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Advancing barrier science and protective materials: The 2025 winners of *TAPPI Journal* Best Research Paper Award and Honghi Tran Prize

At the end of each year, the *TAPPI Journal* Editorial Board Members nominate papers for consideration as recipient of the Best Research Paper Award and Honghi Tran Prize from that year, looking for outstanding contributions that push the science and engineering boundaries of fiber-based materials. For 2025, the Board nominated 10 papers and evaluated each nomination in terms of scientific merit, innovation, creativity, and clarity. After voting on the papers earlier this year, the Editorial Board chose two co-winning papers for this distinct honor.

The winners of the 2025 *TAPPI Journal* Best Research Paper Award and Honghi Tran Prize reflect two critical and evolving fronts: sustainable barrier coatings and high-performance filtration media. While the paper topics are very different—packaging vs. personal protection—both papers reflect a common current concern: the need to engineer materials that balance performance, functionality, and real-world usability.

Reimagining barrier coatings with cellulose nanofibrils

Published in January 2025, the first co-winning paper was “[The influence of precoating layers on the performance of water-based barrier coatings](#),” by Kritee Pokharel and co-authors Douglas W. Bousfield and Jinwu Wang. Pokharel is a graduate student and Bousfield is professor in the Department of Chemical and Biomedical Engineering at the University of Maine in Orono, ME. Wu is a scientist at the USDA Forest Products Laboratory in Madison, WI.

This award-winning research paper on coating science offers a compelling look into multilayer barrier design using bio-based materials. The authors systematically investigated how precoating layers of varying compositions influence the effectiveness of a water-based barrier topcoat—an area of growing importance as the industry and end-users seek alternatives to traditional polymer barriers.

According to Gregory Welsch, global director of Latex Binders for Paper and Board at Trinseo LLC, “a particularly noteworthy aspect of the study is its focus on cellulose nanofibrils [CNFs].” As the member of the Editorial Board handling reviews for the paper and representative from TAPPI’s Coating, Printing and Surface Enhancement (CPSE) Division, Welsch also notes that the “novel, renewable CNF materials are gaining traction due to their ability to form dense, entangled networks that can significantly reduce permeability.” The work explored how differences in CNF fines content and coatweight in the precoat layer impact key barrier metrics, including oil and grease resistance, moisture vapor transmission, and oxygen transmission.

Another CPSE Division member of the Editorial Board, Steve Ottone, Technical Service Representative at Mallard Creek Polymers, says the winning paper shows “a nuanced understanding of how a CNF-based precoat does more than simply add a layer—it actively enhances coating holdout while contributing intrinsic barrier functionality.” This dual role is particularly valuable in high-performance, multilayer coated paper systems, where interactions between layers can make or break performance.



Overall, the study ultimately demonstrates that intelligently engineered CNF precoat can deliver a combination of barrier properties and process efficiency. As the industry continues to explore its immense potential for sustainable, fiber-based products, this work provides both a scientific foundation and a practical path for next-generation barrier packaging.

Rethinking filtration performance of nonwovens

The other co-winner of 2025 Best Research Paper Award and Honghi Tran Prize was “[Filtration performance of face masks and facepiece respirators used during COVID-19 pandemic](#).” Appearing in the February 2025 issue, it was authored by Md Faizur Rahman and co-authored by Mirza

Mohammad Omar Khyum and Seshadri Ramkumar. Rahman and Khyum are graduate research assistants and Ramkumar is professor in the Department of Environmental Toxicology at Texas Tech University in Lubbock, TX.

“The paper on filtration performance from the Nonwovens and Advanced Materials Laboratory, Texas Tech University, shows how different

nonwoven materials like spunmelt, wetlaid, and carded all contribute towards achieving good barrier properties,” says Gaurav Pranami, Ph.D., vice president, R&D, at Imbed Biosciences Inc. and member of the *TAPPI Journal* Editorial Board handling the paper’s peer reviews. “Importantly, the nature of precursors and quality standards are critical in manufacturing these lifesaving products.”

According to Pranami, one of the “important technical implications of this research is that mask performance should not be judged by filtration efficiency alone.” The work evaluates face masks and facepiece respirators through a broader set of performance measures that include filtration efficiency, pressure drop, air permeability, moisture vapor transmission, and behavior across particle sizes relevant to SARS-CoV-2. Gaurav summarizes that “this is significant because an effective mask must not only provide barrier protection but also remain wearable for meaningful periods of time.” A material that filters well but creates excessive breathing resistance may

not perform as effectively in practice as its filtration number alone would suggest.

Pranami also points out that the study “has important implications for quality and standards. Its findings suggest that performance is influenced not simply by the presence of more material or multiple layers, but also by the quality of the raw materials, the integrity of the nonwoven structure, and the consistency of manufacturing.” Among the non-medical masks studied, the domestically manufactured mask was the one that met the higher ASTM F3502-24 performance level, emphasizing the importance of raw material quality, manufacturing standards, and construction in determining barrier performance.

In the short term, this study supports a more standards-based approach to product evaluation, procurement, and quality control for protective materials. Over the long term, it provides a useful framework for the development of next-generation filter media and wearable protective products; better materials should balance protection, breathability, comfort, and manufacturing consistency instead of optimizing a single attribute in isolation.

Converging lessons for a changing industry

Taken together, these two award-winning papers highlight a broader shift in materials science within the fiber-based industries. Whether designing barrier coatings or filtration media, the challenge is no longer simply to achieve peak performance in one metric, but to engineer systems that balance multiple, often competing requirements. These studies not only advance their respective fields but also provide a shared framework for innovation—one grounded in performance, practicality, and purpose.

First authors of the 2025 Best Research Paper Award and Honghi Tran Prize, Kritee Pokharel and Md Faizur Rahman, received their honors during [TAPPICon](#), April 26-29, 2026 in Columbus, OH.

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