SOLENIS

A ROADMAP
FOR PRODUCING

PFAS-FREE FOOD SERVICE CONTAINERS

Replacement of PFAS in your molded fiber food service articles

Across the globe, the elimination of PFAS (per- and polyfluoroalkyl substances) is a key sustainability initiative. Long used as an oil and grease barrier solution in food and beverage paper packaging, like molded fiber food service articles for short-duration applications, we now know that PFAS have potential health and environmental risks.

As consumers, corporate leadership, regulatory bodies and other stakeholders demand more sustainable eco-friendly solutions, brand owners, molded fiber producers and converters must find alternatives that offer sustainability as well as functionality and processability.

Solenis collaborated with molded fiber manufacturing technology company Zume[1] to develop a solution that reduces the need for single-use plastics without negatively impacting end-user experience. Along the way, we gained insights into the furnish formulation and manufacturing process needed to create a food contact-compliant, compostable, PFAS-free molded fiber article that reliably achieves 2-hour holdout with 60°C oil. **Here's what we learned:**

1 THERMOFORMING

A key component of the Solenis Contour℠ solution is the TopScreen™ MF300 family of formulations, which is available globally. Initial results were achieved with MF300-NA, while even better results were subsequently achieved using the next-generation MF305-NA.[2] The MF300 family of formulations works to inhibit penetration and migration of oil or grease through the container's molded fiber structure. Subjecting the part to sufficient thermoforming pressure to increase density of the fiber structure helps to improve barrier performance.

We used Zume-patented Molded Fiber Cell (MFC) and other Zume-designed products to determine that the hot press pressure must be set to a minimum of 11.5 megapascals (mPa). If part aesthetics or other factors are not negatively impacted, apply greater pressure.

[1] Pamela Horine et al., "Putting Forever Chemicals to Rest: An Open Source Guide to PFA-Free Packaging."

[2] As part of continuous improvement efforts, MF305-NA has replaced MF300-NA.

2 FREENESS AND FIBER BLEND

Oil and grease resistance (OGR) can be further improved by managing the fiber slurry to achieve 200-300 Canadian Standard Freeness (CSF), or approximately 40-52 °SR (Schopper Riegler). These freeness levels can be achieved through both refining and fiber blend.

We created a fiber-agnostic formulation to create a solution that can be leveraged worldwide. Our tests included a variety of agriculture fibers: North American (bleached and unbleached) and North American softwood (bleached and unbleached) fibers.

3 CHEMISTRY MANAGEMENT

Often, products that require OGR also need water resistance. Incorporating both these qualities into a PFAS-free solution requires a water sizing agent. It also requires careful attention to the sequence of chemical addition and mixing time to successfully reach the desired OGR. An acceptable combination of water and OGR barrier can be achieved with either TopScreen™ MF7900 AKD (alkenyl ketene dimer) or TopScreen™ MF240 (rosin) based water sizing systems in conjunction with TopScreen™ MF300 and the appropriate retention system and chemistry conditions.

Our solution identified the ideal sequence, doses and mix times[3]:

- *Complete refining to required freeness level, 200-300 CSF*
- *Add 11% TopScreen™ MF300-NA (now MF305-NA) to the slurry tank and mix*
- *Add 2% Hercon™ 79 and 0.2% Hercobond™ 6950 to the slurry tank and mix*
- *Add 0.3% PerForm™ PC2740 to the stock chest and mix*
- *Rapid and complete mixing is desired; optimum mixing time will be system-dependent, typically in the range of 1 to 10 minutes*

The fiber slurry is now ready. Use the slurry within four hours after the chemical addition is complete to prevent overmixing and emulsion disruption. In the case above, the PerForm™ PC2740 was the RDC (Retention and Drainage Control) agent. The optimum choice will depend on the characteristics of the fiber furnish and the water sizing system used.

[3] All percentages cited are on an as-received weight basis.

4 "CHEMISTRY" MANAGEMENT — CATIONIC DEMAND AND RETENTION

Slurry and white water must be closely monitored and managed to optimize attachment of the active chemistry to the fibers. Prior to initiating the addition of chemicals, determine the cationic demand (charge) of the slurry and white water. This is typically done using a BTG Mütek PCD-05 or similar. Slurry samples are commonly 0.4%-0.7% consistency fiber slurry taken from the forming vat. White water samples are typically taken from the filtrate collection tank after the former; this is the water that is removed from the slurry as the part is formed.

For this work, samples were filtered through the standard filter cup provided with the Mütek PCD-05 following the standard procedure. Please note that this testing can be performed utilizing a number of different sample preparation techniques, so it is important to document the procedure used.

- *The optimum slurry charge will typically be in the range of -20 to -50 µeq/l (microequivalents/liter).*
- *Values more than -100 µeq/l or less than -10 µeq/l require dosage adjustments.*
- *White water charge should be monitored, with the ideal being in the range of -10 to -30 µeq/l; if the values go cationic (positive or "+"), dosage reductions will typically be required.*
- *White water turbidity should also be monitored as a measure of retention. Values of <100 NTU are desired, with <50 NTU being ideal.*
- *White water turbidity and charge will be related; the relationship for any given system will need to be developed from testing data. Proper charge management with low and stable white water turbidity will result in the best program efficiency and effectiveness.*

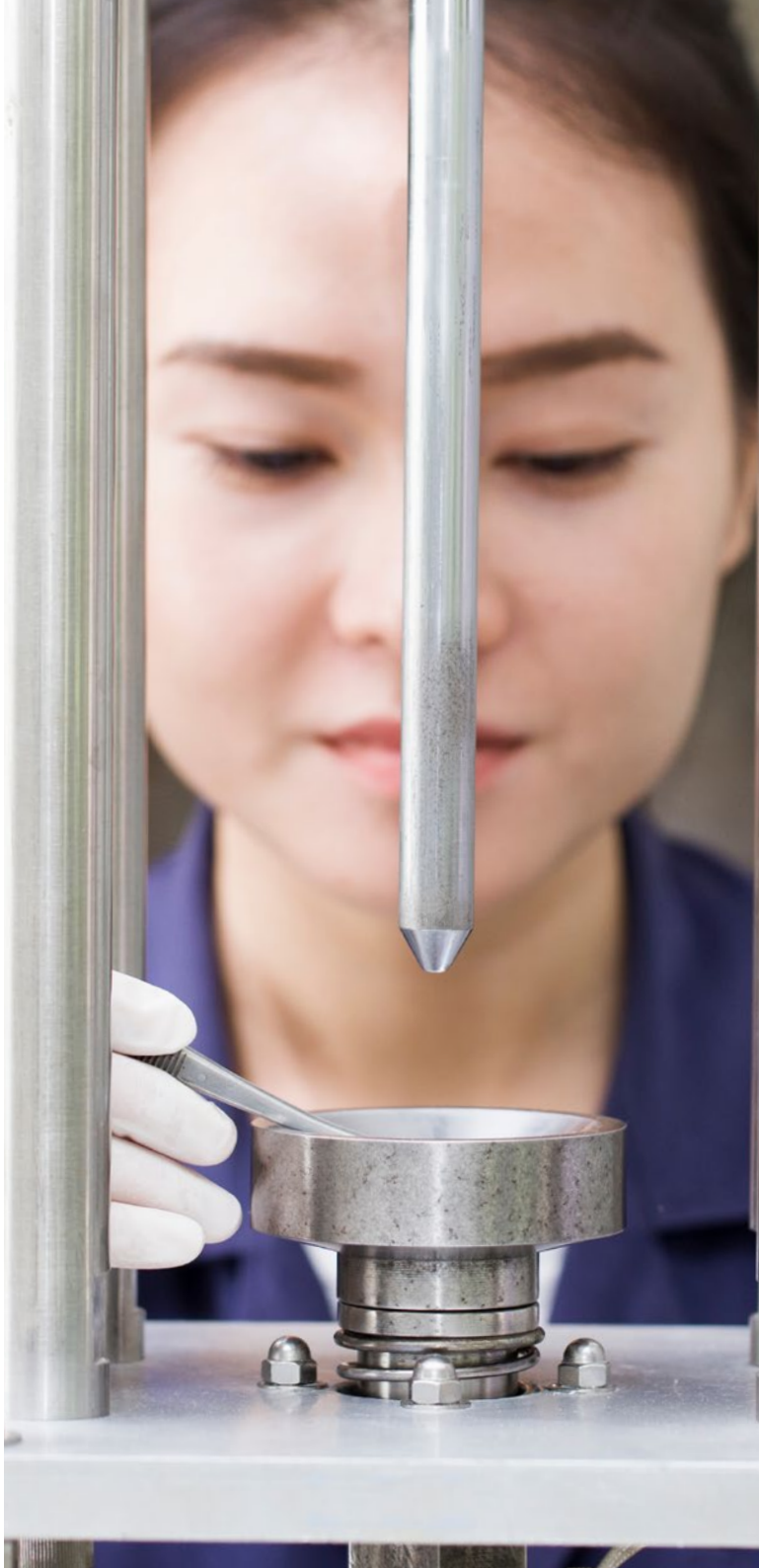
5 PART FORMATION

The last critical step to achieving the desired OGR is to develop uniformity of the fiber matrix and minimization of void volumes. Areas with a lower fiber density will allow oil or grease to penetrate more quickly, so a visual inspection can help identify weak spots.

Measure part formation in two ways:

- *Manual inspection (caliper variation/thin spots, pin holes, voids, crush marks)*
- *Automated visual inspection (AVI) as part of a fully automated Quality Control (QC) system*

Both methods include passing each part over intense light to highlight parts with uneven distribution of fibers or lower density of fiber. Manual inspection is effective but can be subjective, while AVI can measure light transmittance and provide a discrete measurement to determine if you need to make adjustments.



Get the right ingredients for more sustainable solutions.

The Contour℠ PFAS-free program from Solenis can help you create more eco-friendly, compostable, sustainable molded fiber articles that can compete with single-use plastics for many applications.

A Solenis expert can help you design the optimal program for your specific situation. Talk with our team to learn more about these innovative formulations that help you give your customers the PFAS-free solutions they want — and need.

ASK AN EXPERT

https://www.solenis.com/en/PFAS-free-barriers

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