704-289-6464 FAX: 704-296-6400

GOULSTON TECHNOLOGIES, INC.

Press Release

Developing Better Carpet Finishes From Biosustainable Raw Materials

By Nikki Brooks & Srinivasan Ranganatha
Goulston Technologies, Inc.

The manmade fiber industry has recognized that the adaptation of sustainable practices is a key element of good corporate citizenship, and that there is a need for more sustainable products in the marketplace. Fiber lubricants must be a part of the sustainable development in the manmade fiber industry due to the total amount of fiber lubricants used globally as well as the generally short lifespan of functionality of fiber lubricants on the fiber surface.

It is estimated that over 600 million pounds of fiber lubricants are used world-wide each year. These lubricants (known as fiber finishes or spin finishes) are used to provide friction and static control during fiber processing and fabric/carpet manufacturing. In many cases, once the fabric/carpet is made, the finish is no longer required and becomes part of the waste stream in dyeing or finishing processes. The exception is solution dyed fiber where the finish remains with the fiber through processing and into the final end-use product where the finish may be removed by the consumer in home cleaning or professional fabric/carpet cleaning.

As the leader in fiber lubricant technology, Goulston Technologies, Inc. is committed to sustainability by providing the highest performance fiber finish technology possible with the lowest environmental impact. Goulston has created a comprehensive plan to achieve this goal by:

- Maximizing the use of biosustainable raw materials
- Maximizing the use of biodegradable raw materials
- Using raw materials that utilize low energy manufacturing processes
- Ensure components are safe to use
- Designing finishes that provide efficient processing at low finish levels

All of these efforts focus on reducing the overall carbon footprint of our products. At the recent SYFA winter conference, “Sustainable is Attainable” held in Charlotte, NC on Feb 2008, Goulston presented data on the development of sustainable versions of some of their most widely used fiber lubricants, including nylon BCF applications. The scope of this earlier work was limited to the sustainability of the raw material source and the manufacturing process. Goulston believes that lowering the amount of materials used to meet processing needs is the next logical progression in the sustainable development after the use of sustainable raw material sources. This report summarizes the development of a new nylon BCF lubricant derived from biosustainable raw materials, which can be used at significantly lower finish levels than the current industry practices.

Goulston’s premiere nylon BCF finish product (referred to here as Lurol NF-P) has been designed for excellent extrusion and downstream performance. Years of commercial experience with this product provided a well deserved reputation as one of the best carpet finishes available. Goulston has built on this technology base and developed two new generation products; Lurol NF-SB and Lurol NF-SC, designed to provide the same high level of processing performance at significantly lower finish levels. The biosustainable content of these finishes meet the high objectives of Goulston’s sustainability program (see Table 1):

Table 1: Biosustainable Content

Finish	Biosustainable Content
Lurol NF-P	62%
Lurol NF-SB	61%
Lurol NF-SC	62%

Goulston Technologies, Inc. has attained its leadership position in part due to the company’s advanced testing capabilities. We are able to perform a wide range of predictive testing to screen our finish candidates for critical performance parameters such as friction, wetting, and heat stability thereby reducing the number of evaluations required on commercial equipment. Comparative test results are given in Tables 2 through 4:

Table 2: High Speed Fiber to Metal Frictions & Running Statics, 1% FOY

	Friction Force (grams)			
Sample	100 m/min	200 m/min	300 m/min	Voltage, V
Lurol NF-P	120±12	123±11	121±11	-324
Lurol NF-SB	102±11	109±10	104±12	-215

Lurol NF-SC	111±11	115±10	112±8	-193

Table 3: Krüss Surface Tensions & FTA Contact Angles on Nylon Film

Sample	Surface Tension		Contact Angles	
	1Hz	10Hz	Initial Angle(o)	Final Angle(o)
Lurol NF-P	39	43	81	14
Lurol NF-SB	39	44	95	16
Lurol NF-SC	38	42	96	16

Table 4: Thermogravimetric Analysis & Smoke Points

Finishes	TGA @ 200°C	Smoke Point (°C)
Lurol NF-P	3.0	163
Lurol NF-SB	2.7	169
Lurol NF-SC	4.0	157

These results show that the new finish candidates have improved fiber-to-metal lubricity and are very effective at controlling static charge generation (Table 2). The dynamic surface tension and high speed spreading data (Table 3) indicate that the finishes provide very efficient spreading on the fiber surface, resulting in high finish uniformity and effective fiber protection. The TGA results (adjusted for water content) and smoke points provide comparative data that supports our target of low volatility, low smoke BCF finish technology, comparable with the Lurol NF-P which has provided excellent performance in this particular area.

The testing shows indicates finishes should perform well under standard conditions, but these finishes were designed to reduce total finish level required and thus lower environmental impact. Can lower finish level be achieved without sacrificing performance? Will carpet processing performance actually improve? Goulston tested these finishes in commercial scale, high-speed extrusion evaluations using both neat and emulsion application. The finishes were applied in separate trials to nylon at levels well below 0.7% with process speeds of ~3,500m/min (godet speeds) and texturizer temperatures of 220°C. Under these conditions, the new finishes showed significant improvement in both flare propensity and broken filament reduction when compared to Lurol NF-P . Heat stability (no smoking) and plug formation in texturizing was good.

Fibers produced at lower finish levels were evaluated for twisting (at 6,500rpm) and Superba heat set. Lurol NF-SB and Lurol NF-SC noticeably improved twisting performance at levels lower than 0.7% compared to Lurol NF-P standard level control. Twisting is the most critical processing point in low level BCF evaluations. Table 5 shows a comparison of the visible dust and fly levels observed during twisting evaluations. The extrusion and twisting evaluations indicate that our approach is effective and sufficient spreading and fiber surface protection at lower than standard processing levels was definitely achieved.

Table 5: Twisting Dust/Fly Levels

Finish	Rating (5=Low Dust/Fly; 1=High Dust/Fly)
Lurol NF-P Standard	2
Lurol NF-P Low Level	1
Lurol NF-SB Low Level	4.5
Lurol NF-SC Low Level	5

Goulston recognizes that products derived from sustainable resources do not always equate to safe products, and has incorporated product safety as a design element in the development of sustainable products. Skin Irritation tests were carried out utilizing the Dermal Irritection Test Method™ . In this skin test a rating of “non-irritant” is the best possible result, and both finishes were rated as non-irritants.

Laboratory tests, commercial scale evaluations, and the safety testing of the new bio-sustainable nylon BCF lubricants showed that we are able to meet the criteria for the design of GTI’s low level finish technology listed below:

- Excellent carpet processing performance at low finish levels
- Maximum use of biosustainable components without compromising performance
- Utilizing components that biodegrade rapidly and are environmentally friendly
- Creating finishes that safe for the users
- Reducing Environmental Impact of our fiber processing lubricants

The combination of sustainability, safety and excellence in processing has been met through a comprehensive approach to finish design. It is generally accepted that lower finish levels for a given type of chemical nature result in better soiling performance of the solution dyed carpet. We expect that the new fiber lubricants will result in better soling performance due to the lower finish level. This is an example where better design andformulation using environmentally friendlier solutions can also lead to better product performance (such as low soiling in solution dyed carpet) and better financial performance (as in lower chemical consumption and lower effluent treatment cost for scoured/dyed carpets).

Goulston Technologies, Inc. is committed to a process of sustainable development and will continue to develop the technologies that allow us to provide a full range of fiber processing lubricants that maximize fiber process performance and minimize environmental impact.