TOSOH

TOSOH
THE CUSTOMER
MAGAZINE

NO.#01 2022

EXPERIENCE/EDUCATE/ENHANCE

TOSOH BIOSCIENCE

02
EDITORIAL
DEAR READER

Welcome to this issue of the Tosoh Bioscience customer magazine. The first half of the year 2022 flew by and there is a lot to report: Several new products were launched, interesting cooperation projects were started and in-person conferences and tradeshows are back again. At the same time, SARS-CoV-2 infections are still high, climate change manifests itself in record temperatures and we are facing a war in Europe that heavily affects the global economy.

Although these circumstances are more than threatening we also enjoyed many positive experiences during the first meetings and discussions with our customers at conferences and especially at the analytica tradeshow in Munich. We want to share only positive news on the following pages and hope you find some interesting information.

STAY SAFE AND HEALTHY AND ENJOY READING

REGINA ROEMLING
SENIOR MARCOM MANAGER EMEA
TOSOH BIOSCIENCE GMBH

SUPER T AND HIS FRIENDS NEVER WALK ALONE

CONTENT

IMPRESSUM

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03 WHAT'S NEW COLUMNS

UHPLC COLUMNS DESIGNED FOR SEC WITH ADVANCED DETECTION

AQUEOUS SIZE EXCLUSION CHROMATOGRAPHY (SEC) IS AN ESTABLISHED METHOD FOR THE ANALYSIS OF PROTEINS AND MONOCLONAL ANTIBODIES UNDER NON-DENATURING CONDITIONS. TSKgel® SW SERIES COLUMNS HAVE BEEN THE INDUSTRY'S WORKHORSES FOR THE SEC ANALYSIS OF BIOTHERAPEUTICS FOR DECADES. TO ADDRESS THE TREND OF HYPHENATING SEC WITH ADVANCED DETECTION, WE DESIGNED THE LATEST ADDITION TO THIS RENOWNED COLUMN FAMILY FOR A SMOOTH AND EFFICIENT COMBINATION OF SEC WITH LIGHT SCATTERING (SEC-MALS) AND MASS SPECTROMETRY DETECTION (SEC-MS).

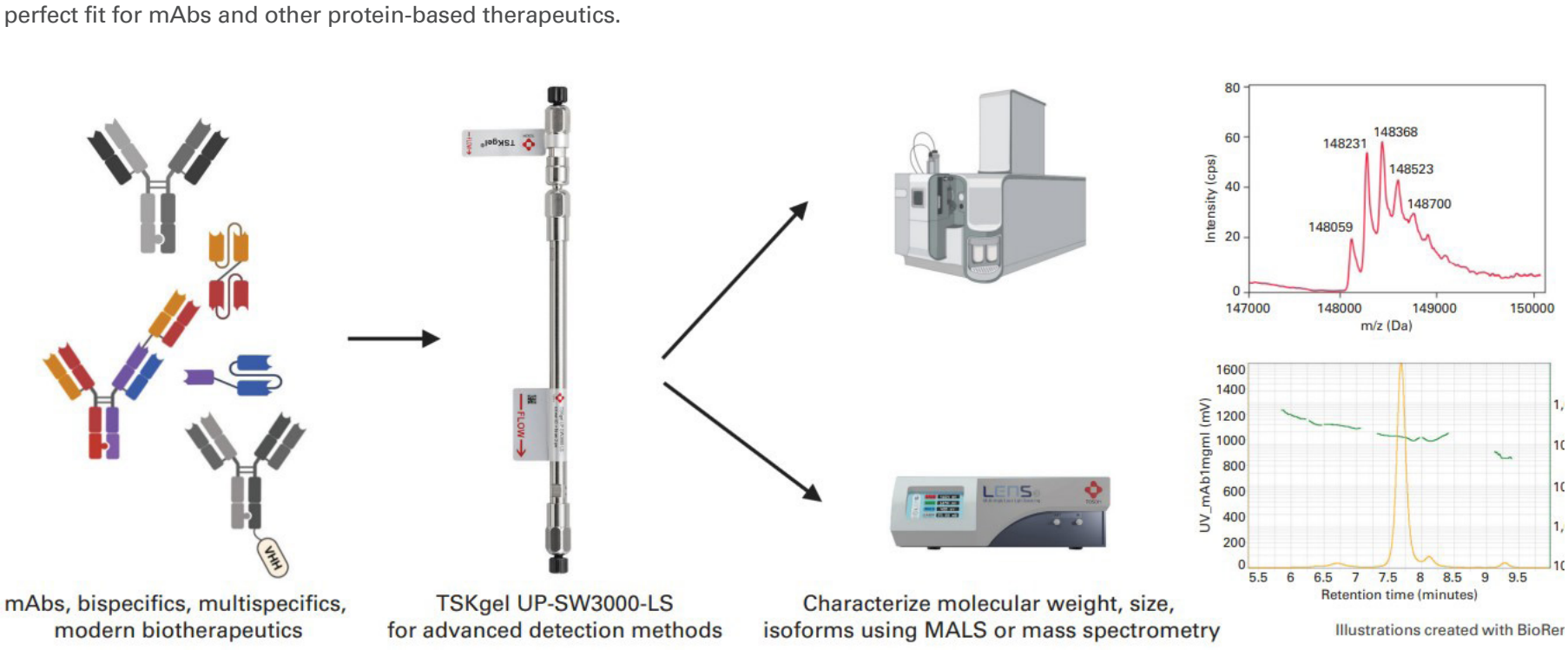
TSKgel UP-SW3000-LS columns offer high resolution, sharp peak shape, and high efficiency yielding methods that are robust, reproducible, and easily transferable between UHPLC and HPLC systems. These U/HPLC columns provide significantly lower noise levels than other columns when coupled with advanced detectors, shortening the time for equilibration and improving data quality.

For multi-angle light scattering (MALS) applications, columns with low noise levels yield high signal-to-noise ratios and this will improve the sensitivity of detection. For mass spectrometry applications, low shedding columns will increase electrospray ionization efficiency and enhance overall MS performance and instrument uptime.

This comes in addition to what the standard TSKgel UP-SW3000 column is valued for: a UHPLC column for high-resolution size exclusion analysis using 2 µm diol-bonded silica particles with 25 nm pore size, a perfect fit for mAbs and other protein-based therapeutics.

Recently, more focus has been placed on biomolecules derived from monoclonal antibodies, such as bi- or multispecific antibodies. These are potentially more complex molecules with increasing low and high molecular weight impurities. An advanced detection method such as MALS or mass spectrometry is needed to characterize these complex samples. The TSKgel UP-SW3000-LS column is designed to be coupled with an advanced detection instrument to achieve these analyses.

The main feature of the TSKgel UP-SW3000-LS column is its reduced noise in MALS and MS detection. For example, the highly sensitive low-angle signal from the LenS3® multi-angle light scattering detector shows extremely low shedding levels from this column. This is extremely important to explore the extraordinary sensitivity the Tosoh Bioscience LenS3 MALS detector is known for. It makes LenS3 and TSKgel UP-SW3000-LS the perfect team for biotherapeutic characterization.



mAbs, bispecifics, multispecifics, modern biotherapeutics

TSKgel UP-SW3000-LS for advanced detection methods

Characterize molecular weight, size, isoforms using MALS or mass spectrometry

Illustrations created with BioRender

SEC APPLICATIONS OF TSKgel UP-SW3000-LS WITH ADVANCED DETECTION

04 EXPERT INSIGHTS

BIOPHARMA PARTNERSHIPS – HIGH-INTENSITY PURIFICATION

THE BIOPHARMA INDUSTRY IS CONTINUOUSLY GROWING AT HIGH GROWTH RATES. DRIVING THE SECTOR'S CONTINUED SUCCESS IS A DIVERSE ARRAY OF PRODUCTS AND PROCESSES. FROM BIOSIMILARS TO VIRAL VECTORS TO BISPECIFIC ANTIBODIES, COMPANIES ARE PURSUING VARIOUS DRUG MODALITIES. BUT AS COMPANIES CONTINUE TO EXPLORE THE POTENTIAL OF NEW THERAPIES, THEY ARE ALSO FOCUSED ON PROCESS INTENSIFICATION TO INCREASE PRODUCTIVITY. IN AN INTERVIEW WITH THE JOURNAL "THE MEDICINE MAKER", ANTHONY GRABSKI, GLOBAL TECHNICAL LEADER OF MULTI-COLUMN CHROMATOGRAPHY (MCC) INSTRUMENTS AND APPLICATIONS FOR TOSOH BIOSCIENCE, AND EMILY SCHIRMER, SENIOR DIRECTOR, PROCESS DEVELOPMENT, CATALENT BIOLOGICS EXPLAIN WHY TOSOH'S UPCOMING MCC PRODUCT LAUNCHES – OCTAVE® BIO AND PRO™ SYSTEMS – CAN HELP COMPANIES ACHIEVE THEIR BIOPROCESSING GOALS.

Tosoh Bioscience (TB): How are bioprocessing needs changing in the industry?

EMILY SCHIRMER (ES): From large pharma companies to contract manufacturers, several trends are changing the industry landscape. We are seeing the addition of larger volume bioreactors, a trend towards optimized cell line development, and increased use of process intensification and continuous processing methods to drive higher productivity. These technologies and product development approaches have enabled a significant increase in the amount of material that can be generated upstream. This increase in upstream material means there is a need for efficient downstream purification methods – to avoid bottlenecks and reduce manufacturing footprints.

TB: What role can Multi-column chromatography play?

ANTHONY GRABSKI (AG): MCC fits the growing industry trend of switching from batch to continuous processes and meets the four design principles for bio facilities of the future: fast, flexible, small, and sustainable. Companies no longer want or need to deal with the large stainless steel equipment, and buffer and resin volumes associated with batch processes. MCC relies on a series of small columns instead of one large column, reducing the total resin volume required by as much as 90 percent.

The various operations of the process protocol (loading, washing, elution, and cleaning) are carried out simultaneously in different columns under the control of individual pumps. Periodic switching of the inlet and outlet streams to downstream column positions via a valve system executes the progression of process steps in a continuous cycle. MCC also allows maximum productivity as mass transfer to the Protein A chromatography resin allows the total capacity of columns to be reached as fast as possible while maintaining high purity and recovery.

Ultimately, MCC opens the bottlenecks that companies typically experience and provides significant economic advantages over traditional batch methods for mAb purification, including 3–10-fold increased productivity, 85–95 percent resin capacity utilization, 30–50 percent reduced buffer consumption, decreased column volume, and smaller versatile process skids.

All very impressive! But what makes MCC technology most important to me is the patients treated with the mAbs and biologic therapies manufactured using it. I hope MCC will make biological medicines more affordable and available, producing the highest quality, safest, and most effective treatments possible for those who need them.

ES: Protein A can be costly – often requiring a large upfront investment to establish the downstream process. The investment required for expensive chromatography matrices is limiting for many of our partners, especially small biotechnology companies. But this can be avoided using MCC because it reduces resin usage. As the industry looks to overcome the bottlenecks that can occur during process intensification, I believe that MCC can offer a pertinent solution.

05 EXPERT INSIGHTS

BIOPHARMA PARTNERSHIPS – HIGH-INTENSITY PURIFICATION

TB: What is the story behind Tosoh's upcoming MC launch?

AG: The Octave® BIO and ProGMP™ Systems are based on MCC technology developed by Semba Biosciences. Semba's in-house research focused on developing MCC methods for Protein A capture of mAbs. After screening many commercial Protein A resins, Semba found that TOYOPEARL® AF-rProtein A HC-650F from Tosoh Bioscience had the best combination of capacity, flow properties, and resulting product purity to achieve the highest productivities when used on Semba's MCC Systems.

These findings and additional superior MCC results using other TOYOPEARL resins for mAb polishing led to a strong partnership with Tosoh Bioscience – and then Tosoh's acquisition of Semba in 2021. The new Octave® BIO works particularly well with Tosoh Bioscience's SkillPak™ pre-packed columns; this powerful combination offers customers a single-source solution for robust, flexible, and rapid MCC process development.

TB: How are customers benefiting from the systems?

ES: Catalent had been considering alternatives to traditional batch chromatography to address process intensification upstream. And that's how our partnership with Tosoh came about. We worked with Tosoh's MCC systems and completed several pilot and manufacturing scale runs. The results clearly illustrated the potential to make significant time and cost savings for our partners. The automation the systems provide is also beneficial to the manufacturer with respect to operator time.

TB: How can companies learn more about MCC?

AG: Over the past three years, Tosoh has been investing in the support infrastructure to help educate current and future MCC users, both with virtual and in-person offerings. Tosoh Bioscience has created its MCC Center of Excellence in Madison, Wisconsin, and expanded the US headquarters in King of Prussia, Pennsylvania, to include a demonstration lab and training facility dedicated to MCC education. We are also investing in a similar set of Centers of Excellence and Application Labs at other offices worldwide. The platform is helping to educate and support the industry from the lab to the field.

OCTAVE BIO MULTI-COLUMN CHROMATOGRAPHY SYSTEM WITH SKILLPAK COLUMNS

CHECK OUT THE FULL ARTICLE HERE: HTTPS://THEMEDICINEMAKER.COM/MANUFACTURE/HIGH-INTENSITY-PURIFICATION

06
PEOPLE BEHIND TOSOH

INTERNSHIP, BACHELOR OR MASTER THESIS AT TOSOH BIOSCIENCE

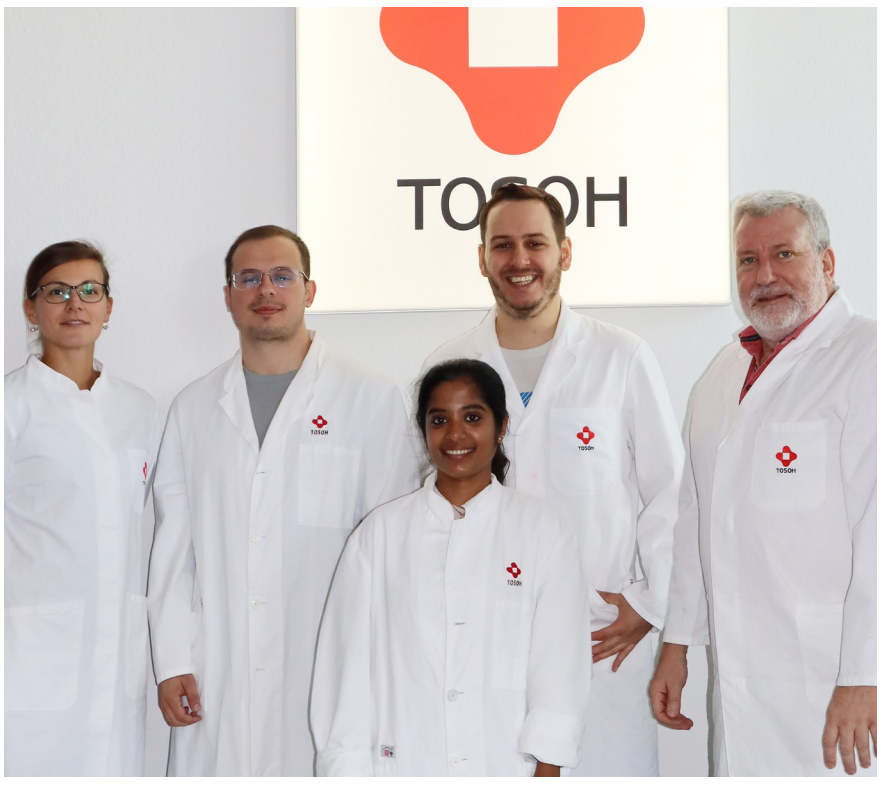
EVERY YEAR, STUDENTS JOIN OUR APPLICATION TEAMS FOR SOME WEEKS OR MONTHS OF INTERNSHIP TO BROADEN THEIR CHROMATOGRAPHY KNOWLEDGE. AT OUR LABORATORY FACILITIES AT GRIESHEIM, GERMANY, OR KING OF PRUSSIA, PA, USA, THEY WORK ON DEDICATED PROJECTS SUPERVISED BY OUR CHROMATOGRAPHY EXPERTS. ON THE OCCASION OF NATIONAL INTERN DAY IN THE US, WE CELEBRATED OUR STUDENTS ON OUR SOCIAL MEDIA CHANNELS. FOR THOSE WHO MISSED IT, WE PRESENT SOME STUDENTS AND THEIR PROJECTS HERE.

Philip Rebel, RheinMain University of Applied Science

Philip studied bio- and environmental engineering and worked at Tosoh Bioscience from December 2021 till July 2022 for his master's thesis, "Characterization and purification of modified antibody fragments." He conjugated antibody fragments with polyethylene glycol and established an SEC-MALS analysis with our LenS3 MALS Detector. He also developed a preparative method using cation exchange chromatography to purify PEGylated antibody fragments.

Aswathy Velamparambil Sasi, University of Hohenheim, Stuttgart

Aswathy, a master student in food biotechnology joined our labs for 12 weeks of voluntary internship to acquire know-how and experience in the downstream processing of biomolecules. She is working on the benchmarking of Protein L affinity chromatographic resins based on the dynamic binding capacity to capture antibody formats such as IgGs, Fabs, and single chain variable fragments (scFv). She also studies the effect of the alkaline stability of the resins to understand its impact on resin lifetime and purification performance on binding capacity and robustness.



STUDENTS AND TOSOH CHROMATOGRAPHY EXPERTS IN TOSOH BIOSCIENCE GRIESHEIM OFFICE

Alana Hausker, biology major at Drexel University, Philadelphia

Alana is the first Drexel University Student at Tosoh Bioscience, where she works with the US team in the cell culture and chromatography labs, located in the King of Prussia, PA offices. Alana produced mAbs from a CHO cell line for downstream purification. Right now, she is focused on testing various Tosoh Bioscience TSKgel columns and TOYOPEARL resins to optimize purification and minimize impurities of AAVs.
We are proud to support the future of biotechnology education and provide our students with an enriching experience by offering various opportunities for interns.

ALANA IN THE TOSOH BIOSCIENCE KING OF PRUSSIA LAB

Ildi Majollari, Karlsruhe Institute of Technology (KIT)

Ildi did his bachelor's degree in Bioengineering at the KIT, Karlsruhe. At Tosoh Bioscience, he worked on column packing (influence of the packing parameters on asymmetry, HETP, etc.), benchmarking Protein A affinity resins, and determining the isotherms and kinetics of TOYOPEARL AF-rProtein A HC-650F and AF-rProtein L-650F resins in batch chromatography. Ildi's five-month internship is now ending, but he will continue at Tosoh Bioscience for his master thesis.

Nicolas Gnannt, University of Applied Science, Darmstadt

Nicolas studies Biotechnology and has been with Tosoh since May 2022. Nicolas is from the south of Germany from a small village near Ravensburg, a town known for its board games. In his internship, he mainly evaluated different resin prototypes and determined the DBC values under different conditions. Currently, he is trying to determine and optimize the elution properties of an FcR-IIIA affinity prototype resin. The internship will last 5 months but Nicolas plans to stay at Tosoh for his bachelor thesis.

07
WHAT'S NEW
DOWNSTREAM PROCESSING

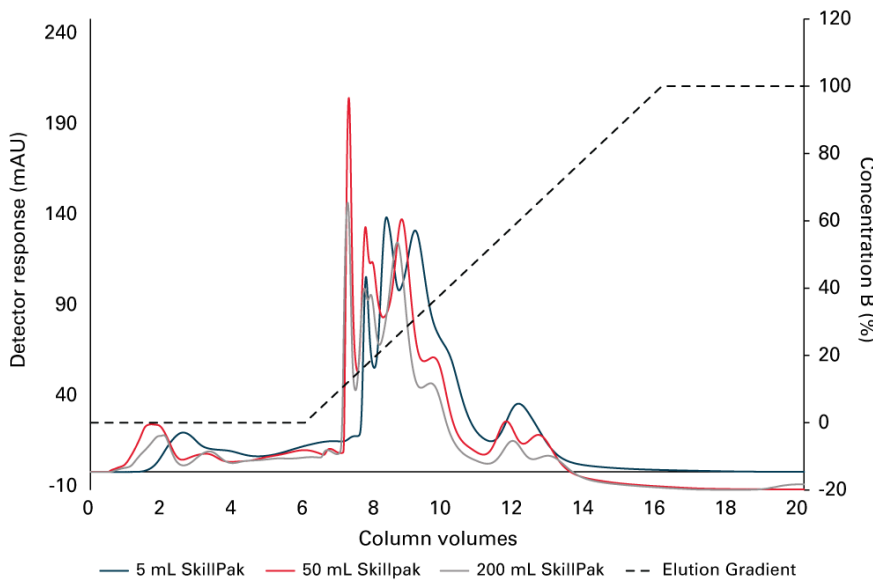
SKILLPAK™ FAMILY OF PRE-PACKED COLUMNS CONTINUES TO GROW

THE FIRST PRE-PACKED COLUMNS OF THE SKILLPAK FAMILY WITH 1- AND 5-MILLILITER COLUMN VOLUME WERE INTRODUCED TWO YEARS AGO AND SINCE THEN HAVE BEEN CONSTANTLY SUPPLEMENTED BY MORE CHROMATOGRAPHY MEDIA. IN RESPONSE TO THE HIGH DEMAND FROM THE INDUSTRY, WE RECENTLY EXPANDED THE RANGE OF AVAILABLE DIMENSIONS. OUR MOST POPULAR RESINS ARE NOW AVAILABLE IN THE NEW SKILLPAK 50 AND SKILLPAK 200 FORMAT SUITED TO SCALE-UP METHODS DEVELOPED ON THE SMALLER SKILLPAK 1 AND 5.

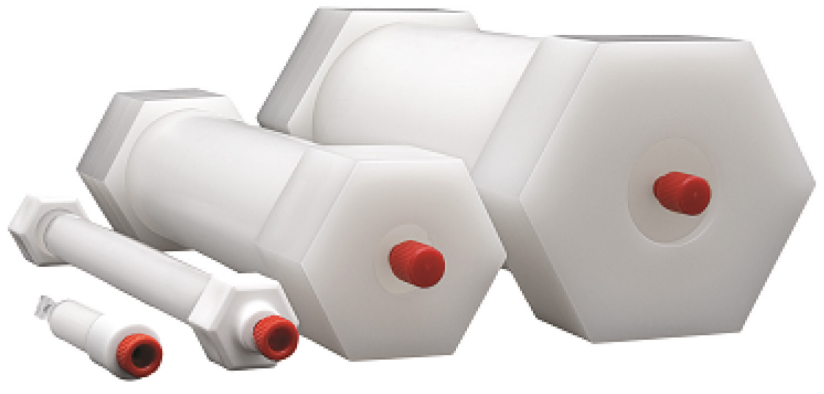
For biologics, the development of robust and flexible processes that can be efficiently transferred and scaled up for production at all scales is one of the most important keys to commercial success. Downstream processing (DSP) needs to align with the scale of the upstream process and typically includes several chromatographic steps from capturing to polishing.

The development of chromatographic purification steps usually starts with the screening of suitable media for a certain separation task to identify the one with the highest capacity for the desired target. This can be done with the help of robotic systems or very small packed columns such as SkillPak 1 (7 mm ID × 2.5 cm L) columns. Typically, some of the best-performing media are then taken to the next level to optimize method parameters to select the preferred media for the process. SkillPak 5 (8 mm ID × 10 cm L) columns are ideally suited for that step.

Once the method development is finished, the method needs to be scaled up for qualification and process characterization studies. The new SkillPak 50 (2.5 cm ID x 10 cm L) and 200 (5.0 cm ID x 10 cm L) columns eliminate unwanted variability associated with the packing process of self-packed columns. They allow seamless scale-up of chromatography processes after method development on the 1 mL and 5 mL columns.



SEPARATION OF A PROTEIN STANDARD ON TOYOPEARL NH_2-750F IN DIFFERENT SCALES



SKILLPAK PRE-PACKED COLUMN FAMILY FROM 1 TO 200 ML

SkillPak pre-packed columns are designed for purification and separation tasks from platform design to pilot scale. They are ready to use and show excellent physical strength and ideal flow characteristics for downstream processing. Pre-packed with TOYOPEARL or TSKgel process chromatography media, these columns offer superior purification of biomolecules, such as monoclonal antibodies, proteins, and oligonucleotides.

All SkillPak columns guarantee optimal performance and can be operated with standard low- or medium-pressure liquid chromatography systems. They are reproducibly packed and consider each resin's varying compressibility. This provides an accurate representation of conditions found in full-scale columns.

SkillPak 1 and 5 columns are designed for fast method development, resin screening, or sample concentration. SkillPak 50 and 200 allow seamless scale-up of chromatography processes after method development on the small one and five-milliliter columns. Besides scaling up DSP methods for industrial purification the availability of various sizes of pre-packed columns also allows for selecting the most appropriate dimension for the desired amount of purified target molecule for laboratory-scale purification tasks in R&D.

08
WHAT'S HAPPENING
FEEDBACK & FOREST

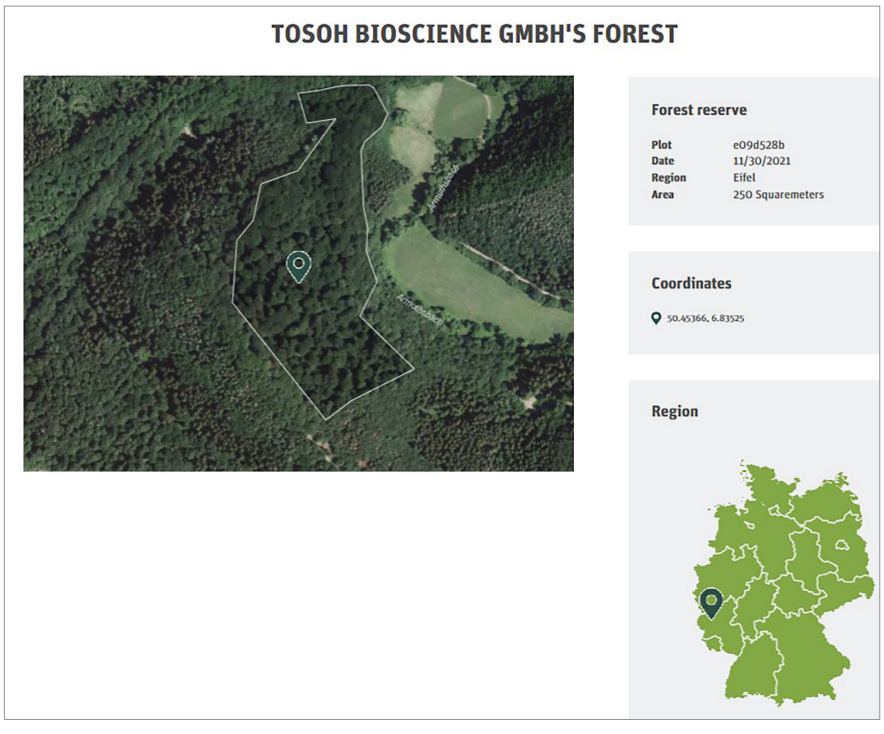
PRIMEVAL FOREST PROJECT

IN NOVEMBER 2021, WE LAUNCHED A CUSTOMER SURVEY IN THE EMEA REGION TO GATHER FEEDBACK FROM PROFESSIONALS ON HOW OUR PRODUCTS WORK IN THEIR HANDS, WHAT ISSUES ARE IMPORTANT TO THEM, AND HOW WE CAN BEST SERVE THEM. WE PROMISED TO DONATE A CERTAIN AMOUNT OF MONEY TO A FOREST PROJECT AS A THANK YOU FOR EACH SURVEY RESPONSE.

The invitation to the survey was distributed to more than 6500 contacts by e-mail. As a motivation to provide feedback, we raffled 10 sustainable drinking bottles among all participants and promised to donate a certain amount of money to a forest project as a thank you for each survey response. With that amount, Wohllebens Waldakademie Primeval Forest Project can lease one square meter of forest for 50 years and thus "give back" to nature.

We received 177 responses with very valuable feedback. We learned a lot and the positive rating of our support encourages our team of chromatography experts in their effort to be a reliable partner for the users. We decided to top up the amount collected through the responses and as a result we are now protecting 250 square meters of forest for the next 50 years.

We will repeat this survey every year to review customer feedback on our products and services. We keep you posted about the 2022 survey and look forward to receiving your feedback.



CHECK OUT WHERE OUR FOREST IS LOCATED:
TOSOH BIOSCIENCE GMBH'S FOREST | WOHLLEBENS WALDAKADEMIE (WOHLLEBENS-WALDAKADEMIE.DE)

NEWS & EVENTS | MEET TOSOH BIOSCIENCE *IN THE VIRTUAL WORLD*

UPCOMING EVENTS

FIND THE LATEST UPDATES HERRE WWW.SEPARATIONS.EU.TOSOHBIOSCIENCE.COM/NEWS-EVENTS/EVENTS

SEP	12-14	2022	GDCH FACHGRUPPENTAGUNG MAKROMOLEKULARE CHEMIE, AACHEN [DE]
OCT	9-13	2022	INTEGRATED CONTINUOUS MANUFACTURING, BARCELONA [ES]
OCT	11-14	2022	SPICA, LISBON, [PT]
OCT	13-14	2022	7TH HALLE CONFERENCE ON RECOMBINANT PROTEINS, HALLE [DE]
OCT	24-26	2022	ARABLAB, DUBAI [UAE]
NOV	1-3	2022	BIOPRODUCTION/CPHI, FRANKFURT [DE]
NOV	15-17	2022	BIOPROCESS UK, EDINBURGH [UK]
NOV	16-18	2022	TIDES EUROPE, VIENNA, [AT]

IN ADDITION, WE RECOMMEND THE VARIOUS RESOURCES THAT WE PROVIDE ON OUR WEBSITE, OUR SOCIAL MEDIA AND ON OUR YOUTUBE CHANNELS: HTTPS://WWW.YOUTUBE.COM/C/TOSOHBIOSCIENCE-SEPARATIONSPURIFICATION