

By Caroline Martin
Special for *O Papel*

The technical competitiveness of the forest base sector

Read about the 10 best ABTCP 2014 papers, where authors reveal details of their research and present promising results for the pulp and paper industry

The competitiveness level of Brazil's pulp and paper industry was the main theme at the ABTCP 2014 – 47th Pulp and Paper International Congress and Exhibition –, held in October by ABTCP in partnership with IPEF (Forestry Science and Research Institute) – and sister entity TAPPI (Technical Association of the Pulp and Paper Industry), of the United States. The exchange of information and knowledge between students, technicians, coordinators, supervisors, managers and executives from the sector began with an opening speech by ABTCP's Executive Director Darcio Berni. He said that the entity focuses on promoting the technical training and technological development of companies. "Competitiveness is a constant subject in our discussions. Therefore, every ABTCP 2014 program, including the technical sessions, thematic sessions and the participation of exhibitors, were oriented to stimulate a reflection and point out paths for increasing our competitive capacity."

Berni pointed out that, over the last few years, the sector boosted its productivity through advancements in Research and Development. "This improvement is fruit of investments in technology and people development. Only like this, working more and more in consonance, will it be possible to boost the competitiveness of companies," he said, adding that, in an increasingly more competitive market, there will only be room for players who truly become efficient in their operations, adapting in the best manner possible to client requirements, offering creative solutions and being capable of promoting competitive conditions in their production chain.

Within this context of continuous pursuit for greater competitiveness, the capacity to innovate makes all the difference, said the Association's executive director. "Even though the Brazilian sector has become a global reference, we can't afford to sit back and relax. The results we achieved in the past are not sufficient to ensure our success in the future. Therefore, innovation should be the target of organizations and a high priority item on the agenda of teams. This ABTCP event is the ideal space for providing knowledge to professionals who, in their day-to-day routine, can make a difference for your company."

Dedicated to this mutual objective, professionals from all areas that form the forest base industry presented the results of recently developed projects and showed some promising results for strengthening the sector's competitiveness. Provided below, you can read about the 10 best technical papers scored by ABTCP's Scientific Committee and the results of relevant research for the technical competitiveness of companies in the sector.

ENVIRONMENT

In observing a common impasse at pulp and paper mills that implement filtering membrane technology for the tertiary treatment of their effluents without conducting pretreatment, and end up having difficulties in operating the system due to a phenomenon technically known as colmatation (characterized by the clogging of membrane pores due to solid parts present in effluents, progressively not allowing for the permeate production of the system), Larissa Quartaroli, environmental engineer and Forestry Sciences Master from the State University of the Midwest (UNICENTRO), in Paraná, who



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is also earning a PhD in Civil Engineering - Sanitation and Environment from the Federal University of Viçosa (UFV), in Minas Gerais, focused on conducting an analysis of Dissolved Air Flotation (DAF) as an alternative for the pretreatment of effluents submitted to microfiltration membrane units. "DAF is a technique that allows obtaining a high level of water and effluent clarification efficiency, thus resulting in more efficient and less costly systems, as well as considerable operational flexibility", justifies choosing the method.

In partnership with four other students, Larissa says that the project is part of her thesis called "Application of Dissolved Air Flotation as Pretreatment of Activated Sludge Effluent in a Pulp and Paper Industry", for the Forestry Sciences Master's Degree Program at UNICENTRO. "The experimental part was conducted at the Environmental Sanitation and Water Quality Laboratory of UNICENTRO's Environmental Engineering Department. For the DAF simulation, bench scale equipment was utilized, called Flotateste, while for the microfiltration simulation, a pilot unit of membranes was used. The effluent samples were brought from a pulp and paper industry. A total of eight batches of experiments were conducted, which lasted one year, with intervals for discussing results", she said. "Different coagulant agents and polymers were also tested in the laboratory, under various dosage options, as well as different operational conditions for DAF use and microfiltration to obtain the most optimized and efficient condition of the system as a whole", she said.

Larissa reveals that the main result found in the study was the minimization of membrane colmatation after applying dissolved air flotation as pretreatment. "The permeate flow at the membrane increased from 69 L/h.m² to 182 L/h.m². The overall quality of the effluent produced also improved significantly, especially in relation to turbidity, color and OCD parameters."

In analyzing the contribution that her project offers to the sector's competitiveness, Larissa says that the behavior of players until just a few years ago was limited to a passive strategy of diluting and dispersing the pollutants generated. Such practice is no longer compatible with current models of environmental management utilized by leading companies in the market. "The posture of corporations in relation to



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Larissa Quartaroli analyzed Dissolved Air Flotation (DAF) as an alternative for pretreatment of wastewater from pulp and paper industry submitted to microfiltration membrane systems

the environmental area has changed. At present, environmental protection costs are perceived as future investments and as advantages in a highly competitive market," she said.

Besides this analysis, Larissa emphasizes that the results obtained indicate DAF's high-efficiency in the removal of parameters indicative of colmatation of membranes, which factor demonstrates the technical feasibility of this application in full scale as a pretreatment unit of effluent before the membrane system, since the clogging of membranes is one of the most important project parameters in the dimensioning of these systems. "Since the current trend in various industrial segments is focused on reducing the production of effluents, and hence the use of water – be it to comply with increasingly more restrictive environmental legislation, or with the objective of reusing water within the industry itself for different purposes – these results can contribute to the image of the pulp and paper industry in the sense of minimizing its pollution potential."

Putting this successful alternative into practice does not include technical challenges, guarantees the student. "Both technologies are already considered well-established as viable options in today's scenario of wastewater treatment, based on solid theories and numerous examples of application." However, adopting

a new posture in relation to investments made in waste treatment stations (ETEs) is necessary on the part of players, in order to comply with environmental legislation and the production of effluents that generate a small environmental impact and can be reutilized in the industrial environment.

Production engineer Leonard de Almeida Batista, who holds a Bachelor's degree in Environmental Engineering and a Master's degree in Forestry Sciences from UFV, focused his efforts on the partial closure of filtrate circuit in an ECF bleaching plant. "The idea stemmed from the opportunity of applying what was my greatest specialty throughout my master's degree program in Forestry Sciences as part of a viable and applicable project that could help in the development of the company where I work", he said about his career at Klabin.

After defining the area to be studied, Batista says that the team started out conducting an analysis of the plant's historical data. "Through a Pareto graph, we identified the biggest opportunities and selected them to be the focus of our work. We then decided on the tools to be utilized and, lastly, we chose the computer simulation associated to bench tests as work methods", he said about how this research was conducted. The author points out that, since the software in question had not yet been tested with a focus on pulp and paper,

it was necessary to prove its efficiency before kicking off the project. Upon proving its efficacy, the computer simulation studies were associated to the bench test results. "By combining the results obtained with the two tools, it was possible to predict the gains and potential losses from implementing the project", he said about the outcome of the method applied.

In terms of results identified, the environmental engineer said it was possible to verify that, in spite of increasing the level of saturation of the system, the recirculation of filtrate under the conditions proposed would not be sufficient to cause incrustation of lines and equipments. In relation to the qualitative properties of bleached pulp, it was possible to identify that there was a drop in final brightness and in the *L color coordinate of bleached pulp, as well as an increase in the *a and *b color coordinates, when recirculation of filtrate above 50% occurred in the study. "In other words, we proved that levels of up to 50% of filtrate recirculation are capable of reducing water consumption (and wastewater generation) without compromising the final quality of bleached pulp", he said.

Further listing the competitive advantages that results of the study yielded for the pulp and paper industry, Batista informs that it is possible to increase production on the bleached pulp line without necessarily having to invest in increasing capacity of the effluent treatment plant, or yet, increase capacity of the water capturing plant. "The result of the study proves that it is possible to obtain the gains mentioned through low investments.

Despite the positive conclusion, the author recognizes that there is still one challenge to be mastered: be able to prove the results obtained in the bench and computer simulation in the industrial plant. "The results are totally in line, however, a structural change in the plant and in the process requires the involvement of more people and partner companies", he said.

Use of bioreactor with aerobic granular sludge for paper machine wastewater treatment was the theme addressed in the paper presented by environmental engineer Ismarley Lage Horta Morais, from UFV's Pulp and Paper Laboratory. The author justifies that one of the main problems faced by companies that utilize the activated sludge system for treating wastewater is the loss of solids in the secondary decanter due to poor



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Leonard de Almeida Batista studied the partial closure of filtrate circuit in an ECF bleaching plant



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settleability of biological sludge. "The excessive growth of filamentous bacteria hinders the growth of biological flake formation and reduces its sedimentation speed, reducing efficiency of the decanter and less quality of wastewater treated", he said.

In further explaining points that surround the area, the author says that in anaerobic systems it is common for microorganisms to organize in the form of biological granules rather than organize into flakes, as is the case with activated sludge. The granules organize more densely and, consequently, present greater sedimentation speed. "Recent studies show the possibility of granules forming in aerobic processes. However, these studies utilized systems in laboratory benches fed with synthetic wastewater, prepared in lab by adding glucose, acetate and nutrients to distilled water. We know that a real effluent of a paper machine presents several components that influence the biological treatment, and make it more complex than a synthetic effluent prepared in laboratory. Therefore, we decided to study the process and try to verify the possibility of forming aerobic granules in a system fed with wastewater from a paper mill. The idea was to compare the treatment efficiency of this system against a conventional system that presented biological sludge in the form of flakes (flocculent sludge)", he said about the initiative.

Additionally, Morais analyzed the behavior of granules during the membrane separation process, since this is a more recent technology that has substituted secondary decanters in more modern systems. "Separation by membrane allows obtaining better quality treated wastewater, but the efficiency and cost of operation are highly influenced by the characteristics of the biological sludge found in the system", said the author.

Studies conducted at UFV's Pulp and Paper Laboratory counted on systems set up in bench scale with activated sludge reactors with granular sludge in parallel with flocculent sludge reactors, all fed with wastewater from a paper machine of a recycled paper mill. The efficiency of removing organic matter and filterability of biological sludge were analyzed for 18 months. "The system with granular aerobic sludge presented high efficiency for removing organic matter in treating paper machine wastewater, comparable to conventional systems used in mills. However, the sedimentation speed of granules is



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Use of bioreactor with aerobic granular sludge for paper machine wastewater treatment was the theme studied by Ismarley Lage Horta Morais

much greater than that of flakes, allowing for a reduction in size of treatment station without altering the quality of treated wastewater", he said. Morais also said that results with membranes indicated the possibility of greater flows during filtration with aerobic granules, even though they presented low resistance to the pressure submitted during filtration and ended up tearing.

The author of the study points out that, since the sedimentation speed of granules is much higher than the sedimentation speed of flakes, this implies in a reduction in the size of secondary decanters and, consequently, a reduction in area necessary for installing a wastewater treatment station. "Additionally, it would be possible to obtain better quality treated wastewater and reduce the risk of sludge loss in the decanter. If considering the stations that utilize separation by membranes, it would be possible to also improve the filtration process, reducing expenses with energy or increase the system flow", he said about the potential of possibilities, without forgetting that laboratory studies require caution and more knowledge prior to being put into practice.

Robson Silva Mendes Junior, Environmental Engineer at Suzano with a Master's degree in Forestry Sciences from UFV, focused on the optimization of drainages for Effluent Treatment Stations (ETs) during general shutdowns of pulp mills. The study sought to determine maximum rates for sending effluents to the ETS during the shutdown period without adverse effects occurring to the good functioning of the ETS and the environment.

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Robson Silva Mendes Junior focused on the optimization of drainages for effluent treatment stations during general shutdowns of pulp mills

According to the author, respirometric tests using bench reactors were mounted in order to determine maximum proportions of addition of these effluents with minimal effect on cellular breathing. The tests proved to be very sensitive and suitable for predicting the toxic effects on aerobic biological treatment systems. Both the results and the method can be used in order to make the control of toxic waste delivery to the ETS more technical during the general shutdowns.

PULP

Given the importance of recovering chemical products in the kraft pulping process, Thanh Trung, vice-president of Technology at FITNIR Analyzers, decided to study an advanced online process analyzer for chemical recovery and pulp mill control. "This stage of the production process ensures that a mill is able to recover 95% or more of chemicals used in pulping, in addition to ensuring that we capture and remove as much potential pollutants as possible before any emissions are released into the environment. Without the recovery of chemical products, mills would not be economically viable", he said. He stresses that the objective of the work is to provide information about various recovery processes so that mills can optimize their processes. "With the increase in energy costs, chemical recovery plays an increasingly more important role", he said.

According to Trung, the work is a compilation of many

studies conducted over the last 15 years. "We have compared several areas of the recovery process. The first challenge of the project was to develop a way to obtain reliable measurements, using cutting edge technique through the use of vibrational spectroscopy", he said.

The author says that this is a very innovative starting point, since it abandons traditional techniques like density, conductivity and titrations. "Vibrational spectroscopy was used to determine liquor compositions online. Through the use of recently developed control strategies based on the true compositions of liquor, the study yielded excellent results", he said.

In practice, Trung reveals that work started out with dissolving tank measurements and control to stabilize TTA (Total Titratable Alkali) and provide feedback to the boiler operations on reduction efficiency. "We continued on and worked on clarified GL TTA trim control, then slaker control and CE control. "By successively perfecting each unit operation, we can improve the cycle tremendously," he said.

With regards to the results, Trung reveals that it was possible to reduce TTA variability in the dissolution tank by as much as 80%, resulting in a more stable green liquor TTA. "Trim control of clarified green liquor reduced even more variability of the green liquor entering the slaker and, as we can measure the actual carbonate concentrations of GL, we can use this information as feedforward parameter for lime addition and slaker control. At the slaker, results have shown that mills can push up the CE, while reducing overliming and improve white liquor strengths."

The author guarantees that all these actions resulted in improvements to the overall chemical recovery cycle, resulting in less lime purchase, increased white liquor strengths, as well as the production of a greater volume of steam for power generation. "Plants also reported having been able to debottleneck their unit operations and increased digester productivity", said Trung.

In his opinion, pressure on the chemical recovery process, with the aim of ensuring the economic viability of mills, will grow as costs of raw materials, chemical products and energy continue to rise. "Lower production costs coupled with better quality products, with the potential of higher production, will play a key role in the pursuit of greater competitiveness for the sector."



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The practical challenges of conquering such improvements include initial investments in acquiring measurement system to provide true liquor compositions, necessary for the optimization and automation of the recovery operations of chemical products, and overcoming traditional mindset regarding the feasibility of online system in such harsh conditions. "Overcoming traditional thinking and antiquated instrumentations are challenging aspects, but every change involving a paradigm shift will face initial challenges. We have documented results and paths to help the industry achieve competitiveness", said Trung.

RECOVERY AND ENERGY

The need to maximize the so-called congruence in the sodium to phosphate ratio, or $\text{Na}:\text{PO}_4$, was the main motivational factor for Solenis' Applications leader Anderson José Beber to learn more about congruent phosphate water treatment control for recovery and power boilers.

He explains that the proposal of operating with a chemical treatment program for high-pressure congruent phosphate boilers is justified for two reasons: "the first is due to the reduction in the formation of alkali; secondly, and very important in pulp and paper mills, is the formation of a buffer environment that can absorb limited quantities of contaminants, without altering alkalization conditions of the boiler water."

In spite of there not being a consensus among specialists, Beber informs that the majority of recommendations determines that a boiler should have more than 90% congruence. The strictest establish at more than 95%. "In this condition, experience shows that boilers are very well protected in terms of eventual problems that may occur, such as caustic corrosion and formation of deposits. The company then decided to develop an automatic system that allowed understanding all perturbations, even if minimal, in a water system for feeding high-pressure boilers."

Beber points out that this is not the only control and automation form for a congruent phosphate program. However, in comparison to traditional processes, such as optical tracer, it presents much higher performance. "Through an exact combination of balance of mass determination and continuous measurements of pH

perturbation in water, it is possible to achieve more than 95% control, most of the time being very close to 100%", he said, pointing out that, considering the pulp market, high-pressure boilers, particularly recovery boilers, represent the biggest assets of a mill, in addition to also posing a major risk in the case of failures.

With regard to the practical execution of the study, Solenis' Applications leader says that, before developing the controlling equipment, there was a need to develop the control algorithm. "This stage was developed by a specialized team at our headquarters in the United States. To reach the control algorithm, thousands of hours of real data were collected from various mills. Based on the data collected, we identified the variables and their relevance in process oscillations", he said. With the algorithm, the equipment was then conceived just a little more than three years ago. Since then, it has been applied in several facilities and distinct markets (pulp, energy and steel). "Talking about this application in Brazil, the benefits of this control were presented and the installation for controlling one of the boilers in this mill was proposed, including for purposes of comparing with others that already possessed other control technologies", he said about the current moment.

"The main and desired result is stability in the $\text{Na}:\text{PO}_4$ ratio. This technology allowed achieving results very



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The theme studied by Trung was an advanced online process analyzer for chemical recovery and control of pulp mills

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Anderson José Beber focused on congruent phosphate water treatment control for recovery and power boilers

close to 100% congruence”, said Beber, reinforcing that the higher the operation stability of a boiler, the higher the safety level. “With results within the recommended ranges, it is possible to eventually discuss with insurance companies the operation issue of this important asset, including maintaining internal surfaces of the boiler clean; reducing and eliminating failures; reducing and eliminating non-programmed stoppages; extending useful life, and other benefits”.

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Maria Noel Cabrera focused on green liquor extraction on eucalyptus wood prior to kraft pulping

Also, according to Solenis’ Applications leader, in eventual failures and systems that prevent contamination of water and/or instability in the production of steam, the system possesses full capacity to absorb these variations and make the necessary corrections in a predictive manner.

With regards to older mills, however, the main challenge could be the availability of important variable signals. “Flow measurements are vital for technology performance”, exemplified Beber. In spite of relatively simple, older mills, in some cases, possess challenges in terms of delivering signals.

Chemical engineer Maria Noel Cabrera, from UDELAR Engineering School, in Montevideo, Uruguay, focused on green liquor extraction on eucalyptus wood prior to kraft pulping. When asked about the initiative of conducting the study, the researcher said that upon implementation of National Forest Law, forest plantations in Uruguay, increased from 25 thousand hectares in 1987 to nearly 1 million hectares today. Two big modern mills were installed and increased GDP of the forest sector, denoting the exponential growth in the country.

On the other hand, informs Maria, Uruguay does not have petroleum, which fact leads the government to seek alternatives for substituting its current energy grid for a more renewable one. In the case of electricity, hydropower stands out in relation to other alternatives. At present, wind, photovoltaic and biomass generation units are being installed. “The objective is to increase total electricity consumption from renewable energy sources to at least 50%”, said the researcher.

However, Uruguay’s transport sector is still highly dependent on imported oil. “Therefore, our main motivation is to produce a fuel that can be mixed with gasoline using national and renewable reserves”, she said. Maria adds that the production of other items besides traditional ones is very interesting for the pulp and paper industry, in view that it allows increasing profitability through a broader portfolio with high volume and low cost products – like bioethanol. “The goal is to obtain bioethanol without degrading the quality of pulp produced”, she said about the ultimate objective of the project.

Regarding the method employed, Maria reveals that the objective was to optimize the extraction of



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hemicelluloses from eucalyptus chips in order to obtain a liquor rich in hemicelluloses to produce bioethanol and pulp with the same characteristics as market pulp. "Extraction tests were conducted in four stainless steel 1.4-liter reactors, inside a 15-liter rotatory reactor. Two of these reactors were operated under the same conditions in order to allow testing the chips after extraction and proceed with the pulping. We initially studied a broad range of extraction temperatures and, after identifying the region that generated the most promising data, we conducted a factorial experiment in this range, using the extraction time, temperature and green liquor load (that was used as extraction agent) as variables. The amount of hemicelluloses (particularly xylose) in the extraction liquor and the viscosity of pulp were the main properties investigated", she said.

After these initial tests, the three most promising extraction conditions were selected, which liquors served to produce bioethanol. "Additionally, we adjusted the alkaline load to proceed with the pulping of chips that underwent extraction, in order to achieve a kappa figure equal to 18. The paper production properties of these pulps were defined and compared with those of a pulp that did not undergo the extraction process. We bleached the four kappa 18 pulps (three obtained in the conditions selected and the control pulp), and, as soon as we have the pulps bleached, we will analyze their paper production properties", she said about the next steps, adding that the entire project has a two-year duration, and that another associated group is working on the purification and fermentation of extracted liquor, with the objective of obtaining bioethanol.

"In this study, we are applying the concept of integrated forest biorefineries, developed by Van Heiningen (University of Maine). They produce new biomaterials besides traditional pulp and paper, boosting profitability of forest products", said Maria about the potential of her project for strengthening the sector's competitiveness. "If we consider a pulp mill with an annual production capacity of 1 million dry tons and a yield of 3% (in the dry oven to the furnace) in the extraction of hemicelluloses, we can obtain roughly 30 thousand m³/year of bioethanol (fermentation yield: 80%), which represents approximately 4% of annual gasoline consumption (considering the different heating



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Bahador Bakhtiari presented Pinch Analysis, a tool used for optimizing energy in pulp and paper mills

values)", said the researcher. "We could also produce 50 thousand m³/year of pure acetic acid, as well as gypsum in very big quantities, but not yet quantified", she said.

Maria acknowledges that the current challenge resides in showing that the paper production properties from the pulps obtained will not be hindered by the levels of extraction. "In this case, it will be necessary to introduce a few changes in mills, particularly in the impregnation reactor and, obviously, it will be necessary to install a new plant nearby to produce bioethanol. Even though we don't have information about high-capacity mills operating in a satisfactory manner for long periods of time, the fermentation of pentoses to bioethanol are working out at laboratory scale. In summary, we have a lot of work ahead of us in this field", she said.

ENERGY EFFICIENCY

Bahador Bakhtiari, Director of Business Development – Process Integration at American Process Inc. (API), presented a tool for energy optimization in pulp and paper mills called the Pinch Analysis. "It is a proven powerful tool for improving the overall energy efficiency and optimizing water usage in pulp and paper mills," said the author.

According to him, the team responsible for developing the project believes that the application of thermal Pinch analysis, combined with practical mill experience has resulted in very important energy, operating and capital cost savings for many mills. "API has conducted

more than 500 process integration studies in more than 200 pulp and paper mills, seeking to optimize the use of energy and reduce water consumption and wastewater generation to a minimum. We have had projects in North America, Europe, and even in South America”, he said about the team’s experience.

API also developed the O-Pinch, a complementary methodology to the Pinch analysis that focuses on operational projects with low or no capital cost. “We presented in our work the theory and practice of Pinch technology, as well as examples of its application in different mills,” he said, affirming that Brazil and South America in general are new markets that the company has its eyes on. “We are in search of new business opportunities in the region.”

PAPER

By managing the size of hydrophobic particles (water repelling) in the wet end of the paper machine, Christopher Lewis, Western North America Regional Applications Manager at Kemira Chemicals and team, focused on reducing machine downtime and defects caused by deposition associated with wood pitch, coated broke and stickies from recycled fiber.

The author says that the work initially focused on how wood extractive content and how extractive species

associated with different wood species impacted deposition propensity. This early approach was derived from methods based on a novel HPLC and GC pyrolysis. “The studies were conducted based on sampling real processes that were suffering from deposition problems. The samples underwent detailed analyses in our lab”, he said. The objective was then expanded incorporate the application of a new measurement for paper, being developed by Kemira and Åbo Akademi. “The method was a modification of flow cytometry specific for application in paper. Even though flow cytometry is not a new method in the scientific community, its application in the paper industry is still somewhat new.”

The partnership between Kemira and Åbo yielded novel algorithms for making data output more useful and applicable for paper. Additionally, Lewis says that some modifications were introduced to the method. The author of the paper emphasizes that modified flow cytometry is exclusively commercialized by Kemira under the trade name Flyto™. “The analyses conducted using Flyto™ are much faster and cost less than the extractive speciation methods, although these methods are still used strategically in conjunction with Flyto™, with the objective of fully characterizing a specific process. Flyto™ allows for the characterization of hydrophobic particles in relation to size, concentration and degree of hydrophobicity”, he said.

In talking about the results obtained, Lewis informs that the agglomeration of hydrophobic substances in the pulp and paper process is a key mechanism for measuring the propensity and degree of deposition and defects. “In general, the elimination or reduction of these agglomerations often mitigates these problems.” He said that, in the first steps, Flyto™ was just a laboratory test, a factor that require samples to be submitted to the laboratory for analysis. “Kemira then developed an online measurement that facilitates continuous process monitoring. The AutoFlite™ online measurement device can even be used in closed loop control to optimize dosage of fixatives normally used for controlling depositions, eliminating overdosing that can exacerbate depositions problems.”

The need to expand knowledge about the permanence of paper property over time led researcher Maria Luiza Otero D’Almeida, from the Pulp and Paper Laboratory

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In order to reduce machine idle time and defects caused by deposition of wood resins, coated paper scraps and sticky residue from recycled paper, Christopher Lewis managed the size of hydrophobic particles



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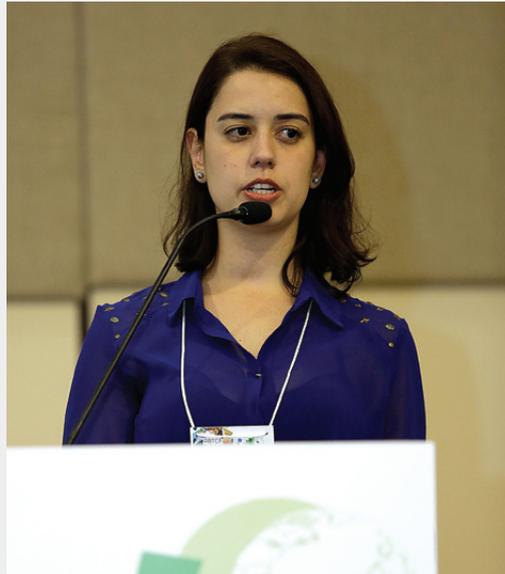
at the Institute for Technological Research (IPT), and team to conduct a study on predicting the expected brightness loss of offset and coated paper. "Permanence is understood as the ability to remain chemically and physically stable in relation to long periods of time", said Maria Luiza. This knowledge, points out the author, is not only relevant for stipulating the validity period of products, but also for determining improvements in product processes.

Regarding the initiative of developing this study, the researcher also revealed that brightness stood out as the property to be investigated because it is one of the most important ones considered by manufacturers and consumers. "Brightness is particularly important in printing and writing paper, since it can affect the tonality of printing inks, as well as the contrast between paper and ink. This fact led to choosing offset and coated paper as the basis of our study, given their widespread use in the country's printing sector", she said.

In practice, the study was conducted based on a sample of offset paper and a sample of coated paper, produced by different Brazilian makers recognized in the market for the quality of their papers. "To predict brightness loss over time, we used the accelerated aging test, using the Arrhenius model", said Maria Luiza, informing that, in this model, we assume that the reaction velocity that leads to brightness loss solely depends on the temperature in which the reaction is occurring.

In applying the model, 4% was defined as an acceptable value for brightness loss; three temperatures higher than 100°C were selected for the test; in each temperature, we verified the necessary time to reach the brightness loss; with the data obtained, the Arrhenius graph was constructed and with it we verified the time necessary for a 4% brightness loss to occur at room temperature. "Since accelerated aging by applying the Arrhenius equation requires time, the study was conducted over a five-month period", said Maria Luiza.

The IPT researcher informs that the main result found was that, in spite of the papers studied having different surfaces (coated paper and noncoated offset paper), and different initial brightness, both would take practically the same time to present a 4% brightness loss at a 25°C temperature. This time was of approximately one year.



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To expand knowledge about paper property permanence over time, Daniela Colevati Ferreira, Mariana Tiemi Iwasaki and Maria Luiza Otero D'Almeida conducted a study on predicting the expected brightness loss in offset and coated paper

The information and results presented in the study can have several applications, depending on the purpose desired. "The data can lead to studies of similar papers not produced in the country, in order to verify if they have a similar behavior to Brazilian papers; it can base paper manufacturer studies aimed at minimizing the brightness loss observed; it can also base an industry positioning to inform the market that brightness loss can compromise paper permanence, but does not compromise the durability of paper, durability being understood as the ability to resist the effects of handling when in use", said the author. "The study showed that brightness loss is a fact. Concrete data is presented for this loss in relation to time, considering room temperature (25°C)."

From this data, improvements to the production processes can be considered with the objective of minimizing brightness loss. "However, improving the permanence of brightness requires changes in the current process, which is not an easy task", said Maria Luiza. She points out that brightness is a highly coveted property and that the consumer market requires that it be high, which fact implies in costs. For the IPT researcher, a broader discussion is necessary regarding the benefits of high brightness and the real harms of brightness loss in relation to time.

Provided below are the abstracts of the 10 best papers presented at ABTCP 2014, which served as sources for the content presented in this cover story and interviews with the respective authors. ■