekka Kotila shaking hands for future challenges.
Simple is beautiful

Great results with a single TrumpJet station

A fine paper line 230 000 tons/a in North America installed a single TrumpJet Flash Mixing station on a headbox feed pipe on a pipe section between screen and the headbox feed manifold. The distance to the slice opening is only three (3) seconds as an average. This time is needed in practice to prepare the fiber furnish and chemicals for initial sheet formation process when the mixing is completed in a flash, practically initial mixing time is less than one (1) second only.

Oder inlet system was removed from the line and at the moment TrumpJet mixing station mix retention aid polymer and silica-nanoparticle simultaneously into the stock flow.

After the installation

- Polymer consumption dropped approximately 40%
- Nanoparticle approximately 60% still with a bit higher retention
- Starch volume of ASA sizing emulsion came down by 15%
- Fresh water use for post chemical dilution was completely eliminated
- Sheet formation improved greatly.
- Response of the process to the TrumpJet flash mixing was immediate and after the above adjustments process stabilized with expected results.

Wetend investments support development of new biobased forest products

TrumpJet Flash mixing technology of Wetend enables wide product portfolio and platform for next generation paper, board, tissue and non-woven production lines. Wetend has developed consistent core business to flash mix effectively additives into the process. Improved mixing reveals repeatedly new opportunities and applications to work with. The outcome without exceptions support the work of our clients to introduce new or improved bio based forest products to consumers and industries.

Flash Mixing Reactor for Micro Bubbled Foam Generation for foam forming process for board, paper, tissue and non-woven products. Wetend has developed a TrumpJet mixing method to generate micro gas bubbles from air or gas and inject the gas flow into high volume liquid process flow. The process generates billions of micro gas bubbles in size 20...50 µm. Foam based production can give excellent formation, bulk and works well with extra long fibers.

Flash Mixing Reactor for Paper and Board Composite Structures; Extra long bio based or synthetic fibers. The new Wetend-Sulzer TIP injection pump innovation makes it possible to fluidize and mix long bio based or synthetic fibers very close to paper/board machine headbox or a non-woven production line. The system opens opportunity to develop and generate new composite structures for board or paper and non-woven products.

Flash Mixing Reactor for Paper and Board Composite Structures: Nano and micro fibers/pulp.

The developed injection technology enables fluidizing nano and micro pulp and efficiently mix it very close to paper/board machine headbox and guiding 90% of the flow directly to paper/board machine headbox or a non-woven production line. The system opens opportunity to develop and generate new composite structures for board or paper and non-woven products.

Flash Mixing Reactor technology for very fast mixing of CO2 gas and milk of lime slurry straight into thin stock in PM/BM approach flow. The stable and controlled reaction produces calcium carbonate crystals loaded on fibers. Four installations have been supplied for In-Line PCC filler production.

Wetend acquires Anti-scaling technology

Wetend Technologies Ltd. has purchased Anti-scaling technology with product ownership and knowhow from Ceresto Ltd – a technology company in Finland.

The acquired technology is used to prevent calcium carbonate scaling of In-Line PCC Reactor as well as for several other types of scaling deposits generated on the inner wall of a process pipe, caused by aggrersively reacting or chemical.

The system can be used for many scaling sensitive additives to safe guard cleanliness, runnability and effciency. Ceresto has been one of the few developers and suppliers of a full scale In-Line Reactor anti-scaling system for paper/board and process industry. The newly signed contract includes also laboratory and pilot testing equipment and gives opportunity to run trials at paper/board mill in relevant process conditions.

The agreement secures the availability of anti-scaling technology for customers of Wetend and in the future and unites knowledge and expertise of the companies for long term customer support.

The technology is already in use in commercial In-Line PCC™ installations with excellent results.

Welcome to meet us in exhibitions and seminars around the world

In 2017 Wetend Technologies will be present in:

Tappi PaperCon 2017, April 23–26, Minneapolis, Minnesota, USA. During the exhibition you can find us at booth 4162.

In addition to the expo, Wetend will be presenting its newest technologies in two presentations.

Tue 25th At 3:30–5:00 pm Dosing of Wet End Additives in premium pairs and Groups in Flash Mixing Reactor: Challenges Old Rules with Great Economical Benefits, Jouni Matula

Wed 26th at 8:00–10:00 am “Fast Flash Mixing in Generation of Micro Air Bubbles for Foam and Process Dynamics in foam forming”, Jusli Matula

China International Paper Technology Exhibition (CIPTE), September 13–15, Shenzhen, China. Welcome to visit us at booth 4535.

Meet our experts also at:

- Zellcheming, July 4–6, 2017, Frankfurt, Germany
- +more events to be announced later

Look forward to meeting you!

TrumpJet Injection Pump by Sulzer and Wetend has a new motor from ABB

Wetend and Sulzer Pumps Finland have developed a new centrifugal pump for TrumpJet injection stock pumping applications. The latest pump update assembly has integrated ABB synchronous reluctance motor with a frequency controller.

Normal centrifugal pumps easily generate fiber-spin deposits. The unique patented impeller and TIP pump case design can treat normal and extra-long fibers without generating spins and lumps. The pump interior parts are designed to stay clean in all normal conditions. The pump is very light and can easily be located on top of a column next to process pipe. This minimizes connecting pipe lines and then secures maximum cleanliness also in piping.

Wetend has supplied already more than 70 TIP pumps to various TrumpJet applications.
Partnership of Valmet and Wetend creates new value for Customers

Valmet Technologies Inc and Wetend Technologies Ltd have entered into a partnership agreement. Valmet will exploit novel TrumpJet Flash Mixing technology in delivery projects for new and modernized paper and board making lines.

Pentti Paukkunen, VP Sales and Marketing, from Valmet states: We want to bring to our customers world class mixing technology and also new future solutions. We want that in the future there are new innovations for the wet end part of paper and board machines and products that will revolutionize concepts and applications. We trust and count on strength of R&D work and pilot plants of our own and our associates, especially when they are closely used by Valmet and our partners.

For us the co-operation with Valmet has opened a new marketing channel and technology development field, says the CEO Jouni Matula from Wetend Technologies. We can introduce new radical developed technologies to our customers globally in a wider and more efficient manner. Although Wetend has systematically conducted research and development work with the paper and board making cluster and with leading paper and board making companies, partnership with Valmet opens new window and platform for innovative development work.

Valmet provides true Cleantech technology – 15 years and moving forward

Traditionally wet end additives are dosed and mixed in various stages and locations. Usually the delaytimes between the locations are long. The process is considereed complicated and difficult to manage and follow. This is how the mixing was done also in the first year of Wetend 15 years ago. That was the way it was always done!

The experience and research work started to teach and educate Wetend staff and customers oriented customers. Gradually mixing point was moved closer and closer to headbox and forming. Additive consumption went down and savings increased, more additives were brought to flash mixing zone – the latest: strength starch. The results excited, sometimes even surprised and have always led to new developments and even better results.

Once the TrumpJet technology development originally started, the target was to reduce retention aid and polymer consumption, improve sheet quality and eliminate totally use of fresh water in the application. The task was successful.

Wetend is one of the first Cleantech companies in Finland and probably in the world too. The core innovaution for the TrumpJet technology was developed in Savonlinna Finland starting year 1997 in a major technology project initiated by Ahlstrom Machinery and University of Lappeenranta. The name Cleantech was developed and given to the project – describing project objectives – and in practice Wetend Technologies Ltd is a spin-off company from the project. The owners of the company acquired at 2001 their early patents from the Cleantech project and established the company.

Recently Wetend joined the national Cleantech Finland marketing organization to promote sustainable values. www.cleantechfinland.com

Jouni Matula
CEO

Cleantech technology
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Foam forming and foam generation technology
First commercial test production plant in operation

“Valmet, Wetend, Sulzer Pumps and VTT work together to develop a foam forming process for board and paper production. The first commercial test production plant has been supplied. In addition, Wetend has supplied five pilot machine foam generation plants. Numerous pilot production tests support the development.

Micro gas bubbles are needed for foam generation but also for mixing of gases like carbon dioxide (CO2) or for In-Line PCC production or oxygen (O2) for white liquor oxidation. Shear forces in TrumpJet Forte G gas mixer cut and dispense the high volume gas flow in a flash into tiny gas bubbles. Hundreds of billions of tiny bubbles – from 10 µm to 100 µm in size – are generated and mixed evenly into the process flow to headbox. The foam mixture looks like milk.

Foam generation and forming in controlled conditions gives excellent formation and new sheet characters including e.g. potential to increase bulk.

Coated fine paper production line in USA gains savings with TrumpJet® Flash Mixing Reactor technology

A novel reactor innovation of Wetend – reactor mixing process with fast chaos mixing pattern – applied to a headbox feed pipe surprisingly enables mixing various additives effectively, practically simultaneously into the process flow. Traditionally anionic and cationic retention aid additives and e.g. strength starch are mixed in a long distance from thick stock chest to headbox screen area.

In TrumpJet Flash Mixing Reactor mixing takes place simultaneously within a second in chaos type of mixing process very close to headbox and forming part of paper or board machine.

A fine paper mill in USA, producing coated printing paper, installed the above described process to the production line. Before strength starch and PAC fixing agent were added to thick stock line of the process, silica was after the machine screen. After the TrumpJet installation, PAC is mixed before the screen, starch and anionic silica are mixed very close to each other in two close by, but in separate mixing stations according to the patented Flash Mixing Reactor concept.

Results
• Saving of PAC 25%
• Saving of Cationic Starch for strength 10...30%, in average 25%
• Saving of Anionic Nanoparticle (Silica) 48%
• Good formation
• Good retention levels and system runnability

Based on the savings Wetend was awarded with an extra performance bonus by the satisfied customer.

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In-Line PCC™ process installed on line producing 350 000 tons of SC paper annually

In-Line PCC™ Reactor was installed already in 2009 at SC-paper production line (750 tons/day) in Finland to produce precipitated calcium hydroxide. The very high water volume of 80% of the total volume is driven instantly in filaments, ligaments and finally into drops and droplets inside the fast moving injection stream and mixed in the main process flow.

In the conversion, Varkaus mill will focus on products where strength, moisture resistance, purity and printability are important to the end customer. These end uses include, for example, fruit, vegetables and food packaging, retail and industrial heavy duty paper products.

Today more than 50% of TrumpJet Flash Mixing systems go for board production. Applications are e.g. consumer products, food packaging and container boards.

In the Stora Enso Varkaus PM3 conversion project, the existing TrumpJet mixing stations of the fine paper line together with new mixers were modernized to TrumpJet Flash Mixing Reactor system for linerboard production. The new system flash mixes additives efficiently prior to the headbox without any fresh water. Anionic and cationic chemicals are mixed into headbox feed stock very close to each other forming the new chemical rector concept of Wetend. Consumption of additives is very low and process runnability is good.

More with Less

The effect is exploited also for a liquid gel e.g. made from either micro fibrillated cellulose (MFC) or nano fibrillated cellulose (NFC). The latest development result is patented innovation to add new substances decreasing conductivity in circulation waters. This leads to cleaner process and excellent runnability of the entire production line.

Gel type of MFC or NFC is fluidized and mixed effectively and finally formed to a composite board or paper production.

In-Line PCC™ process binds colloidal substances decreasing conductivity in circulation waters. This leads to cleaner process and excellent runnability of the entire production line.

Flash Mixing Reactor technology awarded in France by ATIP

Wetend Technologies Ltd was awarded a silver medal “Palme d’Argent” in an innovation competition of its new Flash Mixing Reactor Technology. The award was given by the French Paper Industry Technical Association (ATIP). Innovation Contest was organized in conjunction with the annual ATIP Conference and Exhibition in Grenoble, France on November 24–26, 2015.

Core of the awarded technology: Fast TrumpJet Flash Mixing Reactor with chaos-type mixing phenomena. Result is a new revolutionary process to mix chemicals into the process. Chemical savings are surprisingly large. Cost savings can be 1 Million Euro per a single production line.

Technology enables also generating composite-type of paper or board structure. Also new type of fiber-based materials can be efficiently mixed close to headbox - such like synthetic long fibers, micro- and nanofibers and reactive additives. TrumpJet® Flash Mixing Reactors are already in commercial operation at several paper mills.

The ATIP Innovation Award rewards innovative technologies and solutions for pulp and paper industry. The awards are highly regarded among the European pulp and paper industry.

Welcome to meet us in exhibitions and seminars around the world

In 2016 Wetend Technologies will be present in:

- Tappi PaperCon 2016, May 15–18 in Cincinnati OH, USA. During the exhibition you can find us at booth 607. In addition to the expo, Wetend will be presenting its newest technologies in two presentations on Wednesday, 18th.
  - At 8–10:00 “Eye Opening Operating Results of Flash Mixing Reactor for Efficient Use of Wet End Additives”, Jussi Matula
  - At 10:30–12:00 “Non-Spinning, Fluidizing Flash Mixing Reactor for Synthetic Fibers, Nano- and Micro Fibers and Aggressive Chemicals for Board, Paper and Tissue Production”, Jorn Matula


Meet our experts also at:
- PaperBiorefinery Conference, 11–12 May, Graz, Austria
- 2ndDroming, 28–30 June, 2016, Frankfurt, Germany
- PTP Paper & Board Symposium, 6–7 September, München, Germany
- CIPTE 2016, October 11–13, Shanghai, China
- PappFor 2016, 25–28 October in Saint Petersburg, Russia etc.

Look forward to meeting you!