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NA KRILIH INOVATIVNOSTI: EMBALAŽA IN NOVI IZDELKI IZ CELULOZE

ON THE WINGS OF INNOVATION: PACKAGING AND NOVEL CELLULOSE

PRIMER VKLJUČITVE KODE QR Z GS1 DIGITAL LINK V KOZMETIČNO EMBALAŽO

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V zadnjih letih se je na področju oblikovanja embalaže povečal poudarek na razvoju rešitev, ki izboljšujejo uporabniško izkušnjo in omogočajo večjo interaktivnost med izdelkom in potrošnikom. Ena izmed teh rešitev je vključitev kode QR z GS1 Digital Link, ki uporabnikom omogoča enostaven dostop do dodatnih informacij o izdelku, ne da bi obremenila embalažo s prekomerno količino besedilnih podatkov. Ker kozmetična industrija vse bolj sledi trendom minimalizma, predstavlja integracija kode QR na embalaži, optimalno rešitev. S tem je mogoče ohraniti čistost in eleganco embalaže, hkrati pa uporabnikom ponuditi bogate interaktivne vsebine.

V okviru raziskave je bila oblikovana minimalistična embalaža za olje za ustnice, ki vključuje kodo QR z GS1 Digital Link. Vključena koda QR vsebuje edinstveno globalno identifikacijo izdelka - globalno trgovinsko številko izdelka GTIN (Global Trade Item Number). Kot interaktivni element, uporabnika preusmeri na spletno stran z dodatnimi informacijami o izdelku, vključno z navodili za uporabo, sestavinami izdelka, priporočili za reciklažo embalaže, PDF brošuro idr. Na takšen način je embalaža izdelka ohranila minimalističen dizajn ob zmanjšani količini tiskanih informacij, saj v kodo QR lahko na majhnem prostoru zapišemo več podatkov kot v linearno črtno kodo. Hkrati se poveča interaktivnost in digitalna ozaveščenosti uporabniške izkušnje.

Za implementacijo GS1 Digital Link sintakse z URL in številko GTIN, strukturirane podatke ter vzpostavitev pripadajočih digitalnih vsebin je poskrbela GS1 Slovenija, ki se ukvarja z identifikacijo, zajemom in elektronsko izmenjavo podatkov ter implementacijo standardov GS1 v Sloveniji. Na embalažo natisnjena koda je nato uspešno prestala postopek verifikacije po metodi ISO/IEC 15416.

Učinkovitost kode QR smo preverili z anketiranjem uporabnikov, ki so kodo ocenili kot uporabno in dobrodošlo dopolnitev embalaže za enostaven dostop do dodatnih informacij. Povratne informacije uporabnikov so bile pozitivne. Minimalističen pristop pri oblikovanju je omogočil, da embalaža ostane vizualno preprosta, vendar privlačna. Uporabniki so kodo dobro sprejeli, saj jim omogoča preprost dostop do pomembnih informacij o izdelku, izboljšuje uporabniško izkušnjo in prispeva k boljši predstavitvi samega izdelka.

Gre za prvi primer izvedbe uporabe Digitalnega potnega lista (DPP) na embalaži kozmetičnega izdelka, ki je integriran v kodo QR po GS1 Digital Link standardu, v Sloveniji.

Ključne besede: embalaža, oblikovanje, koda QR, GS1 Digital Link, Digitalni potni list

EXAMPLE OF QR CODE INCLUSION INTO COSMETIC PACKAGING

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In recent years, there has been an increasing focus in packaging design on developing solutions that enhance the user experience and enable greater interactivity between the product and the consumer. One such solution is the inclusion of a QR code with GS1 Digital Link, which allows users to easily access additional product information without overloading the packaging with excessive textual content. As the cosmetics industry increasingly follows minimalist trends, integrating a QR code on the packaging offers an optimal solution. This approach maintains the cleanliness and elegance of the packaging while providing users with rich interactive content.

As part of the study, a minimalist packaging design was created for a lip oil product, incorporating a QR code with GS1 Digital Link. The QR code includes a unique global product identifier – the Global Trade Item Number (GTIN). Serving as an interactive element, the code redirects users to a webpage containing additional product information, including usage instructions, ingredient lists, packaging recycling recommendations, a PDF brochure, and more. This allows the packaging to retain a minimalist design by reducing printed information, as a QR code can store more data in a small space compared to a linear barcode. At the same time, the interactivity and digital awareness of the user experience are increased.

GS1 Slovenia was responsible for implementing the GS1 Digital Link syntax with the URL and GTIN, structuring the data, and setting up the associated digital content. GS1 Slovenia specializes in identification, data capture and electronic data exchange, as well as the implementation of GS1 standards in Slovenia. The printed code on the packaging successfully passed verification in accordance with the ISO/IEC 15416 method.

The effectiveness of the QR code was evaluated through a user survey, in which respondents found the code useful and a welcome addition to the packaging for easy access to further information. User feedback was positive. The minimalist design approach enabled the packaging to remain visually simple yet appealing. Users embraced the QR code, as it provides easy access to important product information, enhances the user experience, and contributes to better product presentation.

This is the first implementation in Slovenia of a Digital Product Passport (DPP) on the packaging of a cosmetic product, integrated into a QR code following the GS1 Digital Link standard.

Keywords: packaging, design, QR code, GS1 Digital Link, Digital Product Passport



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PRIPRAVA PAPIRNIH KOMPOZITOV S KOMBINACIJO CELULOZNIH MIKROSFER IN CELULOZNIH VLAKEN

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Celulozne mikrosfere (CMS) so sferični delci iz regenerirane celuloze z nastavljivimi lastnostmi in velikim potencialom za površinsko modifikacijo. Čeprav je uporaba CMS razširjena na področjih kot so farmacija, kromatografija in tehnologije za prečiščevanje, je njihova uporaba v procesih proizvodnje papirja dokaj neraziskana. V prispevku bomo predstavili metodo za izdelavo mehansko robustnih laboratorijskih listov papirja z vgradnjo do 50 ut.% CMS v celulozna vlakna, kar je delež, ki presega konvencionalne dodatke polnil.

Pri karakterizaciji površine s pomočjo mikroskopije z neskončnim fokusom smo ugotovili, da se je na površini vlakninske mreže vzpostavil kontinuiran sloj CMS, ki je pokril vse praznine in nepravilnosti v površini. Takšna modifikacija je privedla do bolj gladke površine v primerjavi s površino vzorca brez CMS. Meritve prepustnosti zraka po Gurleyu kažejo, da prisotnost CMS spodbuja zgoščevanje materiala zaradi polnjenja medprostorov med vlakni v papirnem listu. Testiranje mehanskih lastnosti listov s konstantno maso vlaken kaže, da vključitev CMS ne poslabša povezav med vlakni, saj se ohranjata tako utržna jakost kot elastični modul. Meritve z inverzno plinsko kromatografijo nakazujejo, da vključitev CMS, ki niso funkcionalizirani, vodi v zmanjšanje površinske energije kar posledično zmanjšuje omočljivost papirja z vodo. S pomočjo rezultatov FT-IR spektroskopije lahko te pojave povežemo s spremembami v nastanku vodikovih vezi v kompozitu. Gledano v celoti rezultati nakazujejo smiselnost izdelave kompozitov iz celuloznih vlaken in CMS, kar predstavlja osnovo za prihodnje raziskave v smeri naprednih kompozitov iz celuloze in CMS z načrtno prilagojenimi lastnostmi.

CREATING ALL-CELLULOSE PAPER COMPOSITES BY COMBINING CELLULOSE MICROSPHERES AND PULP FIBERS

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Cellulose microspheres (CMS) represent a class of spherical, regenerated cellulose particles characterized by tunable properties and high potential for surface modification. While CMS have been widely utilized in fields such as pharmaceuticals, chromatography, and purification, their integration into papermaking processes remains largely unexplored. In this work, we report a method for fabricating mechanically robust paper hand sheets by incorporating up to 50 wt.% CMS into cellulosic fibers, a proportion that exceeds conventional filler loadings. Surface characterization using infinite focus microscopy revealed the formation of a continuous CMS layer on top of the fiber network, resulting in the elimination of voids and surface irregularities. This modification led to a smoother surface compared to control samples lacking CMS. Gurley air permeance measurements indicated that the presence of CMS promotes densification by filling the inter-fiber spaces within the sheet. Tensile testing of hand sheets with constant fiber mass demonstrated that the inclusion of CMS does not compromise fiber-fiber bonding, as evidenced by the preservation of both tensile strength and elastic modulus. Inverse gas chromatography measurements demonstrated that the incorporation of non-functionalized CMS leads to a reduction in surface energy, thereby decreasing the water wettability of the paper. FT-IR spectroscopy further linked these effects to alterations in the hydrogen bonding environment within the composite. Collectively, these results demonstrate the viability of producing composite materials from cellulosic fibers and CMS, providing a basis for future investigations into advanced CMS–cellulose fiber composites with tailored properties.



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BIORAZGRADLJIVI HIDROGELI IZ NATIVNE CELULOZE IN NARAVNIH DIKARBOKSILNIH KISLIN: K ZELENIH ALTERNATIVAM POLIAKRILATOM

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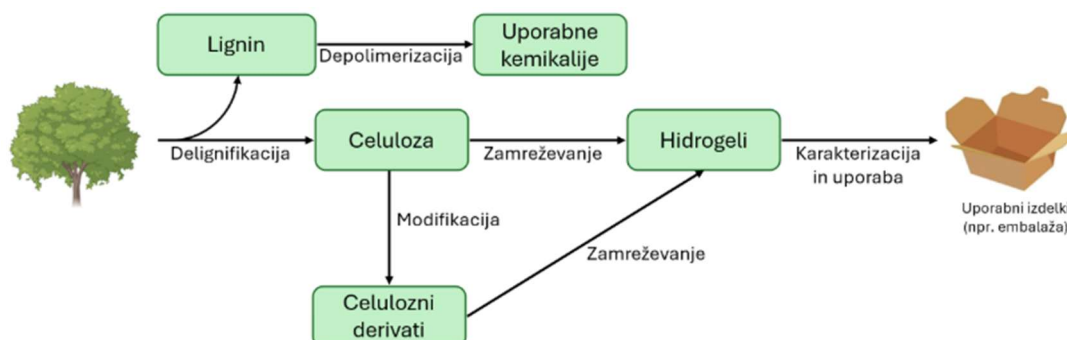
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Zaradi vse večjih prizadevanj za prehod sveta v krožno gospodarstvo se lignocelulozna biomasa uveljavlja kot ključni obnovljiv vir. Njena široka razširjenost, ogljična nevtralnost ter dejstvo, da njena uporaba ne posega v prehransko verigo, jo postavljajo v ospredje sodobnih trajnostnih rešitev.[1] Kljub temu se na svetovni ravni porabi le približno 30 % odpadne kmetijske biomase, preostanek pa pogosto konča kot odpadke ali se celo sežge.[2] Vse glavne sestavine biomase – celuloza, lignin in hemiceluloza – zaradi svojih specifičnih strukturnih lastnosti omogočajo številne reakcije modifikacij, ki vodijo do nastanka novih, uporabnih kemikalij in materialov kot so denimo celulozni hidrogeli.

Celulozni hidrogeli so tridimenzionalne mreže, sestavljene iz native celuloze ali njenih derivatov, ki lahko v svojo strukturo vežejo velike količine vode. Zaradi svojih lastnosti so ti hidrogeli zanimivi za številne aplikacije na področju medicine, kmetijstva, farmacije, živilske industrije, tekstilne in papirne industrije. Na področju slednje se lahko hidrogeli vključijo v embalažo, kjer pomagajo vzdrževati ustrezno vlažnost, kar je ključno za shranjevanje določenih izdelkov.[3]

V tej študiji smo se osredotočili na sintezo celuloznih hidrogelov, zamreženih z naravnimi alkil dikarboksilnimi kislinami (Slika 1). Preučili smo vpliv dolžine verige in koncentracije zamreževalnega reagenta na absorpcijske lastnosti sintetiziranih hidrogelov. Ti so pokazali zelo dobre sposobnosti absorpcije, in sicer vse do 60 % mase hidrogela, kar presega zmogljivosti komercialno dostopnih poliakrilatnih hidrogelov, čeprav je stopnja nabrekanja pri naših hidrogelih približno 80 % nižja kot pri komercialnih alternativah. V sklopu študije smo izvedli multidisciplinarno karakterizacijo sintetiziranih hidrogelov z uporabo FTIR-spektroskopije, NMR spektroskopije v trdnem stanju, termogravimetrične analize (TGA) in diferencialne dinamične kalorimetrije (DSC).



Slika 1: Od biomase do hidrogela in uporabe le-tega v končnem produktu.



- [1] G. Izydorczyk, D. Skrzypczak, M. Mironiuk, K. Mikula, M. Samoraj, F. Gil, R. Taf, K. Moustakas, K. Chojnacka, Lignocellulosic biomass fertilizers: Production, characterization, and agri-applications. *Science of the Total Environment*. **2024**, 923, 171343.
- [2] K.-T. Lee, W.-H. Chen, P. Sarles, Y.-K. Park, Y. S. Ok, Recover energy and materials from agricultural waste via thermochemical conversion. *One Earth*. **2022**, 5, 12, 1404.
- [3] A. K. Singh, P. I., Y. S. Lee, State-of-the-Art Insights and Potential Applications of Cellulose-Based Hydrogels in Food Packaging: Advances towards Sustainable Trends. *Gels*. **2023**, 9, 433.

BIOBASED HYDROGELS FROM NATIVE CELLULOSE AND NATURAL DICARBOXYLIC ACIDS: TOWARD GREEN ALTERNATIVES TO POLYACRYLATES

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As the world moves towards a circular economy, lignocellulosic biomass is becoming an important renewable resource. Its wide availability, carbon neutrality and the fact that its utilisation does not compete with the food chain make it one of the most important resources for modern sustainable solutions.[1] Nevertheless, only about 30% of agricultural biomass waste is utilised worldwide, while the rest often ends up as waste or is even incinerated.[2] All the main components of biomass, cellulose, lignin and hemicellulose, enable numerous modification reactions due to their specific structural properties, leading to the formation of new useful chemicals and materials, such as cellulose hydrogels.

Cellulose hydrogels are three-dimensional networks that consist of native cellulose or its derivatives and are able to bind large amounts of water in their structure. Due to their properties, these hydrogels are of interest for numerous applications in the medical, agricultural, pharmaceutical, food, textile and paper industries. In the latter sector, hydrogels can be used in packaging to maintain the correct humidity level, which is crucial for the storage of certain products.[3]

In this study, we focussed on the synthesis of cellulose hydrogels cross-linked with natural alkyl dicarboxylic acids (Figure 1). We investigated the influence of the chain length and the concentration of the crosslinking agent on the absorption properties of the synthesised hydrogels. They showed a very good absorption capacity, reaching up to 60% of the hydrogel weight and thus surpassing the capabilities of commercially available polyacrylate hydrogels, although the degree of swelling of our hydrogels is about 80% lower than that of commercial alternatives. As part of the study, we carried out a multidisciplinary characterisation of the synthesised hydrogels using FTIR spectroscopy, solid-state NMR spectroscopy, thermogravimetric analysis (TGA) and differential scanning calorimetry (DSC).

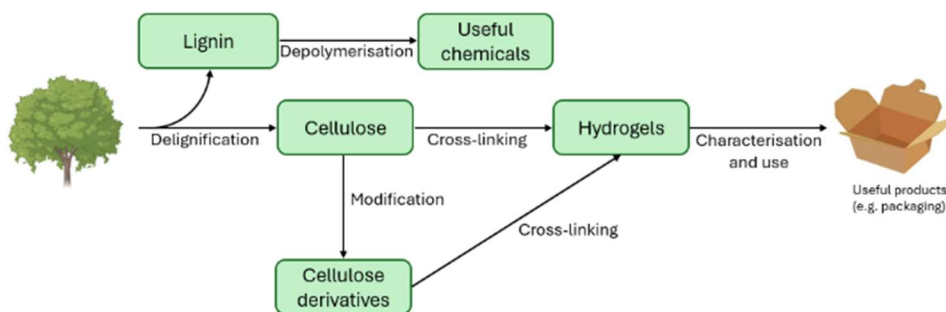


Figure 1. From biomass to hydrogels and their use in the end product.



- [1] G. Izydorczyk, D. Skrzypczak, M. Mironiuk, K. Mikula, M. Samoraj, F. Gil, R. Taf, K. Moustakas, K. Chojnacka, Lignocellulosic biomass fertilizers: Production, characterization, and agri-applications. *Science of the Total Environment*. **2024**, 923, 171343.
- [2] K.-T. Lee, W.-H. Chen, P. Sarles, Y.-K. Park, Y. S. Ok, Recover energy and materials from agricultural waste via thermochemical conversion. *One Earth*. **2022**, 5, 12, 1404.
- [3] A. K. Singh, P. I., Y. S. Lee, State-of-the-Art Insights and Potential Applications of Cellulose-Based Hydrogels in Food Packaging: Advances towards Sustainable Trends. *Gels*. **2023**, 9, 433.

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PRIPRAVA IN UPORABA NANOCELULOZNIH HIDROGELOV

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Bakterijska nanoceluloza (BNC) je posebna oblika celuloze, ki jo proizvajajo mikroorganizmi in se bistveno razlikuje od rastlinske celuloze, ki je osnovna surovina papirne industrije. Medtem ko rastlinska vlakna vsebujejo lignin in hemiceluloze ter so v mikrometrskem merilu, je BNC sestavljena iz povsem čistih nanofibril premera nekaj deset nanometrov. Zaradi te nanostrukture se BNC odlikuje po visoki kristaliničnosti, biokompatibilnosti in izjemni sposobnosti zadrževanja vode. Na osnovi teh lastnosti je mogoče pripraviti hidrogelne formulacije, ki temeljijo na tridimenzionalni nanofibrilarni mreži BNC, nasičeni z vodo. Te formulacije odlikujejo primerne reološke lastnosti, ki zagotavljajo stabilnost in možnost prilagajanja različnim aplikacijam. Poseben potencial kažejo na področju embalaže, kjer lahko služijo kot trajnostna in biološko razgradljiva alternativa plastičnim polimerom. V okviru raziskave so bili hidrogeli na osnovi BNC in kationskega škroba že uporabljeni pri 3D-tiskanju, kar je dokazalo njihovo obdelovalnost in možnost oblikovanja kompleksnih struktur. Trenutne raziskave so usmerjene v dodelavo hidrogelnih formulacij ter v proučevanje vpliva posameznih dodatkov na njihovo stabilnost, reološke lastnosti in primernost za specifične aplikacije. Tak pristop omogoča razvoj materialov, ki so ciljno prilagojeni za uporabo v embalaži ter drugih trajnostnih rešitvah. Dolgoročni cilj je prispevati k razvoju inovativnih in funkcionalnih materialov, ki združujejo trajnost, uporabnost in podporo krožnemu gospodarstvu.

PREPARATION AND APPLICATION OF NANOCELLULOSE HYDROGELS

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Bacterial nanocellulose (BNC) is a unique form of cellulose produced by microorganisms, differing significantly from plant-based cellulose, which is the primary raw material used in the paper industry. While plant fibers contain lignin and hemicelluloses and are micrometre-sized, BNC consists of pure nanofibrils with a diameter of a few tens of nanometers. Due to this nanostructure, BNC is characterized by high crystallinity, biocompatibility, and exceptional water retention capacity. These characteristics enable the preparation of hydrogel formulations based on a three-dimensional nanofibrillar network of BNC, which is saturated with water. These formulations are characterized by suitable rheological properties that ensure stability and adaptability to various applications. They show potential in the field of packaging, where they can serve as a sustainable and biodegradable alternative to plastic polymers. As part of the research, BNC- and cationic starch-based hydrogels have already been used in 3D printing, demonstrating their processability and the potential for forming complex structures. Current research focuses on refining hydrogel formulations and investigating the impact of individual additives on their stability, rheological properties, and suitability for specific applications. This approach enables the development of materials that are specifically tailored for use in packaging and other sustainable solutions. The long-term goal is to contribute to the development of innovative and functional materials that combine sustainability, usability, and support for the circular economy.

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NA KRILIH UČINKOVITOSTI: NAPREDEK NA PODROČJU OPREME IN NADZORA PROCESOV

ON THE WINGS OF EFFICIENCY: ADVANCES IN EQUIPMENT AND PROCESS CONTROL

C-BAR VERTECS: PREIZKUŠENA NOVA TEHNOLOGIJA ČIŠČENJA SNOVI

Axel Dreyer

Voith Paper, Ravensburg, Nemčija

Zahteve pri prebiranju in čiščenju snovi so se v zadnjih letih močno spremenile. Slabše lastnosti surovin za proizvodnjo vlaknin in papirja, ki vsebujejo več nečistoč, in povečevanje proizvodnih stroškov, kot na primer stroškov energije in surovin, so pripeljale do povečanih zahtev po bolj učinkovitih izdelkih in nadaljnjih optimizacijah procesa. Zato morajo vsi proizvajalci papirja povečati svojo učinkovitost s ciljem biti konkurenčni in trajnostni v globalnem okolju industrije celuloze in papirja.

Na tej osnovi je Voith razvil nov profil košare: C-bar Vertecs.

V predavanju bodo predstavljeni rezultati in izkušnje z novo tehnologijo čiščenja. Tokovne analize v povezavi z laboratorijskimi raziskavami so privedle do nove tehnologije. Za oceno učinkovitosti odstranjevanja lepljivk smo uporabili tako obe uveljavljeni metodi (Tappi in Ingede) kot tudi bolj informativno NIR metodo. Slednje nam je omogočilo analizo ločevanja frakcij mikrolepljivk.

Več testov v proizvodnji je pokazalo, da je nova izvedba košare povečala pretok za več kot 20 % ob hkratnem ohranjanju ali celo izboljšanju učinkovitosti ločevanja lepljivk in nečistoč. To obstoječim sistemom čiščenja omogoča obvladovanje omejitev z vidika kapacitete in učinkovitosti ločevanja. Rezultat je povečanje produktivnosti brez kompromisa pri kakovosti, ki se lahko celo izboljša. Povedano na kratko – postavili smo nov standard v zanesljivosti čiščenja. Vgradnja Vertecs košar omogoča zmanjšanje porabe energije. Ob povečanju produktivnosti za več kot 20 % ostaja hitrost rotorja enaka kot do sedaj. Rezultat je znižanje energije, porabljene za čiščenje, na tono snovi.

C-BAR VERTECS: A PROVEN NEW SCREENING TECHNOLOGY

Axel Dreyer

Voith Paper, Ravensburg, Germany

Screening requirements have changed tremendously over the last years. Inferior raw material properties with higher levels of impurities for pulp and paper as well as increasing papermaking manufacturing costs, like energy and raw materials, have led to higher demands for more efficient products and to further process optimizations. Therefore, all paper makers must increase their effectiveness in order to compete and be sustainable in the globalized pulp and paper industry environment.

Based on this, Voith has developed a new profile basket: the C-bar Vertecs.

In this lecture, the latest results and insights of this novel sorting technology will be presented. Flow analysis to extensive tests with laboratory investigations led to the new technology. To assess the sticky removal efficiency, we used both the established Ingede or Tappi methods, as well as the more informative NIR method. This also allowed for the analysis of the separation of microsticky fractions.

Several field tests reveal that the new screen basket invention boosts throughput by far over 20% while maintaining or even enhancing the efficiency of sticky and dirt spec separation. This allows current screening sections to handle production constraints such as capacity and separation effectiveness. As a result, production rates are increased without compromising, and potentially even improving, the quality standard. In summary, we have established a new benchmark in screening reliability. The installation of a Vertecs screen basket allows a reduction in energy demand. With increased production by over 20%, the rotor speed remains at its current speed. As a result, the energy used per ton in the screening process is effectively reduced.

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ZMANJŠANJE OBRATOVALNIH STROŠKOV V PRIPRAVI SNOVI

David Dostál

Bellmer Czech, Litovel, Češka

Obstoječe linije za pripravo snovi obratujejo na meji zmogljivosti. Delež mokromočnih ali različnih bariernih papirjev v mešanici odpadnega papirja se povečuje. Bellmer predstavlja novo opremo z boljšo učinkovitostjo in modifikacije procesa s ciljem znižanja operativnih stroškov.

Študija na primeru uporabe Turbo Desintergratorja v finem čiščenju prikazuje način za zmanjšanje izgube vlaken in stroškov rejekta.

REDUCTION OF OPERATING COSTS AT STOCK PREPARATION

David Dostál

Bellmer Czech, Litovel, Češka

The existing material preparation lines are operating at full capacity. The proportion of wet-strength and barrier papers in the waste paper mix is increasing. Bellmer is presenting new, more efficient equipment and process modifications aimed at reducing operating costs.

A case study on the use of the Turbo Disintegrator in fine cleaning demonstrates how to minimise fibre loss and reduce costs associated with rejects.

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SAMOREGULIRAJOČE TESNENJE ZA IZBOLJŠANO PRODUKTIVNOST ZELO HITRIH PAPIRNIH STROJEV

Juha Leimu¹. Nenad Milosavljević²

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Sunnea Oy, Jyskä, Finska

Stalen izziv v hitrih papirnih strojih je prenos papirja iz odprtega nipa na strojno vprego. Večina sistemov za izboljšanje tekovnosti stroja se zanaša na fizično tesnjenje, ki vzdržuje cono visokega vakuumu in ustvarja dovolj podtlaka za prenos papirnega traku. Seveda pa se sčasoma tesnila obrabijo, poveča se podtlak v conah z nizkim vakuumom, kar povzroča zvijanje strojne vprege. Rezultat so lahko pretrgi papirnega traku, zmanjšana produktivnost ali celo poškodbe strojne vprege.

Na obrabo tesnil vpliva predvsem njihova pozicija glede na nip in oddaljenost od strojne vprege. Optimizacija teh parametrov lahko do določene mere zmanjša težavo vendar je ne odpravi.

Učinek zvijanja – povzročen zaradi vakuumu, ki vleče strojno vprego proti tesnilu – je še posebej problematičen pri rigidnih ravnih tesnilih. Neenakomerna napetost strojne vprege pogosto vodi v poškodbe tesnila. Zmanjšanje tega tveganja zahteva natančno kontrolo pozicije tesnila po celotni širini stroja.

Predlagana rešitev je samoregulirajoči sistem tesnjenja, ki ohranja konstantno razdaljo med tesnilom in strojno vprego, zmanjšuje obrabo in stabilizira delovanje. Predstavljena nova zasnova, potrjena s teoretično analizo in laboratorijskimi testi, obljublja velik potencial v okviru potekajočih poskusov.

SELF-REGULATING SEALING SOLUTION FOR IMPROVED RUNNABILITY AT HIGH-SPEED PAPER MACHINES

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²Abo Akademi University, Faculty of Science and Engineering, Laboratory of Process and Systems Engineering, Turku, Finland

Sunnea Oy, Consulting & Engineering, Air Systems, Drying & Runnability of Paper, Board and Tissue Machines, Jyskä, Finland

A common challenge in high-speed paper machines is transferring the paper sheet from the opening nip to the fabric. Most runnability systems rely on physical sealing to maintain a high-vacuum zone, generating sufficient underpressure to facilitate this transfer. Over time, however, these seals wear down, increasing underpressure in low-vacuum zones and causing fabric bending. This can result in paper breaks, reduced runnability, or even damage to the fabric.

Seal wear is mainly influenced by its position relative to the nip and its distance from the fabric. Optimizing these parameters can mitigate the problem to some extent, but not eliminate it. The bending effect—caused by vacuum suction pulling the fabric toward the seal—is particularly problematic for rigid, straight seals. Uneven fabric tension often leads to edge seal damage. Minimizing this risk requires precise control of the seal position across the machine width. The proposed solution is a self-regulating seal system that maintains a constant seal-to-fabric distance, reducing wear and stabilizing operation. Supported by theoretical analysis and lab-scale test results, this new design shows promising potential in ongoing trials.

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MANJ NAPORA, VEČJI UČINEK: MI PREMIKAMO PAPIR – VARČEVANJE Z VIRI S POMOČJO IZDELKOV PODJETJA RÖCHLING INDUSTRIAL OEPPING

Roland Eckerstorfer

Röchling Industrial Oepping, Oepping, Avstrija

Učinkovitost in trajnostnost sta v današnji industriji papirja pomembnejši kot kdaj koli. Odkrijte kako smo skupaj z našimi partnerji uresničili koncept »manj napora, več učinka« in prispevali k ohranjanju virov ter k bolj trajnostni prihodnosti. V prispevku predstavljamo zgodbe o uspehu naših partnerjev in primere dobrih praks za različne produkte s ciljem doseganja merljivih prihrankov in koristi kot so **zmanjšanje porabe energije, zmanjšanje porabe vlaknin in škroba, zmanjšanje porabe vode, izboljšanje kakovosti papirja in povečanje produktivnosti**.

Kontrola roba papirnega traku ROBALIT WEC

Ta sistem je izdelan iz posebnega materiala ROBALIT61. Na obeh straneh omejuje tok papirne suspenzije in bistveno zmanjša izgube vlaken na tem mestu. V primerjavi z razredčenim robom pri uporabi navadnih šob za rob papirnega traku, so robovi papirnega traku močnejši in bolj odporni na zatrge. Slednje izboljša tekovnost papirja in zmanjša število pretrgov. Zaradi povečanja jakosti roba papirnega traku (do + 50 %) in zaradi bolj stabilnega, pravilnega roba papirja se število pretrgov zmanjša tudi do 35 %.

ROBACERAM PX

ROBACERAM PX je unikaten premium keramični material za izdelavo elementov za odvodnjavanje, ki ga proizvaja Röchling Industrial Oepping. Zaradi svoje enkratne sestave in specialnega proizvodnega procesa, ta vrsta materiala prinaša mnogo prednosti pri doseganju učinkovitost v procesu proizvodnje papirja – **prihranek energije zaradi zmanjšanja pogonske moči, daljšo življenjsko dobo strojne vprege in maksimalno odpornost na toplotne šoke**. Z ROBACERAM PX lahko pomembno zmanjšamo pogonsko obremenitev v sitovi skupini in skupini stiskalnic. Slednje vodi do 13 % prihranka energije brez izgub pri produktivnosti.

SmartTable

SmartTable predstavlja inteligentno rešitev za sitovo skupino pri strojih z dolgim sitom, predvsem pri širokem naboru različnih produktov in hitrosti strojev. Pametna tehnologija prinaša številne prednosti pri doseganju učinkovite proizvodnje papirja za vsako posamezno sorto papirja. Ključne prednosti SmartTable so bistveno izboljšana kakovost papirja, boljše mehanske lastnosti, kot na primer RCT, SCT, CMT, izboljšana formacija, večja produktivnost in manjša poraba energije.

PressSaver

PressSaver so perforirani pokrovi za sesalne omare za odsesavanje vode iz klobučevin (uhle-box). Na voljo so v različnih materialih, od čisto polimernih do čisto keramičnih materialov ali premium keramičnega materiala SL200B, pokrovi so narejeni tako da maksimirajo učinkovitost odvodnjavanja in minimirajo porabo energije.

SmartRoll

Nov in edinstven SmartRoll neprestano prinaša informacije o stanju posameznih komponent med obratovanjem – o obrabi, tlačni obremenitvi in temperaturi. To je prvi primer, ko imata operater in vzdrževalec vpogled v valje med obratovanjem. SmartRoll nadzira vodo za podmazovanje in tlačno obremenitev v tesnilih in tako poveča učinkovitost ter podaljša življenjsko dobo tesnil. Prednosti SmartRoll so visoka varnost delovanja, učinkovit tek stroja, in možnost planiranega vzdrževanja.

Robacoat

Na področju premaznih agregatov in filmpreš pričakujemo, da so uporabljene komponente izjemno zanesljive. Kakovost materialov uporabljenih za ROBACOAT-B in ROBACOAT-PB nosilce palic (raklov) zagotavlja maksimalno varnost in učinkovitost. Za proizvodnjo obeh izdelkov je uporabljen proces dolgotrajnega tlačnega sintranja. Posebej izbrani dodatki in najvišja molekulska masa osnovnega materiala zmanjšujejo koeficient trenja med nosilcem in rotirajočo palico na minimum.

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Wire edge control ROBALIT WEC

This system is made of the special material ROBALIT61. It limits the paper suspension to both sides and significantly reduces fiber loss there. Compared to the diluted edge are of common edge showers, the paper edges are stronger and more resistant to tearing. This improves the runability and reduces paper breaks. Due to the increased strength of the paper edge (up to +50%) and a more stable accurate paper edge, paper breaks are reduced by up to -35%.

ROBACERAM PX

ROBACERAM PX is a unique premium ceramic material for dewatering elements from Röchling Industrial Oepping. Thanks to its unique material composition and the special production process, this material grade brings numerous benefits to achieve an efficient paper production process, like **Energy saving by the reduction of driving power, Longer fabric lifetime and maximum thermal shock resistance**. With ROBACERAM PX the drive load of wire section and press section can be significantly reduced. This leads to an energy saving of up to 13% without any losses on the performance.

SmartTable

SmartTable defines the intelligent wire section solution for machines with fourdrinier wire tables especially for a wide range of different products and machine speeds. The smart technology brings numerous benefits to achieve an efficient paper production process for each paper grade. Key advantages of SmartTable are significantly improve paper quality, increase strength properties like RCT, SCT, CMT, improve formation, increase production output and reduce energy consumption

PressSaver

PressSavers are perforated covers for uhle boxes for felt dewatering in press sections. Available in different material options, from full-poly version to the full ceramic material in premium ceramic material SL200B, the covers are design to maximize dewatering efficiency and minimize energy consumption.

SmartRoll

The new and unique SmartRoll continuously delivers information about the condition of the single components during operation, like wear, loading pressure and temperature. This is the first time, that the operator and maintenance get a view inside the roll during production. The SmartRoll controls lubrication water and loading pressure to maximize the efficiency and enhancing lifetime of the seals. Benefits of the SmartRoll are high operational safety, efficient machine runability and Forward-looking planning possible.

Robacoat

In the area of coating units and film presses, the components used are expected to be extremely reliable. The material qualities of the ROBACOAT-B and ROBACOAT-PB doctor beds stand for maximum safety and efficiency. This application is manufactured using the long-term sintering press process. Specially selected additives and the highest molecular weight of the base material reduce the friction coefficient between the doctor bed and the rod to a minimum.



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VALMET PERFORMANCE CENTER – PODPORA ZA ZMOGLJIVOST IN ZANESLJIVOST

Ville-Veikko PÄTÄRI

Valmet, Espoo, Finska

Valmet Performance Center (VPC) je vogelni kamen Valmetove strategije servisa na daljavo in digitalne podpore, ki strankam v industriji vlaknin in celuloze ter v energetskega sektorju v realnem času nudi dostop do strokovnega znanja in napredne analitike. Preko varnih digitalnih povezav VPC omogoča proaktivno podporo, prediktivno vzdrževanje in optimizacijo procesa ter na ta način pomaga strankam dosegati večjo zanesljivost, učinkovitost in trajnost.

VPC deluje globalno, s centri lociranimi na Finskem, na Kitajskem, v severni Ameriki in južni Ameriki ter na ta način zagotavlja lokalno storitev podprto z Valmetovim poglobljenim znanjem. Prednosti za stranke so:

- **diagnostika in reševanje težav (troubleshooting) na daljavo,**
- **neprestan nadzor učinkovitosti,**
- **strokovno sodelovanje in hitri odzivni časi,**
- **integracija z Valmet Industrial Internet tools (VII).**

Valmet Industrial Internet (VII) dopolnjuje VPC z zagotavljanjem digitalne infrastrukture za zbiranje podatkov, analizo in vizualizacijo. VII povezuje industrijska sredstva v varno omrežje, podpira vpoglede v realnem času in analizo iz zgodovinskih podatkov. VPC in VII skupaj tvorita sinergističen ekosistem ki podatke pretvarja v uporabno inteligenco.

Predstavitev vključuje referenčne primere, ki prikazujejo oprijemljive prednosti VPC in VII. Opisani primeri izpostavljajo izboljšave v proizvodni učinkovitosti, skrajšanje zastojev, izboljšanje kakovosti izdelka in uspešne intervencije na podlagi prediktivnega vzdrževanja.

VALMET PERFORMANCE CENTER SUPPORTING PERFORMANCE AND RELIABILITY

Ville-Veikko PÄTÄRI

Valmet, Espoo, Finska

Valmet Performance Center (VPC) is the cornerstone of Valmet's remote service and digital support strategy, offering customers in the pulp, paper, and energy sectors real-time access to expert knowledge and advanced analytics. Through secure digital connections, VPC enables proactive support, predictive maintenance, and process optimization - helping customers achieve higher reliability, efficiency, and sustainability.

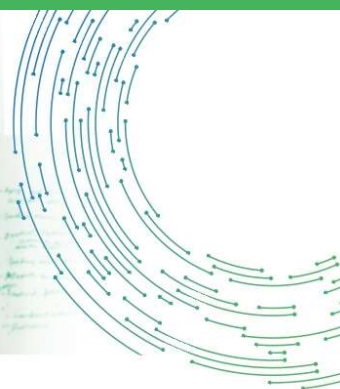
VPC operates globally, with centers located in Finland, China, North America, and South America, ensuring localized service backed by Valmet's deep domain expertise. Customers benefit from:

- **Remote diagnostics and troubleshooting**
- **Continuous performance monitoring**
- **Expert collaboration and fast response times**
- **Integration with Valmet Industrial Internet tools (VII)**

The **Valmet Industrial Internet (VII)** complements VPC by providing the digital infrastructure for data collection, analysis, and visualization. VII connects industrial assets into a secure network, supporting real-time insights and analysis from historical data. Together, VPC and VII form a synergistic ecosystem that transforms data into actionable intelligence.

The presentation includes **reference cases** that demonstrate the tangible benefits of VPC and VII. These cases highlight improvements in production efficiency, reduced downtime, enhanced product quality, and successful predictive maintenance interventions.

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NA KRILIH ZMOGLJIVOSTI: MATERIALI IN DODATKI KOT GONILO SPREMEMB

ON THE WINGS OF PERFORMANCE: MATERIALS AND ADDITIVES DRIVING CHANGE

REŠITVE ZA ZAHTEVNO PROIZVODNJO EMBALAŽNEGA PAPIRJA – INOVATIVNI PRISTOPI ZA VEČKRATNO OBDELAVO

Joachim Hege – vodja tehnologije Servophil AG
Stefan Franke – poslovni direktor za papir Servophil AG

Zlasti industrija embalažnega papirja se sooča z vrsto procesnih težav, ki jih povzroča potreba po zapiranju vodnih krogov in poslabšanje kakovosti predelanega papirja. V preteklih letih je Servophil razvil več možnosti obdelave, da bi rešil težave v tej industriji z okolju prijaznimi rešitvami.

Mnogi kupci imajo težave s kisanjem procesne vode. Oksidativni biocidni sistemi lahko pomagajo, vendar so potrebne visoke odmerke. To vodi do sekundarnih težav, kot je korozija. Povišanje pH s kaustičnimi dodatki je prav tako mogoče, vendar pH ni stabilen in se zelo hitro poslabša.

Servophil je razvil strategije za rešitev tega problema. Postopek vključuje analizo sistema stranke in pripravo predloga, prilagojenega procesnim pogojem stranke. Primeri uporabe so:

- SCS (oksidativno spletno čiščenje, ServoCleanSystem) v kombinaciji s kalcijevim hidroksidom ali kaustično sodo
- S-BACPRO (funkcionalno čistilo na osnovi bakterij) v kombinaciji s kalcijevim hidroksidom ali kaustično sodo

S temi strateškimi pristopi so naši kupci izboljšali svoje procese v več smereh:

- Zmanjšali so topnost kalcijevega karbonata iz surovin iz recikliranega papirja, s čimer so povečali donos
- Preprečili so nastajanje oblog iz raztopljenega kalcijevega karbonata
- Nadzorovali so vnos kalcija v čistilno napravo in zaščitili anaerobne reaktorje
- Nadzorovali so bakteriološko okolje v sistemu procesne vode in sistem preusmerili iz anaerobnega v aerobno okolje
- Zaščitili so sistem pred organskimi usedlinami in biološkimi oblogami

Dodatki, ki nadzorujejo bakterije, ki proizvajajo organske kisline, v kombinaciji s kaustičnimi dodatki, so tehnični preboj.

SOLUTIONS FOR DEMANDING PACKAGING PAPER PRODUCTION - INNOVATIVE MULTIPLE TREATMENT APPROACHES

Joachim Hege – Technology Manager Servophil AG
Stefan Franke – Business Director Paper Servophil AG

The packaging paper industry in particular is facing a number of process problems caused by the need to close water loops and the deterioration of recovered paper quality. Over the years, Servophil has developed several treatment options to solve the problems in this industry with environmentally friendly solutions.

Many customers have a problem with acidification of their process water. Oxidative biocide systems can help, but high doses are required. This leads to secondary problems such as corrosion. Raising the pH with caustic additives is also possible, but the pH is not stable and degrades very quickly.

Servophil has developed strategies to solve this problem. The procedure is to analyse the customer's system followed by a proposal customized to the customer's process conditions.

Examples of applications are:

- SCS (oxidative online cleaning, ServoCleanSystem) in combination with calcium hydroxide or caustic soda
- S-BACPRO (functional bacteria-based cleaning agent) in combination with calcium hydroxide or caustic soda

With these strategic approaches, our customers have improved their process in several directions:

- Reduce the solubility of calcium carbonate from recovered paper feedstocks, thereby increasing yield
- Avoid scaling from dissolved calcium carbonate
- Controlling the calcium load to the effluent plant and protecting anaerobic reactors
- Control the bacteriological environment in the process water system and move the system from an anaerobic to an aerobic environment
- Protect the system from organic deposits and biological fouling

Additives that control organic acid producing bacteria in combination with caustic additives are the technical breakthrough.



Lukas und Thomas Villforth



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Villforth Siebtechnik GmbH is located in Reutlingen, Germany and can look back on more than 150 years of company tradition. Today, Thomas and Lukas Villforth are running the company in the fourth and fifth generation. Villforth Siebtechnik is specialized in the manufacturing and sale of synthetic fabrics, especially forming fabrics for the paper industry. All of them are made in Southern Germany in accordance with the highest quality standards.

Today, the customer base also includes other industries such as fiberboard and chipboard, food industry, leather fiber, glass nonwoven and nonwoven industry in general. Through our global distribution network, Villforth is represented in more than 25 countries all over the world.

The size of the business enables us to take quick and unbureaucratic decisions and thus rapid implementations. We have a strong team, consisting of specialists of both, textile and paper industries. All of our products are manufactured in Reutlingen, Southern Germany. For us at Villforth it is important to guarantee the highest quality standards. We provide tailor-made applications. Our research and development teams are working at maximum speed to meet the fast changing and increasing demands of our customers.

We are proud of the completely unique procedure for the seam of TAD dryer fabrics. At the moment, this product is setting one run-time record after another.

The newly developed **V-POWERLINE** series allows further modification of the forming fabrics to match every specific requirement:

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Abrasion resistant machine side for long fabric lifetime: reduced machine downtimes with increased lifetime potential of the fabric is leading to an overall cost reduction.

eRun

Newly developed yarn material for reduced power consumption: based on the low coefficient of friction, the drive power in the wire section can be reduced. Furthermore, the special yarn material favors a flat lying fabric and prevents edge curling.

TOPAZ[®]NT

The unique Topaz NT coating of the fabric covers the filaments and crossing points of the fabric: preventing the contaminants of fibers and is leading to a cleaner fabric. Simultaneously, the coating increases the dimensional stability of the fabric by approximately 30%.

FENNOBOND 777E: PRIROČNA REŠITEV „PUMP & GO” ZA VRHUNSKO TRDNOST V SUHEM

Christian Biermann^{1*}, Mikko Virtanen²

¹ Kemira Chemicals Germany GmbH, Germany

² Kemira Oyj, Energiakatu 4, Helsinki, Finland,

V zadnjih petih letih se proizvajalci papirja soočajo z naraščajočimi stroški surovin, zlasti kadar potrebujejo močne vlaknine.

In the beginning of 2025, cellulose fibres reached a historical high price gap between strong, long fibres and the cheaper short fibres.

Medtem ko cene recikliranih vlaken ostajajo povprečne, se njihova trdnost še naprej zmanjšuje. V proces recikliranja pride vse manj kraft papirja, stopnja recikliranja papirja pa se je povečala. Hkrati se nadaljuje trend proizvodnje lažjega, trdnega papirja za izdelavo bolj trajnostnih izdelkov.

Tradicionalno se je kationski škrob uporabljal za dodatno trdnost poleg trdnosti surovine in površinske obdelave. Vendar pa je ta možnost zaradi povečane prevodnosti v krogu papirniškega stroja postala manj izvedljiva. Glikoksiliran poliakrilamid (GPAM) ostaja alternativa, vendar zahteva zapleteno opremo in ravnanje z glikoksalom v papirnici.

FennoBond 777E se je izkazal kot učinkovita alternativa: enostaven za uporabo in zmožen zagotoviti podobno povečanje trdnosti kot GPAM. Na lokaciji stranke ni treba ravnati s škodljivimi snovmi. Glede na trenutne izzive na trgu FennoBond 777E ponuja učinkovito rešitev, ki obravnava visoke stroške in upadajočo trdnost surovin.

Ta predstavitev bo obravnavala trenutno stanje na trgu. Po predstavitvi FennoBond 777E bodo predstavljene študije primerov: o celuloznem papirju, papirju na osnovi RCF in sodobnem stroju za proizvodnjo visoko trdnega podložnega papirja.

Ključne besede: suha trdnost, enostavnost ravnanja, podložni papir, papir

FENNOBOND 777E: THE CONVINIENT 'PUMP & GO' SOLUTION FOR SUPERIOR DRY STRENGTH

Christian Biermann^{1*}, Mikko Virtanen²

¹ Kemira Chemicals Germany GmbH, Germany

² Kemira Oyj, Energiakatu 4, Helsinki, Finland,

Over the past five years, papermakers have been facing increasing raw material costs, particularly when needing strong fibres.

In the beginning of 2025, cellulose fibres reached a historical high price gap between strong, long fibres and the cheaper short fibres.

While recycled fibre prices remain average, the strength of these fibres continues to decline. Less and less kraft paper reaches the recycling process, and the paper recycling rate increased. At the same time, there is an ongoing trend to lightweight strong paper to produce more sustainable products.

Traditionally, cationic starch was used to provide additional strength on top of the strength of the furnish and surface treatment. However, due to increased conductivity in the paper machine circuit, this option becomes less viable. Glyoxylated polyacrylamide (GPAM) remains an alternative but requires complex equipment and handling of glyoxal at the paper mill.

FennoBond 777E has emerged as an efficient alternative: easy to handle and able to provide strength increase similar to GPAM. No harmful substances need to be handled at the customer site. Given the current market challenges, FennoBond 777E offers an effective solution, addressing the high costs and declining strength of raw materials.

This presentation will cover the current market situation. After introducing the FennoBond 777E, case studies will be presented: on cellulose-based tissue, RCF-based tissue and a modern test liner machine producing high strength liner.

Keywords: dry strength, ease of handling, liner, tissue

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KONSISTENCA, UČINKOVITOST IN ZMOGLJIVOST: PRENOS LABORATORIJSKIH SPOZNANJ V INDUSTRIJO

Dr. Saide Umerova, Andrea Babić, Lucija Lončar, Mateja Černevshek, Maja Lešnik

Calcit d.o.o., Stahovica, Slovenija

Calcit je eden izmed vodilnih evropskih proizvajalcev kalcijevo-karbonatnih pigmentov, funkcionalnih dodatkov in granul, ki ponuja širok nabor izdelkov, zasnovanih za potrebe industrij, kot so papirna, plastična, barvarska, steklarska, farmacevtska, gradbena in kmetijska. Naši izdelki WPSD HydroPlex, vrhunski NPSD CoverPlex in novi CoverCoat so cenjeni zaradi svoje visoke kemijske čistosti, odličnih optičnih lastnosti in posebej zasnovanih porazdelitev velikosti delcev. Zaradi omenjenih lastnosti so še posebej primerni kot polnila in premazi v papirni in kartonski industriji. Z nenehnimi inovacijami in poglobljenim razumevanjem mineralnih kombinacij je Calcit dobro pripravljen na izpolnjevanje visokih standardov konkurenčnega trga.

Calcit sledi jasnemu in strukturiranemu pristopu za povezovanje laboratorijskih raziskav z dejanskimi proizvodnimi pogoji. S tesnim posnemanjem industrijskih procesov v laboratoriju lahko zanesljivo napovemo učinkovitost izdelka in natančno prilagodimo formulacije pred povečanjem obsega proizvodnje.

V enem izmed nedavnih primerov je bila učinkovitost izdelka ocenjena skozi vse faze razvoja — od laboratorijskega testiranja, preko pilotnih premaznih poskusov, do industrijske uporabe v polnem obsegu na premazni liniji z t.i. zavesnim nanosom (curtain coater). Laboratorijski testi so bili zasnovani tako, da odražajo ključne parametre kupčevega procesa premazovanja, čemur so sledili pilotni poskusi za potrditev možnosti povečanja obsega v nadzorovanih, a dinamičnih pogojih. Rezultati so pokazali izjemno konsistentnost na vseh ravneh, pri čemer je industrijski preizkus pokazal močno skladnost z laboratorijskimi podatki, kar potrjuje natančnost te metode in tehnično prednost, ki jo Calcit prinaša svojim kupcem.

Od razvoja pigmentov do učinkovitosti premazov in izboljšav procesov Calcit nudi praktično podporo, ki kupcem pomaga izboljšati kakovost izdelkov, povečati učinkovitost ter izpolniti zahtevne tržne potrebe. Ta praktičen in sodelovalen način dela dokazuje, da Calcit ni le dobavitelj materialov, temveč zanesljiv partner pri inovacijah skozi celotno vrednostno verigo.

CONSISTENCY, EFFICIENCY AND PERFORMANCE: TRANSLATING LAB INSIGHTS INTO INDUSTRIAL VALUE

Dr. Saide Umerova, Andrea Babić, Lucija Lončar, Mateja Černevshek, Maja Lešnik

Calcit d.o.o., Stahovica, Slovenija

Calcit is one of the leading European producers of calcium carbonate pigments, functional additives, and granulates, offering a wide range of products designed to meet the needs of industries such as paper, plastics, paints, glass, pharmaceuticals, construction, and agriculture. Our WPSD HydroPlex, premium NPSD CoverPlex and new CoverCoat products are valued for their high chemical purity, excellent optical properties, and specifically designed particle size distributions. These features make them especially suitable as fillers and coating pigments in the paper and board industry. With continuous innovation and strong understanding of mineral combinations, Calcit is well positioned to meet the high standards of a competitive market.

Calcit follows a clear and structured approach to connect laboratory research with real production conditions. By closely replicating industrial processes in the lab, we are capable of reliably predicting product performance and fine-tune formulations before scaling up.

In one recent case study, product performance was evaluated across all development stages — from laboratory testing, through pilot coating trials, to full-scale industrial application on curtain coater. Laboratory tests were designed to reflect key parameters of the customer's coating process, followed by pilot trials to confirm scalability under controlled but dynamic conditions. The results demonstrated excellent consistency across all levels, with the industrial trial showing strong alignment with lab data, confirming the accuracy of this method and the technical strength Calcit brings to its customers.

From pigment development to coating performance and process improvements, Calcit offers hands-on support that helps customers improve product quality, increase efficiency, and meet demanding market requirements. This practical and collaborative way of working shows that Calcit is not just a materials supplier, but a reliable partner in innovation across the entire value chain.



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OPTIMIZACIJA ZA UČINEK: SUBTILNE SPREMEMBE, KI SPODBUJAJO TRAJNOSTNO PROIZVODNJO PAPIRJA

David Prevost, vodja tehnične službe

Omya International AG

Omya je vodilni svetovni dobavitelj industrijskih mineralov, ki ponuja širok portfelj izdelkov, prilagojenih za uporabo kot polnila in v premazih v papirni industriji. Temelj uspeha družbe Omya je močna tehnična podpora kupcem, ki ima ključno vlogo pri prepoznavanju najustreznejših izdelkov in zagotavljanju njihove učinkovite implementacije. V zadnjih letih je trajnost postala osrednje vodilo v industriji proizvodnje papirja, kar vpliva na razvoj izdelkov in strategije njihove uporabe.

Na podlagi obsežnih izkušenj in številnih referenčnih projektov je Omya razvila strukturiran pristop k obravnavi izzivov kupcev. Ta vključuje jasno opredelitev problema, predlaganje več možnih rešitev ter na koncu vključitev najučinkovitejše možnosti v rutinske operacije.

Ta prispevek izpostavlja optimizacijo premaznih formulacij s poudarkom na izboljšanju trajnosti. Prva študija primera raziskuje možnosti povečanja suhe snovi v premazu, kar lahko vodi do znatnega zmanjšanja porabe energije za sušenje. Drugi primer obravnava zmanjšanje vsebnosti veziva in njegov pozitiven vpliv na zmanjšanje celotnega ogljičnega odtisa procesa premazovanja. Tretji primer se osredotoča na optimizacijo optičnih belilnih sredstev (OBA) ter prikazuje, kako lahko prilagoditve vrste in doziranja prinesejo tako okoljske kot zmogljivostne prednosti.

Skupaj ti primeri prikazujejo, kako lahko ciljno usmerjene spremembe formulacij prispevajo k bolj trajnostni proizvodnji papirja, skladno s cilji industrije glede energetske učinkovitosti in zmanjševanja vplivov na okolje.

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NA KRILIH TRAJNOSTI: KROŽNO GOSPODARSTVO IN ENERGETSKA UČINKOVITOST

WINGS OF SUSTAINABILITY: CIRCULAR ECONOMY AND ENERGY EFFICIENCY

„VRNITE GA, NE SEŽIGAJTE GA – RECIKLIRANJE PAPIRNIH STROJNIH OBLAČIL ZA OGLJIČNO NEVTRALNI MATERIALNI KROGOTOK“

Jan Freudenberg, Andritz Fabrics and Rolls, Reutlingen, Germany
Klemens rauch, Andritz Fabrics and Rolls, Reutlingen, Germany
Niklas Bäumer, HolyPoly, Dresden, Germany

Program vračanja rabljenih oblačil za papirniške stroje, ki ga je razvila družba ANDRITZ v sodelovanju z družbo HolyPoly, ima za cilj strokovno predelavo pridobljenih materialov in njihovo ponovno uporabo za proizvodnjo novih izdelkov. Končni cilj je zaprtje kroga v proizvodnji oblačil z vključitvijo recikliranih materialov.

Da bi to dosegli, ANDRITZ svojim strankam ponuja ekskluzivno storitev: ustrezno recikliranje vseh stiskalnih filcev in oblikovalnih tkanin – ne glede na njihovega proizvajalca originalne opreme – s popolno preglednostjo recikliranja. V sodelovanju s podjetjem HolyPoly se vzpostavljajo in nenehno optimizirajo potrebni reciklrni procesi. Pri recikliranju je treba premagati več izzivov, med drugim visoko vsebnost vlage v tkaninah in onesnaženje iz procesa proizvodnje papirja. Dodatne tuje snovi je treba odstraniti, materialni tok pa je treba nenehno nadzorovati. Tiskarske blazine in oblikovalne tkanine so pogosto sestavljene iz različnih plastike, ki se lahko loči in reciklira po vrsti ali ponovno uporabi kot kompozitni materiali. Sama tehnologija ni dovolj. Učinkovita logistika, skladnost z zakonodajo in globoko razumevanje posebnih potreb papirnic so prav tako bistveni za uspešno vključitev v obstoječe dejavnosti. S programom vračanja ANDRITZ lahko proizvajalci papirja zagotovijo, da se njihova rabljena strojna oprema ne sežge ali odloži na odlagališču, ampak reciklira, kar pozitivno vpliva na njihov odtis odpadkov.

To trajnostno sodelovanje med podjetjema ANDRITZ in HolyPoly evropsko papirno industrijo približuje podnebni nevtralnosti in omogoča razvoj krožnih, reciklrnih oblačil za papirniške stroje.

"RETURN IT, DON'T BURN IT - RECYCLING OF PAPER MACHINE CLOTHING FOR A CARBON NEUTRAL MATERIAL CYCLE"

Jan Freudenberg, Andritz Fabrics and Rolls, Reutlingen, Germany
Klemens rauch, Andritz Fabrics and Rolls, Reutlingen, Germany
Niklas Bäumer, HolyPoly, Dresden, Germany

The return program for used paper machine clothing, developed by ANDRITZ in collaboration with HolyPoly, aims to professionally process recovered materials and make them available for the production of new products. The ultimate goal is to close the loop in clothing production by incorporating recycled materials.

To achieve this, ANDRITZ offers its customers an exclusive service: the proper recycling of all press felts and forming fabrics—regardless of their OEM—with full transparency of the recycling process. In partnership with HolyPoly, the necessary recycling processes are being established and continuously optimized. In recycling there are several challenges to overcome, including high residual moisture in the fabrics and contamination from the papermaking process.

Additional foreign materials must be removed, and the material stream must be continuously monitored. Press felts and forming fabrics often consist of various plastics, which can either be separated and recycled by type or reused as composite materials. Technology alone is not enough. Efficient logistics, regulatory compliance, and a deep understanding of the specific needs of paper mills are also essential for successful integration into existing operations. Through the ANDRITZ return program, paper manufacturers can ensure that their used machine clothing is no longer burned or landfilled, but instead recycled—positively impacting their waste footprint.

This sustainable collaboration between ANDRITZ and HolyPoly brings the European paper industry one step closer to climate neutrality and enables the development of circular, recyclable paper machine clothing.



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ENERGETSKO SVETOVANJE

Eduardo Fernandes, vodja proizvodnje – energija; Voith Paper

Voithova storitev energetskega svetovanja ponuja celovito analizo porabe energije v strojih za proizvodnjo papirja in pomožnih sistemih. S primerjavo zmogljivosti papirnice z našo interno raziskavo Voith Survey ugotavljamo vrzeli v učinkovitosti in izpostavljammo možnosti za zmanjšanje stroškov in dekarbonizacijo. S pomočjo revizije na kraju samem naredimo pregled porabe energije, ugotovimo glavne porabnike in predlagamo ciljne izboljšave. Naše končno poročilo vključuje strateški pregled potenciala za prihranke, sintezo podatkov in izvedljiva priporočila, razvrščena glede na prilagojene preference. Ta storitev papirnim proizvajalcem omogoča izboljšanje energetske učinkovitosti z učinkovitimi nadgradnjami in ukrepi z nizkimi naložbami, kar podpira trajnost in operativno odličnost.

Pregled prednosti

- Izboljšajte energetske učinkovitost
- Zmanjšajte obratovalne stroške
- Zmanjšajte svoj ogljični odtis
- Izboljšajte parametre trajnosti

ENERGY CONSULTANCY

Eduardo Fernandes, Product Manager – Energy; Voith Paper

Voith's energy consulting service offers a comprehensive analysis of energy consumption in paper machines and auxiliary systems. By benchmarking mill performance against our internal Voith Survey, we identify efficiency gaps and highlight cost-saving and decarbonization opportunities. Through an on-site audit, we map energy use, detect main consumers, and propose targeted improvements. Our final report includes a strategic overview of savings potential, data synthesis, and actionable recommendations - classified according to customized preferences. This service empowers paper producers to enhance energy efficiency with both impactful upgrades and low-investment actions, supporting sustainability and operational excellence.

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OPTIMIZACIJA PORABE ENERGIJE PRI PAPIRNIH STROJIH: VLOGA REDNIH ENERGETSKIH PREGLEDOV

Nenad Milosavljević^{1,2}, Mario Milosavljević²

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Energetsko intenzivna narava sušilnega dela papirnih strojev predstavlja glavno izhodišče industrijskih strategij za optimizacijo porabe energije. To delo raziskuje, kako lahko periodični, strukturirani energetske pregledi služijo kot ključno orodje za izboljšanje energetske učinkovitosti in trajnosti sistemov za proizvodnjo papirja. Študija primera s papirnega stroja podjetja DS Smith prikazuje, kako je optimizacija zračnih sistemov na papirnem stroju, zlasti konfiguracij dovoda in odsesavanja, vodila do merljivih prihrankov energije. Ta izboljšanja niso le zmanjšala obratovalnih stroškov, temveč so prispevala tudi k manjšemu vplivu na okolje ter izboljšani optimizaciji papirnega stroja. Ugotovitve podpirajo vključevanje diagnostike, ki temelji na energetskih pregledih, kot metode nenehnih izboljšav v delovanju papirne industrije.

ENERGY OPTIMIZATION IN PAPER MACHINES: THE ROLE OF REGULAR ENERGY AUDITS

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The energy-intensive nature of the drying section in paper machines makes it a main point for industrial energy optimization strategies. This work explores how periodic, structured energy audits can serve as a key tool in enhancing the energy performance and sustainability of paper production systems. A case study from a DS Smith paper machine illustrates how optimizing air systems at Paper Machine, particularly supply and exhaust configurations led to measurable energy savings. These improvements not only reduced operational costs but also contributed to lower environmental impact and improved optimization of paper machines. The findings support the integration of audit-driven diagnostics as a continuous improvement methodology within paper industry operations.



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