

PTS NEWS

FIBRE based solutions for tomorrow's products

EU Packaging and Packaging Waste Regulation – challenges to be overcome with PTS Research and Services



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Editorial

Dear readers,

The transformation of the paper industry is a huge challenge, but at the same time a source of opportunities. A successful transition requires a combination of progressive technology, devotion, and strategic approach. This will not only enhance the competitive standing of an entity, but also contribute to a more sustainable future. *Papiertechnische Stiftung (PTS)* as the Research and Service Institute of the paper industry plays an important part in research, development, and implementation of a wide range of technologies.

Our support and assistance can act as a driver for progress and innovative strength in the papermaking sector. Further, our training academy offers companies and corporations the opportunity to enlarge and enhance their know-how. It is undisputed that the papermaking industry plays a significant role in the economy and we are proud to be making a contribution.

PPWR – is an abbreviation currently well known to everybody in the packaging sector. In the cover topic of the current issue of this news bulletin, “EU Packaging and Packaging Waste Regulation – challenges to be met with PTS Research and Services”, we present the European Commission proposal for the new Regulation under all its aspects. Here, we maintain a close dialogue with associations and corporations. Together with our customers, we do research on sustainable future-oriented packaging solutions to the benefit of the entire sector and we provide consulting, training and specialised services around these topics. Packaging is a cross-cutting issue and underlies e.g. the systemic importance of the packaging supply chain for the entire economy and society. In this context, our strategic partnership with the Institute of Natural Materials Technology (INT) and the Fraunhofer Institute for Process Engineering and Packaging (IVV) has the potential to cover this subject in an interdisciplinary approach across materials, technologies and value chains.

We as a provider of solutions in the area of research and development on a local, national and international level have shown our presence on various platforms. Members of our team were present at the futureSAX innovation forum: “Energy as a driver for innovation” in Mittweida. There, we had the opportunity to present the development of paper material based fuel cell and electrolysis technologies of the next generation for the conversion and generation of green hydrogen (PtG). At the SME Innovation Day of the Federal Ministry for Economic Affairs and Climate Action (BMWK), PTS presented two forward-looking research projects to industrials, politicians, and scientists. Those projects are focused on the fields of materials and packaging (refer to page 27). Our team members returned from those events with a positive response and new motivation for driving forward the technological papermaking platform.

The second half-year of PTS events is mostly focused on our traditional “PTS Coating Symposium” which is well known across the sector and will take place in Bamberg on 13 and 14 September 2023. This symposium is the international meeting par excellence for industrial, research and development experts to inform themselves about and discuss latest innovations in the coating and surface treatment of paper and board materials.

You are warmly invited to join our discussions on the above-mentioned topics and initiate joint projects.

I hope you enjoy reading this publication and I am looking forward to fresh impetus for possible cooperation with us. I wish you a wonderful summertime.



Yours, Dr. Thorsten Voß
PTS Director



PTS Coating Symposium 2023

13.09 - 14.09.2023 in Bamberg

www.ptspaper.de/veranstaltungen



EU Packaging and Packaging Waste Regulation – challenges to be overcome with PTS Research and Services



Much ado about the European Commission's draft proposal

PPWR – an abbreviation likely to be well known to everyone across the packaging sector. This EU document is so controversial that the pre-final draft leaked to the public already in autumn 2022 has caused a massive stir.

On 30 November 2022, the European Commission published their legislative proposal for revising the current Packaging and Packaging Waste Directive. The lawmaking procedure is underway – the anticipated approximative **timeline** is shown in Figure 1. The revision falls under the goals of the European green deal and the action plan on **circular economy**. The intention is to address and counteract the growing amount of packaging waste. The entire life cycle of packagings is taken into consideration. Figure 2 shows a brief overview of the contents that are most important for the sector.

Regulation instead of a directive – for the sake of the single market

The lawmaking proposal comes in a new form: a directive would first need to be transposed into national law. Changing the form into a **regulation**, however, would mean immediate applicability in all EU member states. The underlying reasoning is to secure the single market by harmonising the requirements. Whether this reasoning is in contrast with the possibility of additional national sustainability measures in the opening clause of Art. 4 (4) is still being discussed.

Detailed provisions in delegated acts of the European Commission

A detailed consideration is indispensable especially in terms of the recyclability of packaging products. However, the Regulation does not intend to lay down detailed provisions in the actual text of the regulation, but to delegate to the European Commission the power to adopt more than 20 delegated acts (Art. 290 of Treaty on the EU). **Delegated acts** are non-legislative legal acts adopted by the Commission with the aim to supplement or amend certain non-essential elements of legislative acts.

Research

Recycling of post-consumer packaging incl. assessment of product residue 2021 – 2024

Inspection method vor visual contaminations / recyclability 2021 – 2024

X-ray inspection of incoming recovered paper 2021 – 2024

Biobased wet-strength agents as substitutes for conventional papermaking additives 2021 – 2023

Biobased fibre-filler compounds 2022 – 2024

PFAS-free greaseproof moulded pulp 2022 – 2025

Conception of recyclable biobased coatings for paper packaging 2021 – 2024

Lignin modification by reactive extrusion for biobased paper coatings 2020 – 2022

Regenerative superhydrophobic coatings of paper products 2020 – 2022

Flavour barrier of packaging papers 2020 – 2022

Barriers with biological brown-algae polymers for paper packaging 2023 – 2025

Manufacture of biobased hotmelts 2021 – 2024

Improved starch adhesives – overall concept 2022 – 2025

Biobased HCHO-free wet-strength agents for starch adhesives for corrugated board 2022 – 2025

Creasing of corrugated board 2021 – 2023

Evaluation of damage to corrugated board 2018 – 2020

Evaluation of packaging composite materials using bending resistance measurement 2019 – 2021

Prediction of formability of paper-based packaging materials 2020 – 2022

Woven paper/textile sandwich structures for lightweight construction panels 2021 – 2023

Double-curvature honeycomb-shaped parts 2021 – 2023

Room acoustic elements made of fibre-based and highly filled single paper layers 2023 – 2025

Test method for tamper-proof security labels 2021 – 2023

Indicator labels – development of a test methodology 2021 – 2023



Experts have doubts as to the question whether such **details**, like recyclability and assessment (grades), financial contributions for controlling the extended producer responsibility, the percentage of plastic recyclates, the methodology of assessment, or whether a packaging can be actually recycled in real practice, inclusive of collection and sorting, are really “non-essential” elements.

Ban on certain packagings and principle of minimisation

The Regulation contains explicit goals for **reducing the per-capita waste stream** in relation to the year 2018: -5% (2030), -10% (2035), 15% (2040). For this purpose, the packaging's weight, volume and empty space shall be reduced to the minimum necessary for ensuring its functionality (Art. 9, Annex IV). Proof shall be furnished to demonstrate and document the required **dimensions**. The empty space in **transport and e-commerce packaging** shall be reduced to a minimum (Art. 9 & Art. 21). The draft provides for a ban on certain single-use packaging formats (Art. 22 & Annex V). This includes single-use packaging (e.g. trays, bags, containers) for fresh **fruit and vegetables** below 1.5 kg, **single-use packaging of food for immediate consumption** in hotels / restaurants / catering premises, and certain **single-serve units** for hotels and restaurants (e.g. sugar bags, shampoo).

Recyclability and design for recycling

All packaging shall be generally **recyclable** by 2030 and then be actually collected, sorted and recycled in the real world by 2035. For this purpose, the European Commission plans to lay down the basic **design-for-recycling** criteria in delegated acts by 2027 (Art. 6). The question whether the successfully developed and established industrial standards, such as the CEPI 4evergreen initiative, will be taken into consideration is still open for the time being. **Recyclability performance** shall be assessed (Art. 6) according to performance grades (from A ≥ 95% to E < 70%) and controlled by a payment system. Packaging products with a performance grade E will cease to be marketable as of 2030. How the recyclability will be assessed in detail remains again to be defined in future delegated acts. Again, it is not known whether existing industrial standards will be taken into consideration. Temporary exceptions from the recyclability obligation are foreseen for innovative packaging, e.g. made of new types of materials.

Recycling rates and recycled contents

The **recycling rates** for paper/board packaging have remained unchanged from the Packaging Directive and continue to be as follows by the end of **2025: 75% | 2030: 85%**. The Regulation lays down a minimum amount of **post-consumer**

Testing services

DIN EN ISO / IEC 17025:2018

Accredited Test Laboratory

- Both lab-scale and pilot-scale evaluation of recyclability
- CEPI recyclability laboratory test method Version 2, October 2022
- PTS-RH 025:2022 Analysis of the aqueous phase in fibre recovery processes
- PTS-RH Method 021:2012 Recyclability testing
- Determination of macrostickies DIN Spec 6745
- In cooperation: Determination of recyclability (incl. sorting)

Design for recycling

- Consulting based on available criteria such as Circularity by Design Guideline for Fibre-Based Packaging (06/2023)
- Testing of prototypes and samples

Avoidance of overdimensioning | minimisation principle

- Testing of strength properties of paper | board packaging
- Over 500 methods including but not limited to BCT, ECT, SCT, RCT, WVTR, Cobb, Kit Test, FINAT methods, ...
- Determination of required strength characteristics and matching with specifications
- Packaging & material modelling and simulations, behaviour and failure predictions

Testing of labelling criteria | labels

- PTS Method of ink-jet | laser codability (QR codes)
- Digital printing
- Resistance to ageing / anti-falsification
- Label testing

Use of plastic recyclates | coatings

- Certificate of food safety compliance
- Consulting, raw material selection, and formulation testing
- Prototyping of plastic recyclates as paper coating
- Analytical testing of migration
- Barrier tests: water vapour, grease permeability, HVTR, O₂, penetration tests

Testing of material composition

- Fibre analyses and composition
- Spectroscopic methods (IR, NIR, Raman)
- Analyses of constituents
- Assessment of recovered paper (EN 643)

recyclate in the plastic part of packaging in order to move forward the recycling of plastic materials. The envisaged use of recycled plastics in a single packaging unit is 35% by 2034 and 65% by 2040. According to the definitions given in the current draft proposal, said recycling rates – nota bene – are also applicable to plastics in packaging where the plastic part is just partially made of plastic, such as composites or plastic-coated / plastic-laminated paper and board. How to assess the properties of recyclate plastic coatings on paper is part of current (contract) research operations of PTS.

Reuse rates and refillability

The PPWR gives much thought to the principle of reuse, although reusability is disputed in science depending on where the system boundaries are placed and how often multiple-use articles are actually reused in the real world. Well-functioning, well established and – when considering all parameters such as hygiene and safety, cleaning, transport, logistics, storage, EOL of the multiple-use articles – ecologically at least equivalent or advantageous paper/board single-use packaging items within a well-performing recycling system are placed at a disadvantage by the current draft of the proposal.

Specifically, the PPWR requires various **reuse percentages** to be observed for packaging in the hotels/restaurants/catering (HORECA) sector, retail sector, transport (B2B, B2C) and e-commerce by 2030 or 2040, respectively (Art. 26). In contrast with the draft leaked to the public, the proposal contains a number of exceptions for **boxes made of board**. However, packaging products for electrical household appliances (e.g. refrigerators, washing machines) shall meet the reuse obligation – although they are often made of corrugated board and thus can be recycled through the recovered paper stream. That does not seem very purposeful. The mandatory reuse rates laid down in the draft are as high as **between 10%** (e.g. non-food articles by



Consulting

Technical committee work of PTS in relation to PPWR

DIN NPa steering committee, DIN | CEN | ISO standardisation committees

- Physical test methods for paper / board / pulp
- Chemical test methods for paper / board / pulp
- Optical test methods for paper / board / pulp
- Test methods for tissue and tissue products
- Test methods for ink-jet media
- Terminology (definitions of sustainability terms)
- Consulting in DIN Spec initiatives (e.g. plastic-free)

4evergreen / CEPI

- PTS is a member of the Alliance
- PTS sends technical advisors to Workstream 1 (recyclability protocol, test methods and evaluation scheme) and to Workstream 4 (WG3, innovation)

EK III Central Packaging Register (collaborator)

Single-Use Plastics Fund Commission of UBA (German Environment Agency)(advisor to the manufacturers' team)

Zellcheming work groups

CircEL paper for paper-based electronic products meeting circular economy criteria

PTS platform for food packaging made of (recovered) paper

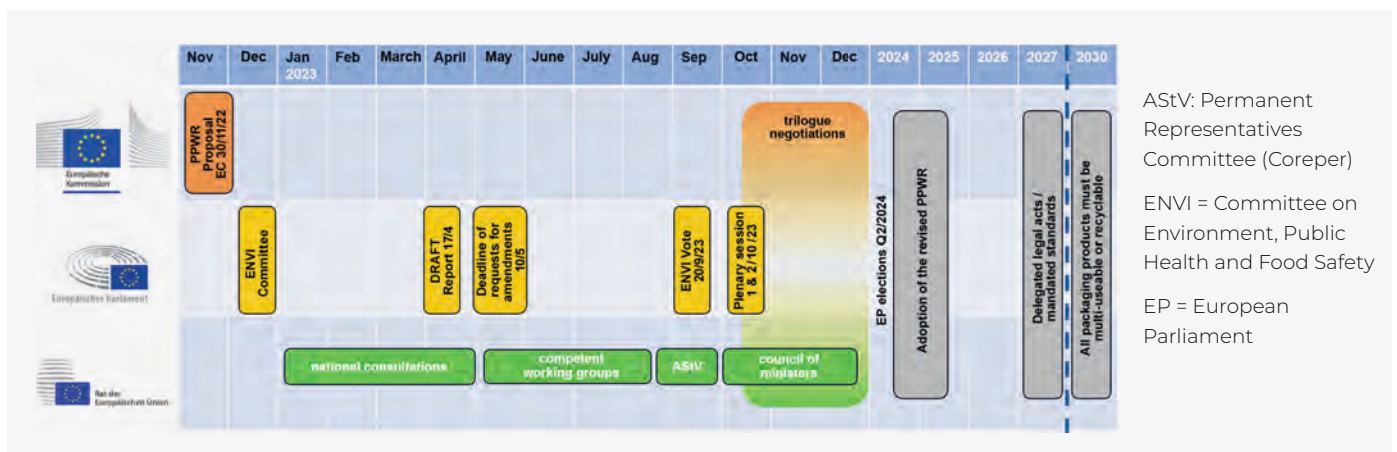


Industrial solutions

Contract research

Pilot plants – paper machine | coating | moulded pulp

- Use of alternative fibrous materials
- Development and use of alternative additives
- Development and application of biobased coatings
- Development of extrusion coatings
- Use of plastic recyclates for coatings on paper



AStV: Permanent Representatives Committee (Coreper)
 ENVI = Committee on Environment, Public Health and Food Safety
 EP = European Parliament

Fig. 1: Packaging and Packaging Waste Regulation - PPWR: Legislative procedure – projected timeline © PTS



Fig. 2: PPWR draft: major contents © PTS

e-commerce, take-away food packaging) and 100% (B2B transport packaging) for the year 2030 already. The reuse rates are then very much higher for 2040 (e.g. non-food via e-commerce: 50%, take-away: 40%).

Labelling requirements

The previously voluntary **material-based labelling** of the packaging for easier disposal will now become mandatory. Also, waste receptacles shall be clearly labelled to facilitate sorting by consumers. Further, the PPWR requires information about the **deposit/return system (DRS)**, **digital information (QR code)** and a voluntary indication of the **recycled content**. The labelling details are also planned to be laid down in a delegated act.

Industrial compostability

Capsules or bags for coffee or tea, adhesive labels for fruits and vegetables, and very lightweight plastic carrier bags shall be industrially compostable (Art. 8). Also, the compostable products shall not be an obstacle to recycling and must be recyclable themselves.

Conclusion and support offered by Papiertechnische Stiftung (PTS) to corporations

The **PPWR legal act** is a project that is ambitious both in terms of the timeline and in terms of contents. The fact that there still are many unclear details in the requirements to be laid down in delegated acts to follow at a later point of time (about 2027) makes it difficult for those concerned to

Advanced training

Individual in-house training (DE or EN)

- Recyclability testing, lab staff qualification, round robin tests
- Inspection of incoming recovered paper, in-situ training
- Basic knowledge of paper manufacture and paper packaging

Advanced training courses of PTS Academy

PTS Insight – Draft proposal of the EU Packaging and Packaging Waste Regulation – PPWR challenges to be met with PTS Research and Services 231117 PPWR, on-line, 17/11/2023, 10-11 a.m.

PTS Coating Symposium

230913 SY CO, in-person, Bamberg, 13-14/9/2023

Introduction to compliance work and quality assurance for paper and board in contact with food (FCM) · 230919 WS FCM EN, on-line, 19/9/2023

Single Use Plastics Directive (SUPD) and Microplastics – definitions, regulatory situation, analytical methods, alternative materials · 230919 WS SUPD, on-line, 19/9/2023

Surface functionalization of paper & board based packaging · 230920 WS SFP, on-line, 20/9/2023

Recyclability of paper & board based packaging 230920 WS REC, on-line, 20-21/9/2023

Insight into the testing of paper, board, corrugated board and packaging · 231106 GK PP, on-line, 6-7/11/2023

Selection and assessment of recovered paper 231114 VK APB, PTS Heidenau, 14-15/11/2023

Products

Recovered paper quality assessment using PBSII or RCP monitor

- Determination of mass percentages of moisture, ash, plastics, fibre, wood pulp
- PBS II as a handheld unit or as a sensor integrated in bale scanner systems, also for direct application on the truck platform
- RCP monitor for application on the feed conveyor to the pulper

Analysis of quality parameters in the laboratory using DOMASmultispec

- Analysis module for determination of (e.g.) dirt specks, stickies, formation, covering, pin holes, structures
- Data acquisition with various hardware variants: scanner | line scan camera system | NIR camera system | THz sensor

adjust to the new obligations. Further, there is a high bureaucratic burden from conformity-related reporting duties at many points in the process. To mean well is not enough. We cannot but hope for substantial improvement of the requirements in the further steps of the legislative procedure.

Here, **PTS** is in a close dialogue with associations and corporations. Together with our customers, we do research on sustainable future-oriented packaging solutions to the ben-

efit of the entire sector and we provide consulting, training and specialised services around the topics covered by the PPWR. You will find more details in this PTS News publication. Further, we will hold a **PTS Insight regarding the PPWR** on **17/11/2023** to which you are warmly invited. We are looking forward to the exchange of views and your inquiries. ●

Dr. Antje Harling,
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Use of miscanthus in papermaking



Fig. 1: Miscanthus plants
(Source: <https://www.energiepflanzen.com/miscanthus/>)

Within the European CORNET research project “Creating value chains for utilization of miscanthus fibres from sustainably managed marginal and postmining areas”, PTS studied miscanthus fibre as a papermaking furnish using different pulping processes.

Miscanthus, also known as Chinese silver grass (Figure 1), is a perennial plant that can be harvested in the third year and will then provide a annual yield of 15 tonnes per hectare for a period of up to 20 years. As miscanthus is rather undemanding in terms of soil quality, it is used e.g. for land reclamation purposes such as revegetation of closed open-cast mines and military training areas. The rhizomes of miscanthus are able to uptake heavy metals like lead and thus can also make a contribution to soil improvement.

Natural miscanthus fibre can be used as a supplementary fibre source in the papermaking industry or in the natural fibre processing industry. Within the scope of the MiscanValue project, mechanical and chemithermomechanical as well as chemical miscanthus pulps were studied as an alternative to typically wood-based fibrous materials.

In the initial phase, thermomechanical pulps (TMP) were produced and tested in the laboratory. They showed high contents of shives and fines as a result of the pulping operation, which had a negative impact on the papermaking process. Therefore, different chemithermomechanical pulps (CTMP) of miscanthus were produced. In order to reduce the flake content, the pulps were beaten in the PFI pulp beater and made into handsheets on which the physical properties were tested. The handsheets such made exhibited physical properties that were competitive with typical hardwood pulps.

An innovative Organosolv pulping process with acetic acid as the dissolving liquid (Acetosolv) was used to produce the miscanthus pulp in the laboratory while testing various pulping conditions and determining

Project title:

Creating value chains for utilization of Miscanthus fibres from sustainably managed marginal and post-mining areas (*MiscanValue*)

Project period:

01/07/2020 – 31/12/2022

Project type/sponsor:

EU Cornet PTS-IGF 283 EBR
“MiscanValue”

Research locations:

- Papiertechnische Stiftung (PTS), project leader: Manuela Fiedler
- Technical University of Dresden, Institute of Natural Materials Technology (INT), Chair of Agricultural Systems Engineering (AST), project leader: Prof. Dr.-Ing. habil. Thomas Herlitzius
- Technical University of Dresden, Institute of Natural Materials Technology (INT), Chair of Wood and Fibre Materials Technology (HFT), project leader: Prof. Dr.-Ing. André Wagenführ
- Czech project partners: UJEP, UCT, and VSB-TUO

Funded by:



aufgrund eines Beschlusses
des Deutschen Bundestages

chemical, morphological and physical properties of the pulps such produced. The resultant papers can provide good structural strength values, but in connection with a significantly higher drainage resistance than for e.g. NBSK or hardwood pulps (Figure 2), which is due to the occurrence of partial fibrillation already during the non-pressurized pulping process. The high SR value has a negative effect on the drainage behaviour in the

paper machine, but suggests a good potential for giving a high-density paper structure. The dynamic strengths are significantly lower than those in commonly available pulps. Optimizing the pulping conditions could be helpful to address this issue.

Corrugated board base paper and a duplex paper were produced in the pilot paper machine at the premises of PTS with the aim to demonstrate

the continuous mode of operation. 30% OCC corrugated medium in both paper grades was replaced by a miscanthus (soda) pulp. The physical properties were tested, showing that miscanthus could be advantageously utilized in the given ranges without impairing the physical properties. The addition of miscanthus had a beneficial effect especially on the paper's tear resistance.

Technologically, the chances of success are assessed to be good, because the preparation of a miscanthus stock can be performed with typical equipment in a way similar to wood-based fibre. Benchmarking shows that the material characteristics thus obtained are rather interesting for packaging and corrugated board base papers in comparison with conventional materials. ●

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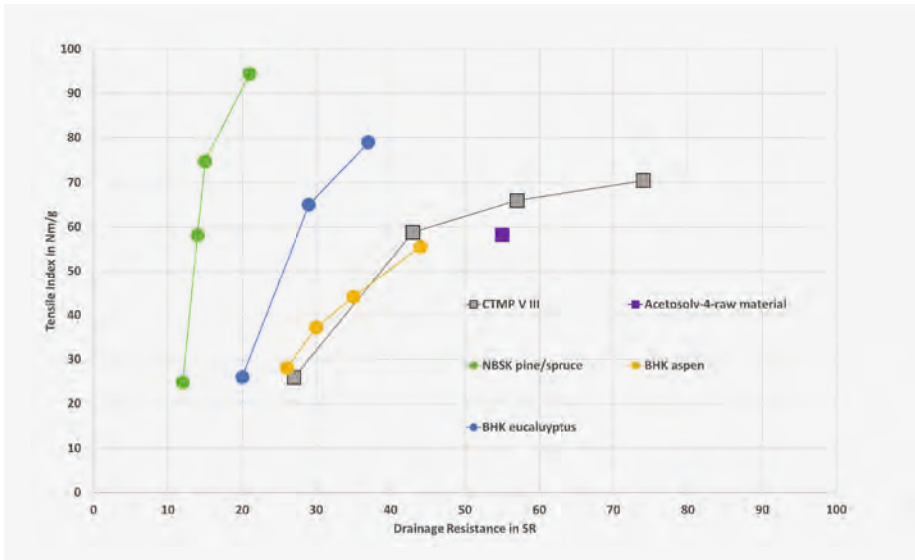


Fig. 2: CTMP tensile index, Acetosolv pulp compared with NBSK and hardwood pulps

Paper-engineered ceramic components for sustainable thermal processes

In February 2023, a project was launched in the context of "Avoiding climate-relevant process emissions in the industry (KlimPro Industry) of 26/07/2019".

The PaKerNat project combines the papermaking and ceramic industries as two sectors that can make a significant contribution to the low-cost manufacture of ceramic lightweight structures. The project covers the development of novel ceramic com-

ponents, specifically radiation shields that can be used in air at temperatures of up to 1,500°C and can reduce by at least one magnitude the heat radiation between the effective volume and the refractory lining, i.e. the wall losses, of industrial kilns. An additional objective is to develop paper-ceramic sheet support structures as kiln furniture (BHM).

The weight and thus the required heating-up energy demand of the kiln

Project title:
PaKerNaT Improving the carbon footprint of high-temperature processes by novel radiation shields and kiln furniture made of paper-derived ceramic lightweight structures

Project period:
01/02/2023 – 31/01/2026

furniture is planned to be drastically reduced, at least by 60% from the state of the art.

The selection of the base materials, the layout of the microstructure, and the load and ceramic-specific design of both the radiation shields and the kiln furniture are based on computer-assisted processes.

The ceramics are designed to have a high residual microporosity in the product. The pore-size distribution of radiation shields and kiln furniture needs to be optimized by appropriate material selection and treatment methods with regard to the thermal and mechanical properties so as to achieve optimal radiation and creep characteristics.

The transformation of the raw materials into pulps and the papermaking methods for forming the green bodies must be developed for low-cost scalable

processes. The heat-treatment parameters for complex debinding and sintering are determined by means of in-situ measuring operations and computer simulation to ensure that the products can be manufactured in the future in a safe and energy-efficient way in industrial furnaces. The project includes the development of a connection concept for plates and filament-wound bodies for building larger-sized structures.

The production processes are tried and tested up to the pilot scale. The goal is to produce a demonstrator both for the radiation shields and for the kiln furniture, which will then be tested and evaluated under industrial use conditions in terms of its useful life and its energy-saving and carbon-reducing potential. ●

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Project type/sponsor:

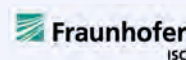
DLR project sponsor

Research locations:

- Fraunhofer Center for High-Temperature Materials and Design HTL (coordinator)
- Friedrich Alexander University (FAU)
- Papiertechnische Stiftung (PTS)
- Paul Rauschert GmbH & Co. KG.
- OecoPac Grunert Verpackungen GmbH



Bundesministerium für Bildung und Forschung



FIBRE based solutions



Lehrstuhl Glas und Keramik



Your Challenge. Our Technology.



OecoPac GRUNERT VERPACKUNGEN GMBH

Project title:

Inorganic geopolymer-based paper improvement – “geopolymer coating”

Project period:

01/06/2023 – 30/05/2025

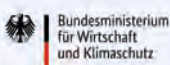
Project type/sponsor

AiF – Joint Industrial Research (IGF)

Research locations:

- Papiertechnische Stiftung (PTS)
- Technical University of Darmstadt (TUDa), Institute for Materials in Building

Funded by:



aufgrund eines Beschlusses des Deutschen Bundestages



TECHNISCHE UNIVERSITÄT DARMSTADT

INSTITUT FÜR WERKSTOFFE IM BAUWESEN

Inorganic geopolymer-based improvement of paper – geopolymer coating

In addition to mineral constituents, conventional paper improvement systems (coating colours) contain synthetic polymers of petrochemical origin which work as binders for inorganic pigments to be interlinked and fixed to the substrate. Those materials, however, are more and more challenged in terms of their recyclability and biodegradability.

The intention is to use purely inorganic coating formulations in substitution for petrochemical binders and thus produce high-quality SUPD-compliant

papers with enhanced performance characteristics. So-called “geopolymers” based on waterglass and metakaolin are used as inorganic binder systems for this purpose. Typically, those materials are utilized as high-performance construction materials because of their high mechanical, chemical, and thermal stability, which makes them attractive especially for use in paper-based construction materials. In such use scenarios, the multifunctionality of geopolymer coatings makes it possible to address not only optical aspects, but also mechanical and fire safety criteria.

Preparatory studies with such inorganic binder systems were successful in creating thin and flexible layers having very good adhesion, giving rise to variety of material engineering, process-related and use-specific questions requiring clarification within the scope of the given research project.

Corporations and entities along the entire value chain will profit from the project results, but a particular added value will be created especially for SME-dominated paper converters, coating plant builders, and clients, i.e. packaging designers and manufacturers/users of paper-based construction materials. ●

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Project kick-off

M.Era.Net SustainFibersFCM

Initial situation

The Directive (EU) 2019/904 on the use of single-use plastics (Single Use Plastics Directive, SUPD) addresses the problem of littering in cities. The Directive insists on a significant reduction in the use of single-use plastic or multi-material multi-layer (MMML) products and on their substitution by non-plastic alternatives. This causes a rapidly growing demand for plastic-free fibre-based packaging products. Recycled paper is a sustainable fibre-based material, but its use in food contact materials (FCM) is difficult because of safety concerns due to contaminations (e.g. mineral oil residue, printing ink constituents, BPA).

As a result, recycled paper is often combined with a barrier layer that is typically made of plastic. Such composite materials make recycling difficult and do not meet the plastic substitution requirements laid down in the SUPD. Therefore, paper from virgin pulp is used as substitute for recycled paper in many food packaging products. There is an urgent need for sustainable natural fibrous materials that are safe when in direct contact with food.

Project goal

The goal of the Sustain Fibre FCM project is to come up with safe and sustainable moulded fibre packaging products for food based on the use and processing of fibrous material from regional agricultural crop waste. The focus of the project is on the development of SUPD-compliant packaging, e.g. for the take-away market, as already insistingly requested by the European Union and the general public.

Plant material is dissolved according to the innovative chemical-free thermal pressure hydrolysis (TPH) / steam explosion technology which is provided by the Austrian company AGRES and can be integrated in a bio-economy installation. The properties of the fibre mixture are adjusted with regard to the mechanical properties and surface characteristics of the moulded-fibre article by modification of part of the fibres at the Łukasiewicz – Lodz Institute of Technology in Poland.

The moulded-fibre prototypes are made in the thermoforming-fibre-moulding plant of Papiertechnische Stiftung (PTS). The prototypes are intended to demonstrate the usability of the material and are fully characterized in mechanical

Project title:

Development of sustainable fibre-based food packaging materials made from agricultural residues using safety-by-design (SustainFibreFCM) / Entwicklung nachhaltiger faserbasierter Lebensmittelverpackungsmaterialien aus landwirtschaftlichen Reststoffen unter Anwendung des Safety-by-Designs (SustainFibreFCM)

Project period:

06/2023 – 05/2026

Project type/sponsor:

M-ERA.Net Call 2022 / EuProNet

Research locations:

- Papiertechnische Stiftung (PTS) (project coordinator)
- Austrian Research Institute for Chemistry and Technology (OFI)
- Łukasiewicz – Lodz Institute of Technology
- Technical University of Graz – Institute for Analytical and Food Chemistry (TU Graz)
- AGRES Systems GmbH (AGRES)

Project leaders:

Dr. Antje Harling, Erik Mehlhorn



Moulded-fibre article for direct food contact



Agricultural residues as papermaking fibre, example of straw

analyses conducted by the project consortium.

The food safety assessment within the project is performed according to a novel approach using a combination of in-vitro bioassays (performed at OFI

in Vienna) and instrumentation-based chemical analyses (performed at TU Graz and PTS). The project is further supported by an all-phase LCA (Life Cycle Assessment) analysis of the developed products at the Łukasiewicz – Lodz Institute of Technology and by an



analytical verification of the EOL (End-of-Life) option of recycling through the recovered paper stream (PTS).

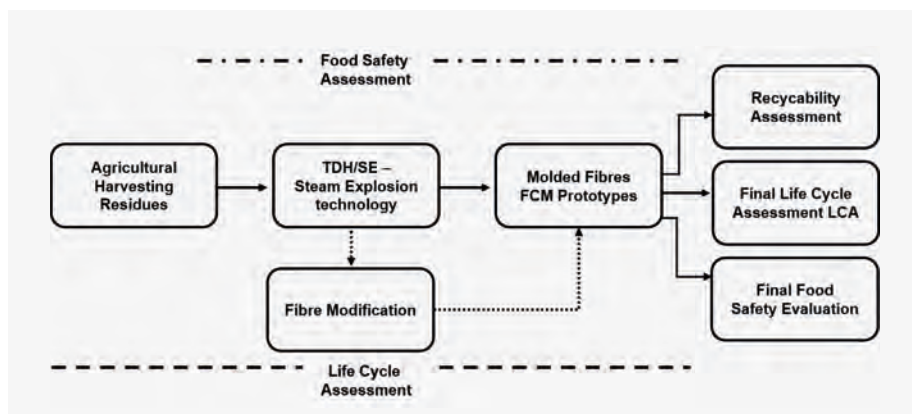
Acknowledgement of project sponsors

This project is co-funded by tax funds based on the budget adopted by the Saxon parliament.



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Erik Mehlhorn, erik.mehlhorn@ptspaper.de



EU M.Era.Net SustainFiberFCM Project Schedule

Project commissioned by the German Federal Environment Agency (UBA): **“Global project – national state of the art: Input and output balance for per and polyfluoroalkyl substances (PFAS) in paper mills processing recovered paper”**

Since December 2022, the Technical University of Darmstadt (Department of Paper Manufacture and Mechanical Process Engineering, PMV) and Papiertechnische Stiftung

(PTS) have been working together on the balancing of PFAS streams in paper mills processing recovered paper (FKZ code: 3722 36 302 1). The first progress report was submitted

on 31/05/2023. The project work is planned to end on 30/11/2025.

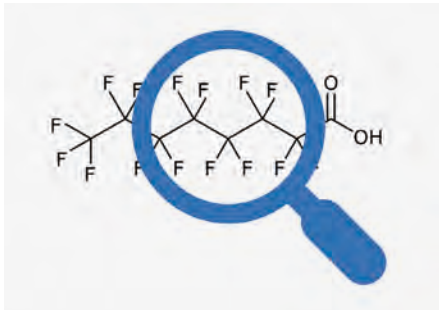


Fig. 1: PFAS (specifically PFOA) under the magnifying glass (© PTS)

Background

Per and polyfluoroalkyl substances are the subject of much debate these days. Hundreds of news articles (examples are given in Fig. 2) are published almost every day where you read about “forever chemicals”, “forever poisons”, “poison of the century”, “environmental toxins” under alarming headlines and keywords such as “PFAS: odourless, tasteless, carcinogenic”, “Threat to public health”, “Packaging brings toxins into fast food”, etc... The wide range of technological applications of the PFA substance group across all industrial sectors, inclusive of the paper industry, is as significant as the uncertainties, risks and dangers related to it.

On 13/01/2023, the German authorities responsible for chemical law (Federal Environment Agency UBA, Federal Institute for Occupational Health and Safety BAuA, Federal Institute for Risk Assessment BfR), together with authorities from the Netherlands, Denmark, Sweden and Norway, submitted

an EU-wide restriction proposal under REACH¹ with the goal to introduce a general restriction to the manufacture, placing on the market and use of all PFASs. The tables A.79 to A.81 in the associated Annex XV of the Restriction Report provide a list of specific uses of PFAS in food contact materials including those based on paper and board. The current consultation phase for the comprehensive PFAS control recommendation will end on 25/09/2023.

The restriction proposal created unprecedented media interest in the topic, which calmed down gradually over a longer period.

Further, international research activities conducted by 15 European media with an interactive map on PFAS contamination of soils in Germany and Europe and its media-effective publication in February 2023 caused further news reports on the subject².

UBA Research Project

The goal of the UBA research project is to provide an evidence-based foundation for estimates of PFAS streams in paper mills that do not use fluoric additives in their process.

A comprehensive literature review³ was carried out to elaborate and generate relevant information on the use of PFAS in paper products. Many relevant industrial players including paper manufacturers, paper converters, and manufacturers of printing inks and



Fig. 2: Collage of arbitrarily chosen newspaper articles about PFAS

Project title:

Global project – national state of the art: Determination of an input and output balance for per and polyfluoroalkyl substances in paper mills processing recovered paper

Project period:

01/12/2023 – 30/11/2025

Project sponsor:

Federal Environment Agency UBA

Research locations:

- Technical University of Darmstadt (Department of Paper Manufacture and Mechanical Process Engineering, PMV)
- Papiertechnische Stiftung (PTS)

Project leaders:

Antje Kersten (PMV, general management), Dr. Antje Harling (PTS)



additives were contacted directly to gain more detailed insight in the use of PFAS and derive better estimates.

In addition, an anonymous survey about the usage of PFAS⁴ was conducted and evaluated in an (interim) report. The review is ongoing and participations are welcome. Every response contributes to the enhancement of the data. The gathered information was compiled into a theoretical analysis of potential distribution processes of PFAS during production in consideration of the wide variety and broad scope of properties of the PFA substance group. Apart from considering the mainly environment-related distribution of PFAS components in the sewage, sewage sludge and exit air of the paper machine and power plant,

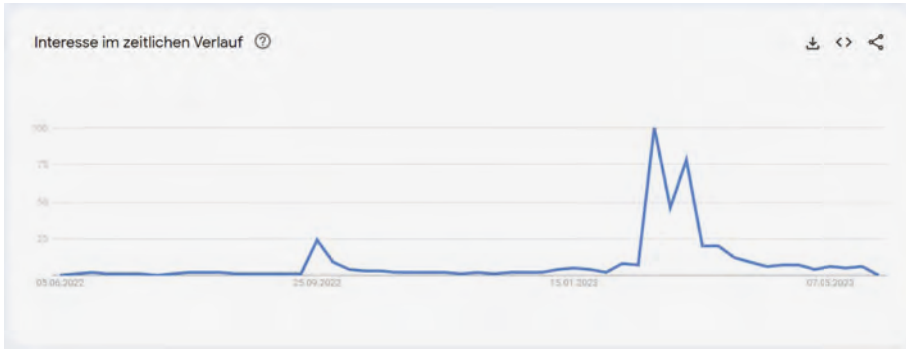


Fig. 3: Google Trends analysis on the popularity of the search term “PFAS”³

a comprehensive tool was created to calculate a potential PFAS input into the various recovered paper grades and rejects. The calculations made in the current stage of the project are chiefly based on assumptions about usage amounts, composition of the recovered paper fraction, and various other aspects. Once the results of the analysis are available during the course of the project, the calculations will be more and more precise and will support the overall assessment of the PFAS streams.

The work package of the current project phase is to develop a sampling and analytical concept. It includes sampling in a paper mill in the field of graphical paper manufacture and in the pre-

ises of a corrugated board base paper manufacturer. Potential sampling points are outlined in Figure 3.

The sampling and analytical concept is planned to be finalized in autumn 2023, then followed by its implementation in the paper mills selected for sampling. The laborious sampling operations and the then following sample analyses should make it possible to establish a realistic balance of PFAS input and output paths during papermaking and to identify the underlying processes of isolation of those substances. The analytical testing of the samples and specimens, and the further development of the necessary analytical methods are performed in close cooperation

with Eurofins Umwelt Ost GmbH. One objective among others is to deliver the project results to the Federal Environment Agency (UVA) which will use them to evaluate the best available techniques (BAT) for avoiding PFAS contaminations of the environment.

If you wish to support the project, e.g. by taking part in our survey on PFAS usage, please contact fcM@ptspaper.de.

Max Schneider,
max.schneider@ptspaper.de

Sources

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- [2] <https://foreverpollution.eu/>
- [3] <https://trends.google.de/trends/explore?geo=DE&q=PFAS&hl=de>
- [4] <https://forms.office.com/Pages/DesignPageV2.aspx?subpage=design&token=3961bb7590bb43178f-15017c8a176e83&id=lyrXYJGY3kCpxdiGe-7BaQhHYVGdZQRxJtDvqxizZ0zdUNVd-JRk1EOTFQQk9QQIE3NUpPMTRDNET-MUS4u&analysis=true>

Collage

- <https://www.hna.de/lokales/kreis-kassel/alte-giftstoffe-sind-unter-neuem-namen-aufgetaucht-92162163.html>
- <https://unserwasser-bi-lueneburg.de/pfas-chemikalien-reichern-sich-im-grundwasser-an/>
- <https://www.alamy.de/alarm-uber-die-steigende-flut-toxischer-forever-chemicals-guardian-schlagzeile-pfas-chemical-schadstoffe-artikel-23-februar-2023-london-uk-image529410724.html>
- <https://www.alamy.de/alarm-uber-die-steigende-flut-toxischer-forever-chemicals-guardian-schlagzeile-pfas-chemical-schadstoffe-artikel-23-februar-2023-london-uk-image529410724.html>
- <https://www.bint.bayern/pfoa-nix-fisch-nix-wildschwein/>
- https://www.youtube.com/watch?v=j_X9Q1yRA-w

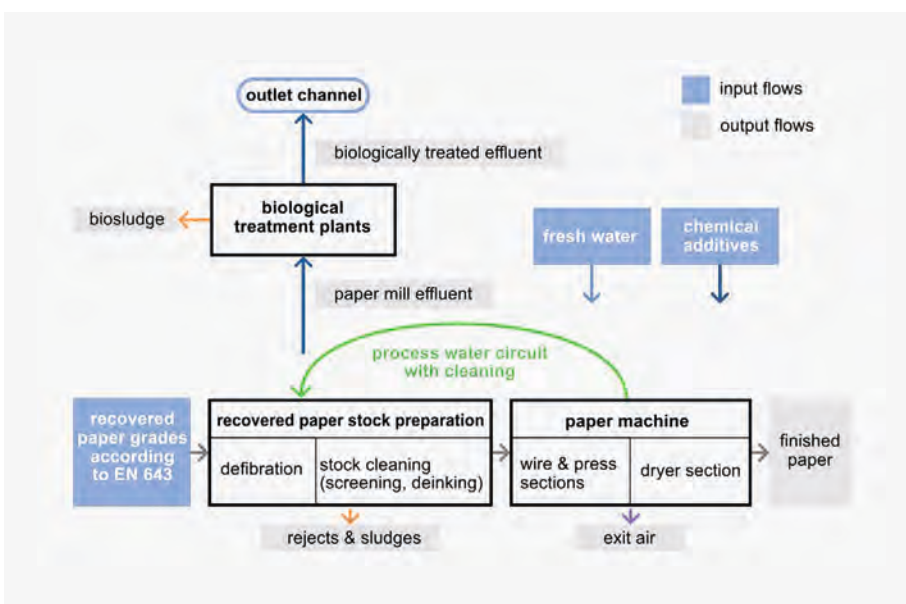


Fig. 4: Flow diagram with input and output flows of paper mills processing recovered paper (© PTS)

Development of an analytical method for the determination of the year of manufacture of paper

New ways to determine the absolute age of documents and art objects

Paper is an important support for documents and art objects. Therefore, the forensic examination of paper is of great importance in solving criminal cases of document and art forgeries. Determining the age of paper has always been an issue of particular interest in this context.

The chemical composition and the paper structure are approximate indicators for certain production periods of a paper^[1,2]. However, this allows the year of origin of a paper to be roughly limited to an interval of several decades only.

A much higher accuracy in determining the age of paper is possible with the radiocarbon dating method (carbon-14 method). In a IK-MF research project 170102 (2018 to 2020), PTS developed a paper dating method applying the C-14 dating approach to starch extracted from the examined paper^[3,4]. The method obtained a dating accuracy of 2 years for papers made after 1955. This method is meanwhile well-established in forensics and was used in connection with several court proceedings and other cases.

The biggest obstacle to the applicability of the method in the carbon dating of paper is that the paper must contain starch. Also, the method consumes about 2 g of paper thereby destroying part or all of the document or object to be examined.

Early tests in the mentioned research project demonstrated already possible ways of how to determine the age of a paper with high accuracy by means

of the measured C-14 concentration in the paper fibre mixture. So just smallest amounts of paper would be needed and the paper object on a whole would remain virtually intact. In another research project following up on those early findings, the possibilities of dating a paper by measuring the C-14 content of the paper fibre mixture are currently examined in more detail with a corresponding method being developed.

The C-14 dating method makes use of the carbon isotope C-14 and its radioactive decay with a half-life period of 5730 years. The potentially achievable accuracy of the method is given as +/- 20 years. This accuracy is true for dating results related to the recent past (the last 2,000 years) and drops significantly for decreasing C-14 contents and a higher age a sample, up to about 50,000 years. The situation is different for the time after about 1955 because of the so-called nuclear weapon effect. From 1955 onward, the nuclear weapon led to a noticeable increase in the C-14 concentration in the earth atmosphere as a result of above-ground atomic bomb tests. After the ban on such tests in 1963, the C-14 level has been declining again (refer to Figure 1). The steep curve of the atmospheric C-14 level makes it possible to determine age differences of just a few years.

Deriving the year of production of a paper from the age of its starch component is based on the assumption that the starch obtained from annual plants (such as potatoes, maize or wheat) is integrated in the paper no later than in the year the plant was

Project title:

Development of an analytical method for the dating of paper produced after 1960 based on C-14 measurements on paper pulp mixtures

Project period:

01/04/2023 – 31/03/2025

Research location:

- Papiertechnische Stiftung (PTS), Project leader: Dr. Enrico Pigorsch



harvested. In contrast therewith, C-14 dating of paper on the basis of its pulp component has general limitations. One must bear in mind that the pulp component of a paper is a blend of cellulosic fibre from a variety of old trees and tree species. Also, the fibrous material of an individual tree is composed of multiannual growth zones which may encompass several decades. It is therefore not possible to date a paper directly from the C-14 concentration measured in the paper pulp mixture, because the result will always be a mixed age. Figure 1 shows the positions of C-14 values measured on the fibre mixtures contained in the papers as compared to the C-14 concentration in the earth atmosphere. As expected, the C-14 values of the fibre match the reference curve of the nuclear weapon effect only to a

Properties & parameters	Dating of paper from extracted starch	Dating of paper from paper fibre
Accuracy	2 years	up to 5 years
Paper consumed	1 to 2 g approx. 1/2 A4 page	approx. 0.1 g approx. 3 x 4 cm (0.5 x 21 cm)
Application period	1955 – 2020	1960 – after 2030
Determinable papers	writing, printing, copy papers with starch	all papers made of virgin pulp

performed in cooperation with the Leibniz Laboratory Radiometric Dating and Stable Isotope Research of the University of Kiel and the Curt-Engelhorn-Centre of Archaeometry gGmbH in Mannheim. ●

Dr. Enrico Pigorsch,
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- [4] E. Pigorsch, B. Kießler and M. Hüls, New method for the absolute dating of paper by radiocarbon measurements, J. Forensic Sci. 67(4) (2022) 1505-1512

Table 1: Parameters of the two different paper dating methods

very attenuated degree. The average of the C-14 values of the fibre mixtures, as represented by a polynomial trend curve, is significantly flatter than the reference curve and the peak is shifted to the right. However, a more detailed analysis of the results reveals significant correlations between the C-14 total concentration in the paper pulp mixture and the pulp composition and the production year of the paper.

These results offer new approaches to the dating of paper on the basis of reference data and computed model

curves that take into account both the average age of trees and the exact composition of the pulp mixture.

The correlation findings are examined in more detail in the new IK-MF 220201 research project "C-14 paper fibre dating". The essential benefits of determining the age of a paper through its pulp component over dating the paper through extracted starch are summed up in Table 1.

The project started as of 1 April 2023. The C-14 measurements are

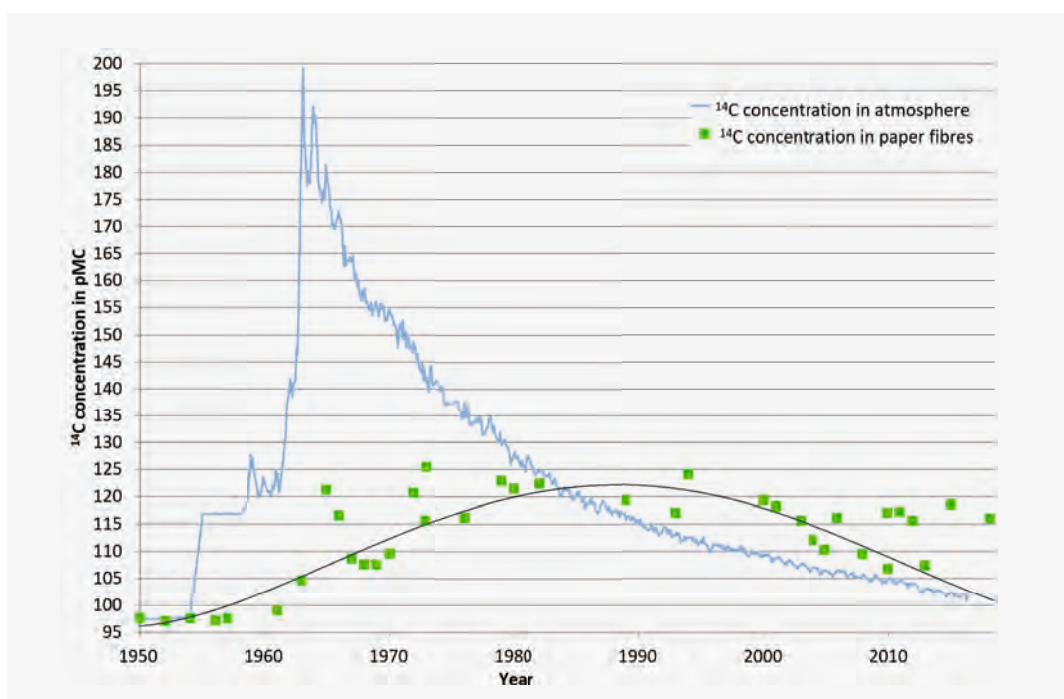


Fig. 1: Curve of C-14 concentration in the earth atmosphere and C-14 concentration of fibre mixtures of papers with known year of production

Re-evaluation of Bisphenol A – Impacts on the paper industry

Background

Bisphenol A (BPA) is one of the most important industrial chemicals worldwide. The use of BPA is a frequent subject of much discussion, which tends to repeatedly create uncertainty among consumers. One reason, among others, is that BPA is classified as an endocrine disruptor (Category 1B) according to the Regulation (EC) No. 1272/2008 (CLP Regulation).

BPA can be identified also in fibre-based products such as paper and board. BPA was used in lower mass percentages as a standard colour developer especially in thermal papers until it was banned for this purpose under the REACH Regulation (January 2020). However, although banned, BPA-containing thermal papers can still enter the recycling loop, e.g. through non-European shipping labels or discarded archive records (such as bank statements, fax sheets, tickets, cash receipts).

Also, printing inks, adhesives, varnishes or plastics in connection or composition with paper products may contain BPA as a residual monomer or degradation product, although in much smaller amounts than found in thermal paper. BPA residues might enter food contact materials by way of contamination when recycled paper fibre is used for the manufacture of new paper products.

Depletion of BPA in the recycling loop after the ban on BPA-containing thermal papers is very slow, because BPA-containing papers re-enter the circuit again and again.

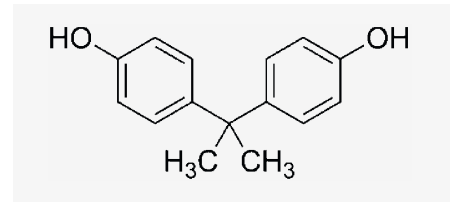
Re-evaluation of bisphenol A by EFSA and BfR

After the public consultation and subsequent consulting phase, the

European Food Safety Agency (EFSA) published its final re-evaluation of BPA^[1] on 19/04/2023.

Based on the newly evaluated scientific findings in their entirety, the experts of EFSA established a **TDI value of 0.2 nanograms / kg of bodyweight per day**. The new value replaces the prior temporary value of 4 micrograms / kg of bodyweight per day established in 2015 and is 20,000 times lower. The TDO (tolerable daily intake) value describes the amount of a given compound that can be taken up every day during the entire life of a human person without any identifiable health risk.

The reduction of the TDI value by EFSA was decided as a result of the summary evaluation of studies between 2013 and 2018 and because of a negative effect on the cellular immune system. The estimated exposure through food exceeds the new TDI, giving rise to health concerns. It is imaginable that there will be further bans and drastic reductions of existing thresholds for substance migrations from food contact materials into food (e.g. in Reg (EU) 10/2011), in addition to the already existing use bans on varnishes, coatings (Reg. (EU) 2018/213) and thermal papers (VO (EG) Nr. 1907/2006), under the risk management process in the European Commission. It is foreseeable that in the short or medium term the German Federal Institute for Risk Assessment (BfR) will, when adopting the BPA assessment, opt for a significant reduction of the maximum tolerable amount of migration from paper into food in its BfR Recommendation XXXVI for paper/board made of recovered fibre. However, BfR published a divergence paper^[2] concurrently with EFSA and highlighted significant



Bisphenol A (structural formula)

methodological shortcomings in the way how the new TDI was established. In an independent literature review, BfR came up with a TDI of 0.2 micrograms / kg of bodyweight per day^[3]. This value is 1,000 times higher than the TDI published by EFSA (refer to Table 1).

TDI value for bisphenol A	Value in nanograms per kg of bodyweight
EFSA 2015, temporary TDI	4.000
EFSA 2023, TDI	0,2
BfR 2023, TDI	200

Table 1: History of bisphenol A evaluations, TDI = Tolerable Daily Intake

Conclusion of BPA re-evaluation

Regardless of which new TDI will be applicable: a significant reduction of maximum tolerable BPA migration from paper into food can be expected.

Consequences for the paper industry

The reduction of the TDI and the possible enhancement of existing restrictions imply a risk for the sale of certain products in food contact.

In any case, paper products that are manufactured on the basis of recovered paper and are intended for contact with moist or greasy food will be concerned by the final assessment



Cash receipts made of thermal paper

of their food conformity. Such products include tissue (sanitary papers, paper towels, napkins), paper, board, corrugated board, and similar products. Results for BPA in cold and hot water extracts (CWE/HWE), which are used to evaluate the conformity of such food contact materials, show the latest EFSA TDI value to be significantly exceeded (by a factor of 20,000) in products that are made with the use of recycled fibre.

Potentially, all paper products for food contact will be concerned, regardless of whether or not recovered paper and/or virgin fibre is used and regardless of the type of food contact (e.g. dry contact). A gas phase transfer of



Recovered-paper yard

BPA in the magnitude of a few nanograms per kilogram cannot be ruled out for the time being and has not been reported yet at such concentration levels. First determinations of BPA contents in virgin fibre-based products in the lower nanograms range, as measured within the scope of validation tests, show that such products are able to comply with the new TDI.

For questions regarding re-evaluation and analytical aspects, please do not hesitate to contact us at:

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[1] Re-evaluation of the risks to public health related to the presence of bisphenol A (BPA) in foodstuffs; EFSA Journal 2023; 21(4):6857; DOI: <https://doi.org/10.2903/j.efsa.2023.6857>

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Mineral oil evaluation by EFSA in 2023: where to go from here?

Mineral oil hydrocarbons – what are they and where do they come from?

Mineral oil hydrocarbons (MOH) are a variety of similar compounds with different chain lengths. They are generally categorised into two main groups having a chain length of 10 to 50 carbon atoms: saturated hydrocarbons (MOSH) and aromatic hydrocarbons (MOAH).

Mineral oil components can enter food in various ways. One source can be improper use of mechanical oils,

lubricants or oily compressed air along the entire material and process chain. Also, hydrocarbons can contaminate raw materials, intermediate products and final products through migration from packaging and transport materials. Known input paths are recycled papers/boards, unsuitable mineral oil-containing printing inks, oligomers from polyolefin plastics, constituents of hotmelt adhesives, or the treatment of packaging materials with mineral oil products.^[1, 2]

Re-evaluation by EFSA

On 15 January 2023, EFSA experts published the draft of their scientific opinion on the update of the risk assessment of mineral oil hydrocarbons in food in which they provisionally concluded that MOSH do not pose a health concern. The evaluation is based on the analysis of the accumulation of mineral oil hydrocarbons in various types of tissues. The highest concentrations were found in fat tissue, and in liver and spleen. Adverse effects on the liver were observed in

a specific strain of rat. However, there are indications that these effects are not relevant for human health and thus can be disregarded in the toxicological assessment for the human body.

The experts also confirmed that some substances in the aromatic mineral oil fractions (MOAH) might give rise to health concerns. New studies support the conclusions made in the previous EFSA opinion of 2012 according to which the genotoxicity of mineral oil hydrocarbons is related to the presence of certain MOAH having three or more aromatic rings.

Based on the existing data gap on toxicity and carcinogenic potential, a health risk from the uptake of MOAH in food cannot be ruled out.

The experts recommend further research to quantify and narrow down the occurrence of mineral oil aromatic hydrocarbons in food.

It is necessary to collect further toxicity data of the relevant aromatic fractions as a function of their ring size in order to allow for a better assessment of the risks associated therewith^[3].

Assessment of mineral oil contaminations and statutory requirements

Undesired input of MOH in food means contamination. The EU food law (Reg 178/2002) provides that food must be safe. Food is deemed to be unsafe if its injurious to health and unfit for human consumption. Food is deemed to be unfit for human consumption if it has become unacceptable for human consumption as a result of contamination. Contaminations by mineral oil hydrocarbons can cause food to be unfit for human consumption because of the health concerns associated with them.

In Germany, there are so far no specific statutory requirements regarding the migration of mineral oil hydrocarbons from packaging into food. In July 2022, the Federal German Ministry of Food and Agriculture (BMEL) submitted the government draft of the so-called "Mineral Oil Ordinance" (Mineralölverordnung). In December 2022, however, the upper house (Bundesrat) decided not to approve the proposal^[4].

The Standing Commission on Plants, Animals, Food and Feed (SCoPAFF) der Europäischen Union (EU) published a statement on mineral oil hydrocarbons in food in April 2022. In order to ensure a uniform EU-wide approach for the purpose of the single market, the member states agreed on maximum levels for MOAH to take products off the market and recall them, where necessary. This arrangement is a de facto categorisation of MOAH as contaminants so that a national mineral oil regulation is no longer needed. Since the limits of determination (LOD) in food are sufficiently sensitive and reliable, a non-acceptable contamination of food can be safely determined.^[5]

The following maximum levels (limits of determination) for total MOAH without consideration of fractions are applicable:

- 0.5 mg/kg for dry food with low fat/oil contents ($\leq 4\%$ fat/oil)
- 1 mg/kg for food with higher fat/oil contents ($> 4\%$ fat/oil, $\leq 50\%$ fat/oil)
- 2 mg/kg for fat/oils ($> 50\%$ fat/oil)

Obligations of the manufacturers

It is necessary to make it very clear that the above-mentioned limits of determination for MOAHs are related to final concentrations in the food and absolutely not to MOAH levels in paper or board. Therefore, food companies must evaluate all input paths (food raw materials, processing, storage and transport of raw ma-



Migration of mineral oil constituents from a recycled fibreboard into the food

terials, packaging materials) within their responsible risk management processes with the aim to comply with the above-mentioned values on a whole and across all possible input paths in the value chain.

Depending on a given product, it may be useful to substitute mineral oil containing process additives or adjust the packaging material or packaging design to obtain a migration barrier effect. In-house monitoring of the typical mineral oil hydrocarbon contents as part of a quality assurance programme is a possible tool for the early detection of excessive levels or even production disruptions.

Papiertechnische Stiftung (PTS) is accredited under ISO 17025 offering migration tests and level determinations for MOSH / MOAH in fibre-based materials. We also give you advice and support by developing test plans, providing advanced training, or contributing to the research and development of appropriate barriers with the aim to ensure a safe, bio-based and recyclable design from the very beginning.

For further questions or requests, please do not hesitate to contact fcm@ptspaper.de.

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Project title:

Framework fOr Resource, Energy, Sustainability Treatment in paper (FOREST)

Project period:

01/04/2023 – 31/03/2026

Project type/sponsor:

BMWK call for funding “Resource efficiency in industry, commerce, trade and service sectors“ in the 7th Energy Research Programme (EFP)

Research locations:

- Modellfabrik Papier gGmbH
- ABB AG
- J.M. Voith SE & Co. KG
- Institute for Textile Technology of RWTH Aachen University (ITA)
- FH-Aachen, Institute NOWUM Energy
- TU Dresden, Chair for Wood and Fibre Material Technology
- Papiertechnische Stiftung (PTS), project leader of sub-project: Dr. Gert Meinl

Funded by:



aufgrund eines Beschlusses des Deutschen Bundestages

Kick-off of the FOREST research project

FOREST – Framework fOr Resource, Energy, Sustainability Treatment in paper production

The FOREST project aims to develop a comprehensive digital framework for paper production processes elucidating the energy and material flows and as such eventually also the carbon flows and footprints down to the sub-process and sub-product levels. Data is collected not only on the planning (ERP) level but also directly on the process (MES/Edge) level in conjunction with digital modelling operations.

The framework provides various support potentials for the well-aimed

acceleration of the paper industry’s transition towards climate neutrality.

Effective process optimisation by visualising the ACTUAL condition of the production plant

Visualising the ACTUAL condition of the production plant provides all stakeholders with a deeper understanding of the process. It especially facilitates the identification of plant areas with particularly high optimisation opportunities in online operation.

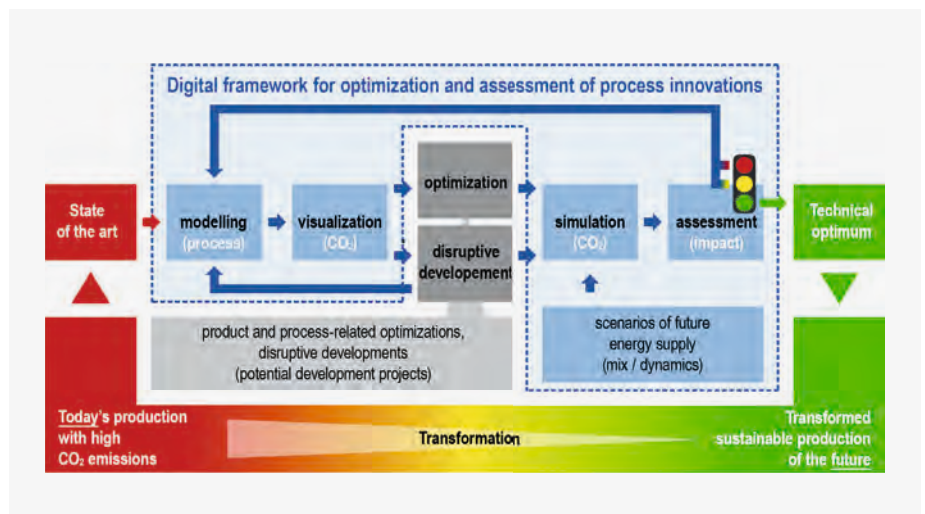


Fig. 1: Acceleration of the sustainable transformation through the digital framework



Fig. 2: FOREST kick-off meeting in the coworking space in Düren

The benefit of optimisations – of both the process settings and the plant layout – is mostly difficult to be adequately quantified in advance. As

a result, optimisation ideas cannot or not fully be implemented in continuous 24/7 production operations. Furthermore, there are optimisation approaches that offer a high added value for an individual process step but do not have a noticeable effect on the process in its entirety.

Predictive benefit assessment and efficient plant optimisation through the digital framework

Thanks to the digital framework, it becomes possible to assess the benefit of optimisations and plant

modifications even before they are implemented (bottom-up approach). As a result, the framework makes it also possible to optimally estimate the boundaries of the newly created process window and to accelerate the time until the optimal operating point is reached.

The clear assessment of optimisation projects allows both the businesses and the funding bodies to select and make well-aimed investments in optimisation projects having a high potential for energy efficiencies and saving resources.

Anticipative plant development through the digital framework: from top-down requirements to future-oriented solutions

The other way round, the digital framework allows to define requirements for future developments (top-down) that result e.g. from external change drivers such as from changes in energy supplies or in cost.

In summary, the framework provides support for the evaluation of optimisations and thus contributes to their faster implementation.

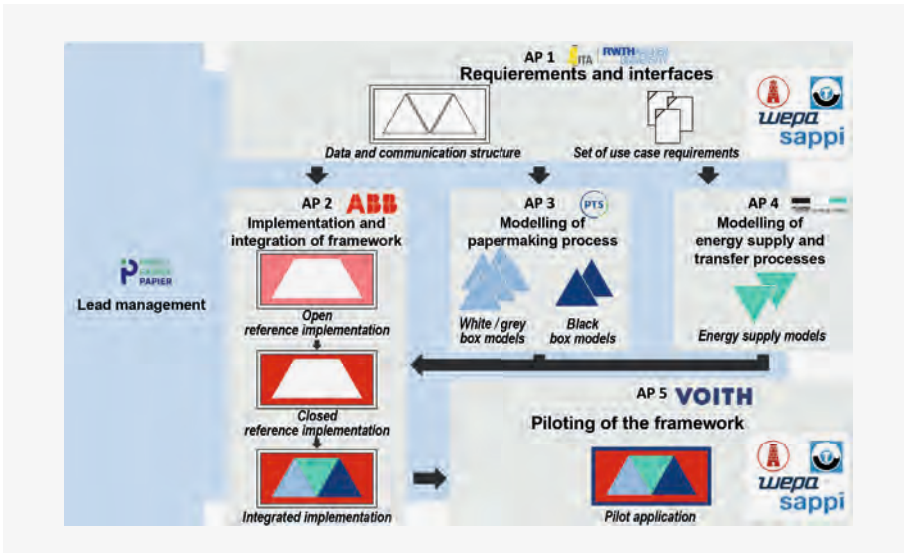


Fig. 3: Structure and network of the work packages

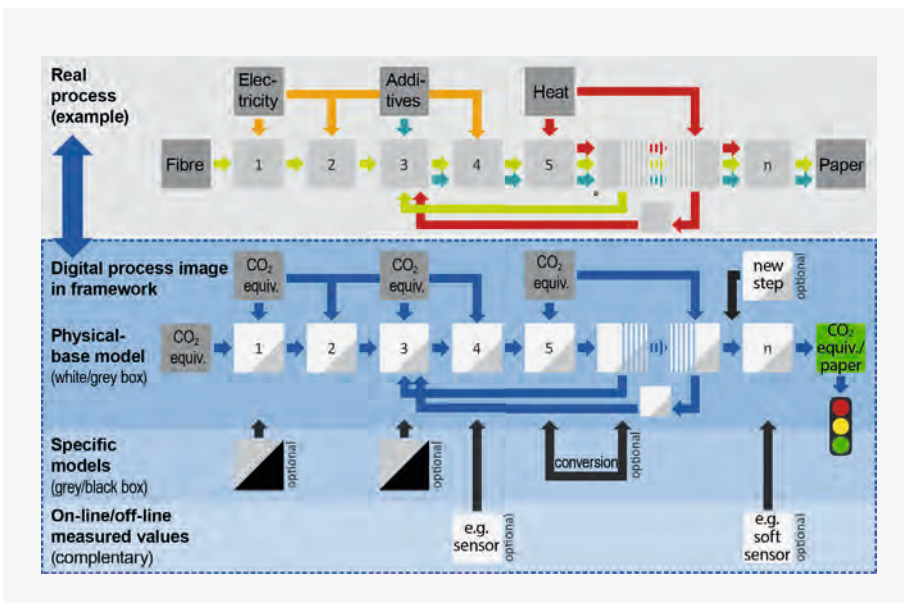


Fig. 4: Sketch of the framework to be developed and its components

outline visions more precisely, and to fix future dates and tasks.

The task of ITA within this project is to define arrangements and interfaces with the framework. For this purpose, detailed use cases will be created and then a set of requirements will be derived from them. The set of requirements will include the needs to be covered by the framework, as well as the functionally necessary basic requirements. Further, ITA will develop a digital test environment for all required process modules.

They can be simple look-up tables, can be based on physical formulas (white-box modelling) and/or can be highly complex machine learning models (black-box modelling).

Acknowledgements

The project work is funded by the Federal Ministry for Economic Affairs and Climate Action (BMWK) within the scope of the 7th Energy Research Programme of the German government (FKZ: 03EN2095B). ●

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Heat recovery based on steam recondensation and dew point shift

Papermaking consumes a lot of energy. In order to achieve the national climate goals while safeguarding the economic competitiveness of paper-based products, it is imperative to drastically reduce the energy demand. The Model Factory for Paper research collaboration has the ambitious goal to reduce the use of energy by 80%. To achieve this goal, it is necessary to optimise the entire chain of value creation down to the individual process level, to coordinate and partly even re-design processes.

Problem definition

More than half of all the energy required by the paper machine is used to heat the dryers. The water removed by heat from the paper web is led away by means of hot air through a dryer hood. In the conventional process, part of the heat is recovered via heat exchangers and delivered to processes working at a lower temperature level. The pre-cooled exit air from the hood is then used for heating the production hall or discharged into the

environment as a balance loss. This hot and saturated air carries a considerable portion of water vapour into the atmosphere which is the at the origin of the typical clouds that form above paper mills. A simplified calculation of the water balance of a paper mill gives a water vapour release of approximately one tonne of steam per tonne of paper produced. The evaporation heat is a multiple of the energy amount for raising the temperature of the gas mixture. To give a better idea: The amount of heat released for the production of one pack of office paper is sufficient to bring about 15 litres of tap water to the boil.

Requirement

Given the high amount of energy exiting the mill as steam, the final goal can be described in more simply way: "No steam leaves the mill". This can only be achieved by recondensation of the steam contained in the exit air before its release to the atmosphere. Extensive condensation of water vapour requires a heat sink with a

Project title:

Thermodynamic optimisation of the papermaking process

Project period:

06/2022 – 03/2023

Project type/sponsor:

Model factory for paper in-house project

Research locations:

- Papiertechnische Stiftung (PTS) – Methods & Simulations, Toma Schneider
- FH-Aachen; Institute NOWUMEnergy, Prof. Dr.-Ing. Isabel Kuperjans
- Modellfabrik Papier gGmbH, Peter Beakaert

temperature as low as possible, which is not available in the papermaking process. Extensive reuse of the thermal energy requires a substantially higher temperature than that of the sink.

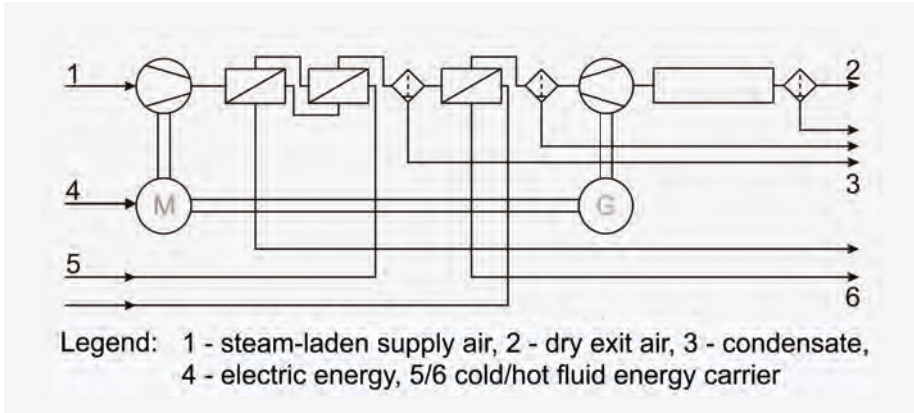


Fig. 1: Principle circuit diagram: heat recovery by dew point shift

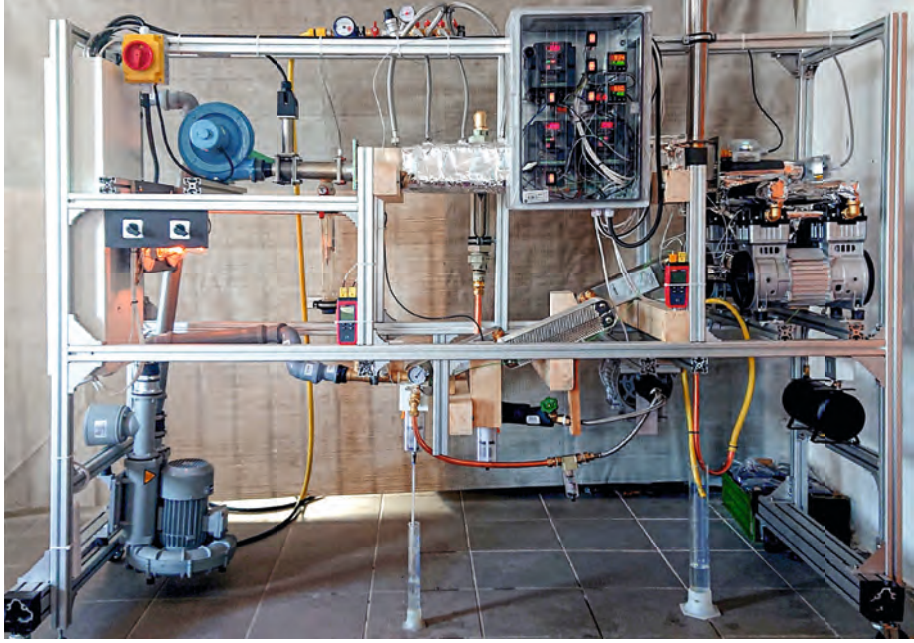


Fig. 2: Test installation: heat recovery by dew point shift

Solutions to this technical problem are heat pumps which have not been used for cost reasons so far and cannot readily cope with high temperature strokes.

Solution

An alternative to the subsequent raising of the temperature level of the heat sink can be to shift the dew point of the water vapour towards higher levels by increasing the absolute pressure (Fig. 1). Nearly adiabatic compression of gas mixtures causes the gas temperature to increase. So it is possible to properly adjust the source temperatures and the dew point curve via the compression ratio. These ideas

were translated into the paper drying processes and prepared by PTS for an intellectual property application.

Implementation

A first lab-scale test installation was set up (refer to Fig. 2) and the basic principle was successfully tested in a pre-trial within a preliminary project on the envisaged collaborative research project FOMOP1. The 85°C hot air-steam mixture with a steam load $X = 0.15 \text{ kg}_{\text{water}}/\text{kg}_{\text{air}}$ from a heat channel is compressed to approx. 5 bar and then passed on to a heat exchanger cascade. In the counterflow-type heat exchangers, the air-steam mixture is cooled down to about 40 °C, causing

95% of the steam to condense. After expansion in an expander where part of it is transformed into mechanical energy, the air temperature goes down to below 10 °C. The resultant dry air could be used for cooling purposes and then returned to the dryer hood.

Outlook

In perspective, two implementation variants can be derived from this method.

A first variant holds out the prospect of revamping existing systems. This would be done by reconditioning the saturated steam for the dryers in combination with vapour compression. The energy would be provided electrically and introduced into the process via compressors. As before, technical energy losses would make it possible to provide heat to other sub-processes in the paper machine.

A second variant is looking into convection drying of the web with hot air. Here, hot air circulates in a semi-closed system and is dried by shifting the dew point. The goal of the envisaged FOMOP project is to show how much of the theoretically possible energy reduction, in the amount of two thirds of conventional dryer heating, can be technically achieved in practice. ●

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Footnote

[1] FOMOP – StG Forschungscluster Modellfabrik Papier – VPI: Climate-neutral papermaking

Problems at the manufacturer's joint?

FEFCO Test Method No. 55 – Determination of the strength of the manufacturers' joint of corrugated fibreboard containers



Fig. 1: Test unit for determining the glued seam strength according to FEFCO Test Method No. 55 ©PTS

As part of further development of test methods, PTS put into operation a test device that allows the strength of the manufacturer's joint of corrugated board boxes to be tested. A cut-out that includes the manufacturer's joint and the adjacent board material is removed from the box and then clamped in the test unit (cf. Figure 1). The test unit is integrated in the general-purpose test equipment and applies a gradually increasing test load to the specimen until reaching a predetermined value or until failure of the joint tested. Force-distance curves

are recorded, allowing the strengths of the seam and potential weak points of the manufacturer's joint to be analysed. The developed test unit is composed of a stiff metal frame which comprises two clamping jaws that allow the free ends of the test piece to be clamped at right angles in parallel with the manufacturer's joint, and a mobile shaft equipped with a rounded pressure head. Thanks to the new test method after FEFCO Test Method No. 55, it is now possible to characterise to a larger extent especially the glued seam at the joints of

corrugated board boxes and carry out optimisations.

You have questions regarding the new test method or other physical and mechanical tests on paper, board or packaging? Please do not hesitate to contact our team: materialtesting@ptspaper.de.

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Together around the globe with Mpack & Fibre Circle – Method training for CEPI Recyclability Test Method Version 2 Part I

This spring, he had the pleasure to welcome **Mpack Operations Pty Ltd** and **PAMDEV NPC t/a Fibre Circle** to our premises in Heidenau for a theoretical and practical method training. The corporations from Johannesburg and Springs in South Africa have set themselves the goal to implement a separate

collection of recovered paper in order to increase the recycling rates in the long term and thus enhance the circular economy.

With the aim to test the recyclability also of packaging products, the two-day visit was spent performing together

the CEPI Recyclability Test Method Version 2 Part I (for recyclability in standard paper mills) and then evaluating the laboratory test results by means of the Recyclability Evaluation Protocol – Beta Release – published by 4Evergreen in 2023. This joint work led to vivid exchanges on methodological aspects and helpful tricks in lab practice, but also resulted in critical observations on aspects that need clarification in the final version of the evaluation protocol.

We are happy about the successful method training, about the exciting talks regarding the different national situations, and about the future collaboration with the Mpact Innovation Centre and Fibre Circle. ●

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From left to right: Marie Geißler (PTS), Adine Visser (Mpact), Cugulethu Nkala (Fibre Circle), Bongani Xaba (Mpact), and Vanessa Wortmann (PTS).

Networking

Annual Meeting: Association of Bavarian paper, cardboard and plastics processing industry (VBPV)



On 24 March 2023, the Association of Bavarian paper, cardboard and plastics processing industry (VBPV) held its annual meeting in Tegernsee to which members and partners were invited. Papiertechnische Stiftung held a stand to inform the meeting about the wide range of services offered by PTS. Besides the latest ideas and services for supporting the transformation of the paper sector in energy and sustainability issues, many conversations also addressed the professional training of professionals and managers by PTS. In the public part of the event, Sonja Meise from #Food News Germany presented a series of pictures with examples of packaging solutions aimed at consumers and future professionals of „Generation Alpha“. ●

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Annual meeting of the Association of Bavarian Paper Mills

The annual meeting of the Association of Bavarian Paper Mills took place in the hotel Bayerischer Hof in Munich

on 5 May 2023. PTS was present to exchange views on the current Packaging & Packaging Waste Regulation

(PPWR) with partners from the paper and packaging industries, traders and ministries. For example, the Bavarian Ministry of Economic Affairs submitted to the German upper house (Bundesrat) a recommended resolution for preferring fibre-based packaging made of paper and board because of the ecological benefits associated therewith. The objective is to eliminate packaged products from the multiple-use system. ●

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PTS in close exchange with the German paper and plastics processing industry



On the kind invitation by HPV Director Jürgen W. Peschel and CEO Stefan Rössing, PTS Director Dr. Thorsten Voß and the line managers Dr. Antje Harling and Dr. Martin Zahel attended the annual meeting of the Central Association of the Paper and Plastics Processing Industry (HPV) in Berlin. The excellently organised event

offered the opportunity to enter into discussion about current subjects of topical interest for the sector. The top-class programme included speeches by Jens Spahn (CDU/CSU, member of Bundestag), Reinhard Houben (FDP, member of Bundestag), and Dr. Rainer Dulger (President of the Confederation of German Employers' Associations,

BDA). Apart from specific technical aspects, the main focus was laid on issues of corporate governance and business operations such as future energy supplies and shortage of skilled workers. This provided much impetus to PTS as to the design and contents of its training business in the future. Also, the initial statement by Ruediger Vogel (business consultant), "Corporations are looking for people matching their gaps, job seekers are looking for work matching their lives", provided some food for thought. ●

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PTS on the SME Innovation Day of BMWK



On 15 June 2023, the Federal Ministry for Economic Affairs and Climate Action (BMWK) held the SME Innovation Day in the open air to present the groundbreaking results of the innovative small and medium-sized businesses and the effectiveness of the federal government's innovation funds. PTS held a stand at the exhibi-



tion to inform about anti-counterfeiting security labels designed to protect products against tampering. The labels react to predefined influences through individualized indicator systems (IK-MF 220041 "FindE!").

Further, PTS presented test devices designed to determine the in-plane

and out-of-plane shear behaviour of materials based on natural fibre (IGF 21513 BG „UniVorsUm“). Apart from the presentation of said research and development results, the PTS team members had interesting talks with visitors and other exhibitors. PTS is glad to have had the opportunity to provide a large audience with information about the findings of its paper research work and thanks all participants for the inspirational exchange. ●

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RUN on the REWE Team Challenge



On the 6th day of June, PTS took part in the REWE Team Challenge run in Dresden, as every year. The runners from PTS competed well on the 5 km long track and obtained good results for the HEAD-box, RUNability, and fibre ORIENTATION teams among an overall field of about 22,500 participants. The route ran from the starting point in the city centre (Altmarkt) via Ostra-Allee avenue along the Elbe river to the finish in the Rudolf Harbig stadium. Besides the sporting challenge, this year's participation was once again a successful experience, accompanied by many bands and spectators. PTS express their thanks to the organisers of the Team Challenge and to the participating employees, looking forward to next year's run in 2024. ●

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Events in 2023 & 2024

Sep	PTS Coating Symposium 2023 · Symposium · 13. - 14.09.2023 · Bamberg  ★	
	Introduction to compliance work and quality assurance for paper and board in contact with food (FCM) Workshop · 19.09.2023 · Online 	Microplastics and Single Use Plastics Directive (SUPD) – definitions, regulatory situation, analytical methods, alternative materials Workshop · 19.09.2023 · Online 
	Surface functionalization of paper & board based packaging Workshop · 20.09.2023 · Online 	Recyclability of paper & board based packaging Workshop · 20. - 21.09.2023 · Online 
Oct	Einführung in die Papiererzeugung: Modul 1 – 4 · Grundkurs · 23. - 27.10.2023 · Dresden 	
Nov	Einblicke in die Prüfung von Papier, Karton, Wellpappe und Verpackungen Grundkurs · 06. - 07.11.2023 · Online 	Auswahl und Bewertung von Altpapier Vertiefungskurs · 14. - 15.11.2023 · Heidenau 
Feb	Papierherstellung im Überblick · Seminar · 06. - 07.02.2024 · Heidenau 	
	Introduction to compliance work and quality assurance for paper and board in contact with food (FCM) and actual challenges · Workshop · 27.02.2024 · Online 	
	Surface functionalization of paper & board based packaging Workshop · 28.02.2024 · Online 	Recyclability of paper & board based packaging Workshop · 28. - 29.02.2024 · Online 
Mar	Introduction to paper manufacturing Grundkurs · 12. - 13.03.2024 · Online 	Recyclinggerechte Gestaltung von faserbasierten Lebensmittelverpackungen Grundkurs · 19. - 21.03.2024 · Online 
May	PTS Wellpappe Symposium 2024 · Symposium · 07. - 08.05.2024 · Dresden  ★	

Registration & information:
www.ptspaper.de/veranstaltungen

Contact



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PTS Technical Meeting “Paper, board and tissue in food contact” in March 2023 – highlights

Dr. Harling and Dr. Kleebauer welcomed the attendants and presenters to Dresden and moderated together with Mr. Schneider the technical meeting “Paper, board and tissue in food contact”. The varied programme covered the recent developments in food contact materials (FCM) and provided much “food” for thought and discussion both on the panel and during the breaks.

Recent developments in the folding box sector,

Christian Schiffers – Association of the Folding Box Industry (FFI)

In the beginning, Mr. Schiffers provided a comprehensive overview of the current trends in the folding box sector in Germany and Europe. He made it very clear that the regulatory endeavours of the European Green Deal were about to cause a “regulatory tsunami” coming towards packaging manufacturers: EU climate law, chemicals strategy, corporate sustainability reporting, farm-to-fork strategy, and the EU plastics strategy arising from the Single-Use Plastics Directive (SUPD) and its implementation in national law, to mention just a few. He presented in detail the Packaging and Packaging Waste Regulation (PPWR). Furthermore, he outlined in a keyword style the challenges arising from the European regulatory activities in terms of printing inks, perfluorated chemicals (PFAS), mineral oil, endocrine disruptors, and the revision timeline for the Regulation 1935/2004.

Chemicals strategy for sustainability – an impact analysis,

Dr. Sabine Lindner – PlasticsEurope Deutschland e.V.

The European Green Deal was explained by Dr. Lindner under the

aspect of the new chemicals strategy of the EU. At present, a comprehensive knowledge base for the identification and assessment of the chemicals does not exist.

Therefore, this knowledge base must be established and compiled in a cooperation between authorities, such as ECHA and EFSA, and industries. She outlined the opportunities and questions arising from the “One substance – one assessment” (OSOA) approach that is envisaged to be used for the coordination of the collection and assessment of data and for the subsequent regulatory implementation. She criticised the introduction of the “mixture assessment factor” (MAF) as an additional allocation factor meant to account for combination effects of substances in mixtures because of the potential overlap with already existing allocation factors.

SUPD | single-use plastics legislation and impact of the PPWR,

Thorsten Plutta – PRO-S-PACK collaborative association for service packaging

A currently much debated goal of the EU is to ban or at least reduce single-use products made of plastics. Therefore, Thorsten Plutta placed the focus on the SUPD and its implementation in national law, and on the impacts this has on paper products. He pointed out that the newly created German Single-Use Plastics Fund (EW-KFond) encompasses all packaging products placed on the market including e.g. in-house packaging in system catering and in the medical area where the packaging will not typically leave the establishment. Furthermore, there are already attempts on the municipal level to extend the levies to be



Fig. 1: Display of food contact materials © PTS

paid into the SUP fund to all and any packaging regardless of the material. With regard to the PPWR, he criticised that recent studies had already shown that multiple-use obligations would produce negative ecological effects and that risks related to food safety were not taken into account.

BPA – EFSA Draft for re-evaluation and criticism by BfR,

Dr. Claudia Lorenz – Federal Institute for Risk Assessment (BfR) – Safety of food contact materials

Dr. Lorenz presented the position of her institute and significant points of criticism on the re-evaluation of BPA by EFSA. Her statements were brisk and cutting edge because she made them accessible to the audience before official publication of the divergence paper by BfR and EFSA. She referred to several points on which BfR and EFSA were not able to achieve a scientific and methodological consensus. From the BfR's perspective, there are both older and recent studies having a higher scientific quality than those considered by EFSA. They lead to significantly different results. Nota bene: The divergence papers and a BfR risk assessment of BPA are meanwhile freely accessible over the Internet (cf. page 17, BPA article by E. Mehlhorn).

Bisphenol A – Analytical challenges and opportunities with the introduction of the new TDI,

Jörg Konetzki – Institute Kirchhoff Berlin GmbH

After a short introduction to possible health hazards from PBA, to the EFSA Draft for re-evaluation, and to the safety requirements on food contact materials arising from Regulation 1935/2004, Mr. Konetzki went on to address the challenges regarding the analytical determination of the extremely lower tolerable daily intake (TDI) value of BPA. A very big problem is the elimination or reduction of BPA in blank values. Sample preparation should therefore be kept as simple as possible. For the analytical separation by means of HPLC, an additional trap column would be needed to retain BPA from the HPLC system for so long as is necessary to ensure that the latter arrives at the MS/MS detector after the BPA from the sample. This would allow limits of determination of 25 ng/kg of material via extraction and 1 ng/dm² of material for migration testing with Tenax®.

Organoleptic analyses (optical brighteners / sensory analysis) – problems and solutions,

Prof. Dr. Thomas J. Simat – TU Dresden
Equipped with the popular Sniffin' sticks, professor Simat began his presentation with an introduction to the world of organoleptic testing. He compared the DIN 10955 and DIN EN 1230-1/-2 standards and described their scopes of application in organoleptic tests.

In the second part of his presentation, he covered the empiric analysis of optical brightening agents (OBA). The test is based on a visual assessment of fluorescence intensity under UV light in comparison with a reference scale. However, the sulfonated stilbene derivatives frequently used as optical brighteners present an isomerism

equilibrium, and only the trans-form is fluorescing. That is why the fluorescence intensity decreases significantly over time as a function of the matrix. This fact is not taken into account by the current standard. A way how to identify and quantify the various stilbene derivatives is not given either.

PFAS – Sample preparation, sum parameter method, and single substance analysis – challenges and solution approaches,

Axel Ulbricht – Eurofins Umwelt Ost GmbH

The worldwide efforts to restrict the use of "forever chemicals", as per and polyfluorated alkyl substances (PFAS) are generally called, are directly linked to the question how to analyse them. Against this background, Mr. Ulbricht presented the various approaches depending on whether the objective is to analyse PFAS single substances or sum parameters such as Total Organic Fluorine (TOF). He outlined methodological workflows of the various determination procedures, their applicability to certain matrices, and what their respective benefits or drawbacks are.

Current developments in German and European FCM legislation,

Saskia Both – State Office for Consumer Protection

Ms. Both took the attendants of the technical meeting on a ride through the current landscape of German and European FCM legislation. She also indicated the EU-wide cooperation efforts by authorities e.g. within the scope of the GMP-FCM Enforcement Working Group. She gave a comprehensive overview of the results of the consumer consultation on food law and the study on certificates of conformity in the supply chain, which were both conducted by the European Commission, and of regulatory initiatives and implementations, such as the Plastics Recycling Regulation.

Insights into the activity of food inspectors in Germany – a report from the field,

Maik Maschke – Federal Association of Food Inspectors of Germany

Mr. Maschke presented the diverse and very wide-ranging tasks of the Food Inspection and Veterinary Offices (LÜVA) in Germany. Initiated by the question who of the attendants from the paper industry had contact with food inspection authorities last year, Mr. Maschke's presentation was followed by a variety of questions from the audience and their vivid discussion. This showed the great interest in looking at the paper industry from a different perspective from time to time.

Microplastics: do they concern paper companies using recovered paper for food contact materials? Presentation of an AiF project,

Antje Kersten – TU Darmstadt

How do microplastics enter the paper and how can they be determined in paper? This is what the Technical University of Darmstadt in collaboration with the RheinMain University of Applied Sciences intend to investigate in their joint research project. Ms. Kersten presented the first results regarding microplastics in paper mill effluents and paper samples.

Recyclable barrier solutions – the BiPaRe project and the new PTS test method PTS-RH 025:2022,

Dr. Jennifer Daeg – Papiertechnische Stiftung (PTS)

Bio-based barrier coatings can bring a disturbance potential into the recycling of paper products. Therefore, the goal of the research project presented by Dr. Daeg is to establish a testing methodology that considers said disturbance potential as early as in the development phase of sustainable packaging. The intermediate results of this project show already that bio-based barrier materials are

competitive with materials of fossil origin BOTH in terms of their barrier effect AND their recyclability.

Liquid boards: food safety, recyclability, and ecologically valuable – does it all still fit together?,

Michael Brandl – EXTR:ACT e.V.

Mr. Brandl's mission is to have all valuable materials used in liquid boards returned to the cycle. Consumer protection and product safety have utmost priority and can be achieved only if all parties involved in the cycle work together.

Good manufacturing practice in paper conversion – conformity work in practice,

Stephanie Lange – Papierverarbeitung Peters GmbH & Co.KG

After looking at the wide range of requirements for the paper industry from a variety of perspectives, the final and concluding contribution was made by Ms. Lange who presented the organisational and bureaucratic obstacles to be surmounted in the area of conflict between available resources, production environment, customer requirements, sustainability and environmental criteria, and legal regulations in the paper processing and converting industry. ●

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PTS Coating Symposium 2023 in Bamberg: make your plans.



PTS Coating Symposium 2023 – THE coating technology in-person event in Bamberg

On the 13th and 14th of September this year, the PTS Coating Symposium (international) will be held again as an in-person event in the heart of the cultural UNESCO world heritage city centre of Bamberg, which is at the same time Germany's secret beer capital. Having organized the previous symposium in an online format in 2021, we are now happy to hold this most important coating-related symposium of the papermaking sector as an in-person event to bring together research,

development and industrial specialists. The main focus of this year's symposium is on latest trends in coating technology regarding bio-based barrier solutions for paper packaging, application technology, and ensuring the recyclability of products. You can look forward to a top-class programme with Eveline Lemke (Thinking Circular®) and Dr. Christian Kind (Koehler Paper) as key-note speakers, the accompanying exhibition, the social programme for networking, and exciting discussions.

We are looking forward to seeing you.

Come and be a part of this internationally renowned industrial meeting.

- **Sponsors and exhibitors:** Present your solutions, products and services to a broad industrial audience and experts on various platforms.

Event management



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www.ptspaper.de/veranstaltungen

Event organization

Follow-up on the PTS Conference “Paper & Board Recycling – Smart & Circular”



The PTS Conference “Paper & Board Recycling – Smart & Circular” took place in the Hyperion Hotel near Dresden castle on 23 and 24 May 2023. The conference was held in English, offering the international participants and attendants a platform for exchanges and exciting insights around the topics of Circular Economy and Digitization. Current developments and innovations from the multifaceted world of paper and board recycling were highlighted in numerous presentations. The conference was a hybrid event with participants and presenters from nine different countries, such as France, Israel, and Belgium.

Dr. Martin Neumann-Kipping moderated altogether seven theme sessions during the two conference days. The themes of Day 1 were current legislation, conditions for recycling, innovative packaging trends and their impact on recycling. Another focus was placed on the questions: How can digital technologies pave the way for a consistent circular economy and is it possible to keep more “lost fibre” in the loop and thus achieve a 100 per cent recycling rate? The concluding panel discussions gave participants and speakers the opportunity to enter into discussion about the topics presented and to bring in fresh ideas and questions. This interactive approach facilitated an intensive exchange of knowledge and allowed for a more profound discussion of the themes of the day. The focus of Day 2 was laid on innovative recycling technologies, use of advanced instrumentation for process monitoring and control, and

current trends and visions of process digitization. The second day was also concluded with a final panel discussion with the experts of the presentations.

The social programme included a guided tour of the historic centre of the wonderful cultural city of Dresden and a joint dinner which provided an opportunity for informal networking and exchange of experience and ideas.

The PTS Conference “Paper & Board Recycling – Smart & Circular” offered a unique environment for participants to expand their knowledge, establish new contacts and work together on forward-looking solutions for the recycling of paper and board and thus get closer to the goal of a fully closed circular economy.

We express our thanks to the research team around Dr. Martin

Neumann-Kipping, to our presenters, and to the entire organization team for their excellent work in arranging and running this conference. It is thanks to their commitment and contribution that the PTS conference has become what it is today: an important meeting point for specialists from the paper and recycling industries.

We look forward to future events and are curious about further – smart and circular – progress and innovation in the field of paper & board recycling and what contribution will come from digital technologies. ●

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Integrated Design meets PTS: Creative solutions for an ecological future of the paper industry

Papiertechnische Stiftung (PTS) in Heidenau runs laboratory and pilot plants for fibre stock preparation and small-scale manufacture of various types of fibre-based materials. Such materials can be graphical papers, packaging papers, special papers, wetlaid nonwovens, or fibre moulded parts. Alternative fibrous materials have gained more and more importance over the years.

In spring 2022, when Johanna Poncar kindly asked us to support her for her bachelor thesis in ecology and design, in which she dealt with the manufacture of papers and moulded parts from fibre residue, we were immediately thrilled and enthusiastic. One year later, it emerged that the collaborative work with the Cologne International School of Design at Cologne University of Applied Sciences (KISD TH Köln) would continue when we were contacted by Sina Reinartz. In her bachelor thesis she dealt with coffee side products as a new paper-making resource. The motivation and the perspective of the two students for their subjects has left us with lasting enthusiasm and we enjoyed supporting them. But let them speak for themselves.

KISD TH Köln

The original concept of design has developed a lot over the past few decades. The spectrum of things that can be designed has become much broader and is no longer limited to everyday objects. Also, social structures, communication processes, or services are characterised, specified and shaped by design.

Students at the Cologne International School of Design attached to Cologne University of Applied Sciences (KISD)

are given the means to deeply understand and systematically bring to life the diversity and complexities of design. During their studies, the aspiring designers acquire practical and theoretical design knowledge that qualifies them for current and future fields of action in design.

Johanna Poncar – fruit paper

While working on her bachelor thesis in 2022, the student Johanna Poncar came up with the idea to study residual materials from the food industry. There, she came across what is known as pomace, which is the marc remaining from pressing operations in the juice-making process and is composed of solid parts of fruits and vegetables. The analysis of the different types of pomace showed that the basic fibrous structure of rhubarb pomace was very promising for further processing.

As rhubarb pomace is highly perishable, this material is mainly delivered to biogas and incineration plants where the intrinsic potential of the pomace remains unused.

With a per-capita consumption of 30 litres, Germany is by far the biggest juice consumer worldwide. Producing much juice means producing much pomace. The annually obtained amount of rhubarb pomace in Germany alone is 4,000 tonnes for which there is no meaningful use so far or which must be disposed of at a charge.

First trials in her own home kitchen revealed that rhubarb pomace is suitable as an alternative fibrous material for the manufacture of paper and three-dimensional moulded parts. “My first experiments quickly showed that

rhubarb was suitable for the manufacture of papers. But I then quickly reached the limits of my school as to its papermaking possibilities. That is why I started looking for experts that are able to support me for my project.”

In collaboration with Papiertechnische Stiftung, it was possible to confirm the feasibility of the mechanical production of papers and fibre moulded parts from rhubarb pomace. The substitution thus made possible for part of the wood fibre is of high topical relevance in the paper industry. The material thus developed can be smoothly re-integrated into the natural cycle. Because of its shock-absorbing properties, its local availability and its food contact safety, the rhubarb pomace-based material is suitable as a packaging material for fresh fruits and vegetables. Thanks to the interdisciplinary cooperation with experts in paper research, agriculture and juice production, the pomace material was used to develop the strawberry tray “fruchtpak”. The resource-saving packaging concept is based on an extensive analysis of how strawberries are handled and is adjusted to the requirements of all parties involved, i.e. Strawberries in display are well visible through the open lid prior to sale. After sale, the closed lid of the “fruchtpak” tray protects the fragile strawberries during transport and extends their storage life.

Her bachelor thesis was awarded second place of the Cologne Design Prize 2022.

The idea of combining a well known manufacturing technology and a readily available residual material shows the critical role of design in development processes.



Sina Reinartz – beans to be spilled

The major portion of the valuable coffee beans is lost on the way from the coffee plantation to our coffee cups. Unbelievable 99% is wasted, whereas less than 1% actually reaches the cup. Coffee is undoubtedly the most popular hot beverage and semiluxury item of the German people. The demand for coffee is steadily growing, and the same is true for the amount of coffee residue.

However, coffee dregs are only part of the story. As early as in the production phase, coffee beans leave their traces, like the coffee silver skin from roasting. Instead of simply throwing away this valuable resource, it is high time to conduct a material study in order to find new ways of recycling.

The valuable coffee bean travels thousands of miles before finally reaching cafés, workplaces, or homes. Often, we take a cup of coffee as granted without being aware of what happens behind the scenes or what the necessary production steps are. Plantation and transport play a crucial role, as well as the waste stream that is produced by

the large coffee industry and leaves its traces in the environment. In a time when sustainability becomes more and more essential in all areas and resources are limited, be it in design or in papermaking, I want to make a contribution to raising awareness and transparency of coffee by-products.

My personal interest and motivation began already during school time when I worked as a waitress in catering establishments. In continued this sideline activity in a café also during my design studies at KISD. Coffee has become a companion to me, but the incredibly huge amounts of residues that are produced on a daily basis gave me a lot to think about. When just one café produces so much waste, what is the situation in a larger coffee factory or in the entire industry? That is the reason why I decided in my bachelor thesis to develop, in collaboration with PTS, a thrilling option for the recycling of coffee dregs and roasting residues from coffee production. Meanwhile, I do not work any longer as a waitress in a café, but in a local coffee factory and roasting house in Cologne.

My goal is to investigate into the full potential of coffee side products as so far unused raw material for the pulp and paper industry. I wish to raise the public's and industry's awareness and make it clear to them that waste material is not useless but a valuable resource that should be treated as a substitute filler. My concept is e.g. to develop a closed circuit system in a coffee factory where really everything is used on the spot without any remains.

The time has come to look for solutions how to recycle unused resources in an ecologically and economically meaningful way for the paper industry. Thanks to the support provided by PTS where renewable energies were used most of time and 100% exclusively during my trials, I as a designer was in a position to implement my conceptual ideas with professional precision. ●

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PTS Winter Party – Everyone loved it.

Our motto was: Winter Party instead of Christmas Party! With the aim to escape the hustle and bustle of Christmas and the huge number of seasonal winter events, PTS decided for the first time to have a Winter Party instead on 1 February 2023.

All colleagues gathered in the conference building of our partner institute IHD (Institute for Wood Technology of Dresden) to toast to the recent months and the new year.

After the aperitif and the opening address by PTS Director Dr. Thorsten Voß, the management team agreed to face anonymous, sometimes inconvenient questions submitted by the audience in writing on beer mats that were thrown to Marcel Herzog, the moderator of the soiree. Lydia Tempel, Antje Harling, Martin Zahel, Thorsten Voß, Lisa Beyer, Marcel Haft, and Anja Gruhl stewed about questions like “What was your most embarrassing moment



ever?”, “Which three persons from the PTS team would you take with you to a desert island?”, or “Do men commit a deadly sin by wearing shorts?”

Then, the chairman of the works council, Benjamin Hiller, introduced the new nine works council “fellows” in a “Lords of the Rings” style.

After dinner with piano accompaniment, the colleagues competed in teams against each other in the quiz show called “Papiertechnische Stiftung – Do you happen to know...?” Celine Farr and Martin Zahel moderated the questions, checked the response rates, and uncovered e.g. carriers in film. So it became public that there is one person in our midst in PTS who speaks a crucial sentence in the film “Pappa ante portas” of the German comedian Loriot. We are famous! Also, other hidden talents came to light, such as the green thumb of our Director, or instrumental abilities. A particular highlight was the category “Earlier career aspirations”: a bratwurst seller, a Pokémon master, an excava-

tor operator, and an astronaut finally decided nevertheless to start a career with PTS, much to the delight of our institute. In the past, however, some of the employees actually worked in sometimes quite exotic jobs like melon picker, dairy driver, refuse collector, or mascot performer in the form of an oversized pear. Hats off to so much commitment!

The winning prize was a trophy cup to be taken home by the winners of the evening – of course in the form of a do-it-yourself model in paper, as it should be for a paper institute.

Many thanks to the entire PTS team for this memorable evening, and special thanks to Celine Farr, Lea Stelzig, and Debora Zahel for having prepared the party with so much loving care. ●

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