

AUGUST 2, 2010

C&EN

CHEMICAL & ENGINEERING NEWS

GROWING NEW LIMBS

Closing the gap between sci-fi and reality **P.40**

ACS IN BOSTON

Events planned for national meeting **P.67**



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SUSTAINABLE SOURCING

Looking far afield for green ingredients **P.16**



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FROM THE EDITOR

Sustainability And Growth

THIS WEEK'S cover story on sustainability focuses on a green supply chain—manufacturers who are working to ensure that the ingredients that go into their products are produced in a sustainable fashion by workers who are treated fairly.

Senior Editor Melody Voith talked to four niche consumer-brand companies about their relationships with raw material suppliers and profiled their efforts to work with those suppliers to ensure that the raw materials supported the companies' green claims. Even for relatively small companies catering to high-end markets, Voith's reporting suggests, ensuring a green provenance for raw materials is a challenge.

Soap manufacturer Dr. Bronner's Magic Soaps, for example, is committed to using only tropical oils that are certified to be organic and made under fair-trade practices. "Finding palm, olive, and coconut oils that meet Bronner's high standards," Voith writes, "has taken Gero Leson, the company's chief operating officer, to the ends of the Earth."

The kind of commitment practiced by Dr. Bronner's simply isn't possible for all companies, Voith notes. Unilever, for example, which makes Dove soap, is the world's largest buyer of palm oil. Unilever has committed to buy all of its palm oil from certified sustainable sources by 2015, Voith writes. But the company acknowledges that "there isn't yet sufficient volume coming through segregated supply chains where buyers can have confidence that the refined oil which they are buying comes from a plantation, mill, and refinery that have been certified sustainable."

It's easy to dismiss the sustainability efforts of niche players like Dr. Bronner's and the other companies Voith discusses in her story. They're small and they cater to upscale customers willing to pay a premium to demonstrate their green sensibility. But larger companies are paying attention to consumers' increasing concern about the environment and their impact on it.

Walmart, for example, has 11 "Standards for Suppliers" posted on its corporate page. The "Environment" standard states: "Suppliers must ensure every manufacturing facility complies with national and local environmental laws, including all laws related to air emissions, water discharges, toxic

substances and hazardous waste disposal. Suppliers must validate that all input materials and components were obtained from permissible harvests consistent with international treaties and protocols in addition to local laws and regulations."

As Voith points out, the ingredient prospecting carried out by the companies she interviewed "may smooth the way for mass-market brands to improve the sustainability of their raw materials."

This issue also contains many letters we received in response to my editorial "Addicted to Growth" (C&EN, June 28, page 3). As you can see, about an equal number of writers agreed and disagreed with the editorial. The editorial was also posted on the "Editor's Blog" on "CENTral Science," and received a number of comments, the first two of which pretty much defined the scope of disagreement on the subject of endless economic growth.

The first reader to comment wrote: "After reading your editorial ... 'Addicted to Growth,' I am appalled! 'Earth ... no longer exists'? This is a CHEMISTRY magazine and such editorials have no place within its pages. Furthermore, if you are not living on an Amish farm and riding to work on horseback, you are a complete hypocrite.

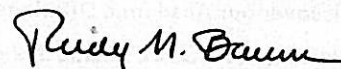
"'Growth is a religion'? So is environmentalism!"

The second wrote: "I strongly agree with both McKibben's sentiments and the Editor's post, but I fear that humankind may prove incapable of implementing and accommodating a 'controlled decline.'

"Instead, I often hear business and political spokespersons, developers, and engineers voice their earnest conviction that 'when the economy recovers,' jobs, economic growth, and construction will return to previous levels.

"If responsible leadership cannot envision and acknowledge a progressively resource-limited and ecosystem-damaged world, how can we plan for a controlled decline in growth—and wealth?"

Thanks for reading, and commenting.



Editor-in-chief

Views expressed on this page are those of the author and not necessarily those of ACS.



DR. BRONNER'S MAGIC SOAPS

FIRST POUR A representative (left) of Dr. Bronner's in Ghana oversees a test of palm oil processing.

A GREEN SUPPLY CHAIN

Manufacturers of consumer products go the distance to source **SUSTAINABLE INGREDIENTS**

MELODY VOITH, C&EN WASHINGTON

IN THE PAST FEW YEARS, consumer-goods companies have learned that improving their sustainable credentials is not just a matter of peering inside their own operations. They must also examine the environmental and social footprint of every player in their supply chain. The search for sustainable ingredients can take a company anywhere from the warehouses of its current suppliers to a tropical jungle in Africa.

The path is not always smooth. Sourcing sustainable materials can mean putting pressure on suppliers to share sensitive information and help create green products—or risk being cut out of the supply chain altogether, say the brand managers and sustainability chiefs who talked to C&EN about their experiences.

The relationship that manufacturers have with their suppliers is at the core of designing a green product, according to Kevin Brady, director of Five Winds, a consulting firm that helps companies improve their sustainability performance. “They

try to assess the performance of their suppliers with data and questionnaires, but it’s challenging and expensive—especially with global supply chains—to understand what is going on.”

Ingredient suppliers with sustainability problems are a risk for a company’s brand, Brady points out. A smart company will “figure out a way to manage that risk and work with suppliers that are responsible and will provide ingredients that are non-toxic, low CO₂ emitting, and fairly and responsibly made,” he says. It’s a lot to analyze, he admits, but companies must look broadly at environmental, societal, and technological performance.

At the same time, although databases claiming to sort good ingredients from bad ones abound, Brady warns that expecting suppliers to share every piece of information with their customers is a “utopian vision.” Instead, he advises, manufacturers should be “moving to a more collaborative approach, using their leverage with suppli-

ers to improve the footprint of the supply chain and stimulate innovation.”

To see this collaboration at work, C&EN spoke with four niche consumer-brand companies about their relationships with raw material suppliers. All are firms that appeal to customers who seek environmentally friendly products. In each case, the companies could not source off-the-shelf components but rather had to work closely with suppliers to find raw materials that support their green claims.

At soap manufacturer Dr. Bronner’s Magic Soaps, President David Bronner is committed to using only tropical oils that are certified to be organic and made under fair-trade practices. Finding palm, olive, and coconut oils that meet Bronner’s high standards for sustainability has taken Gero Leson, the company’s chief operating officer, to the ends of the Earth.

“I didn’t know what I was getting into, but I said that I would find these sources,” Leson recalls. “And then the travel start-

ed." Since taking on the assignment in 2005, Leson has sourced olive oil from the West Bank, coconut oil from Sri Lanka, and most recently, palm oil from the West African nation of Ghana. "It was the greatest work I've ever done," Leson reflects.

Consumer-product manufacturers normally do not collect frequent-flyer miles to source their main ingredients because they can generally rely on suppliers or brokers to provide what they need. But Dr. Bronner's found that the only way the company could ensure that it received organic and fair-trade products was to work directly with farmers.

Agricultural raw materials make up about 95% of the content of Dr. Bronner's soaps and body care products; the rest are mineral components. Olive oil imparts smoothness to liquid-soap products, while derivatives of coconut oil, which contains lauric acid, promote a rich lather. Making bar soap, meanwhile, requires palm-derived oleochemicals.

Palm oil is increasingly used in food, soap, and biodiesel products. Though the oil is a renewable resource, questions about the environmental impact of palm plantations and fair treatment of work-

ers have caused headaches for companies that depend on it. As global demand has skyrocketed, consumer-goods makers have been plagued by allegations of child labor and reports of plantations taking over land that was once tropical rainforest.

UNILEVER, maker of Dove soap, is the worlds' largest buyer of palm oil. Although it is a leading member of the Roundtable on Sustainable Palm Oil, a group of producers and purchasers of palm oil, the firm has found its reputation tarnished by the practices of its palm oil suppliers. In December 2009, it suspended business with the Indonesian company PT Smart, part of the Sinar Mas Group. Two months later, a BBC documentary included footage showing another Indonesian firm, Duta Palma, allegedly clearing protected rainforest to grow palm trees. The company supplied oil to a broker used by Unilever.

Unilever has committed to buying all of its palm oil from certified sustainable sources by 2015. But the company acknowledges that "there isn't yet sufficient volume coming through segregated supply

chains where buyers can have confidence that the refined oil which they are buying comes from a plantation, mill, and refinery that have been certified sustainable."

Dr. Bronner's buys considerably less palm oil than Unilever does and has been able to avoid using brokers, who can't always guarantee the provenance of the oils they supply. As a private, family-run company that sells to customers who "have a consciousness," David Bronner says, it can afford to pay more for its ingredients. Bronner is the grandson of the firm's founder, Emmanuel Bronner, who promoted a quirky philosophy of world peace in addition to being a soapmaker.

In 2002, David Bronner had just taken the helm of the company when his concerns about the effect of synthetic fertilizers and pesticides on the health of the land and workers prompted him to switch to organic oils. "Going to organic was our first big move," he recalls. "It was difficult but possible. We had to identify different partners and found a few key brokers with sources around the world who could get certified organic products."

Welcome to the 4th Siegfried Symposium

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For the first time the University of Zurich and the Swiss Chemical Society together invite you to join them for the fourth Siegfried Symposium. During the Symposium two internationally recognized prizes will be handed over to its winners.



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The medal is for excellence in the field of chemical process development. This gold medal and the prize money of CHF 10 000.- go to Dr. Chris Senanayake from Böhringer for his huge contributions towards efficient processes in the pharmaceutical API production. He is renowned for the development of practical stereoselective synthesis and is a master of developing stereoselective processes "on scale".



The Sandmeyer Prize

The Swiss Chemical Society awards the Sandmeyer Prize to a person or to a group for outstanding work in industrial or applied chemistry. The prize money of CHF 20 000.- is sponsored by KPMG. Markus Eyholzer, Dominique M. Roberge, Michael Gottspöner and Norbert Kockmann are the members of the winning team. Their work has been groundbreaking in the field of industrially adaptable microreactors and continuous flow processes.

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But as fair-trade practices for growing coffee and cocoa gained attention, Bronner realized “children could be harvesting our organic coconuts. We needed to get third-party certification of labor practices for our supply chain.”

The company was able to obtain certified organic and fair-trade olive oil from the West Bank. From there, it went out on its own to source the other oils, starting with coconut oil in Sri Lanka. The operation now employs 160 people and processes 50 million coconuts a year.

BY COMPARISON, scaling up has been slower in the palm plantations of Ghana, according to Leson. The palm oil project started with 250 tons per year, enough to sustain the first small-scale plantation and processor. The company has been adding small landholders to the supply chain and helping farmers increase their productivity. For the grower, “unless you have a dedicated customer for your product, you don’t have a start. That’s the power we brought to the table,” Leson observes.

The Ghanaian plantations had been there for generations, meaning Dr. Bronner’s could verify that no new land would be sacrificed to grow palm trees. But the soils were not yet able to sustain high production, and the business practices did not meet fair-trade guidelines. “Since the basis of our business there was to be organic and fair trade, we had to recruit farmers, get them certified organic, make sure they treat the workers right, pay them the fair-



trade premium, and work on community development projects,” Leson says.

It hasn’t all been about educating farmers and digging wells, however. “It has to be a business,” Leson insists. “We need to ensure the quality and reliability of supply, and then there’s the issue of the price. It’s the most expensive oil that we’ve ever bought.” Leson estimates that Dr. Bronner’s spent \$2 million to \$3 million just to set up each project, although he expects costs to fall with economies of scale. “These are not meant to be tiny boutique operations. I’m concerned about efficiency because I want

TROPICAL TIES
To enhance the viscosity of its hair color products, Aveda uses oil from babassu nuts harvested in Brazil.

it to be there for another 10 or 20 years.”

Increasing production efficiencies in Ghana will continue to require on-the-ground decision-making by Dr. Bronner’s. For example, to obtain palm oil, the individual palm fruits

are chopped out of the bundle harvested from the tree and washed by hand, rather than by machine. “We’re the largest employer in the village now. We have more than 100 people working for us, and 75 of them are ladies,” Leson reports.

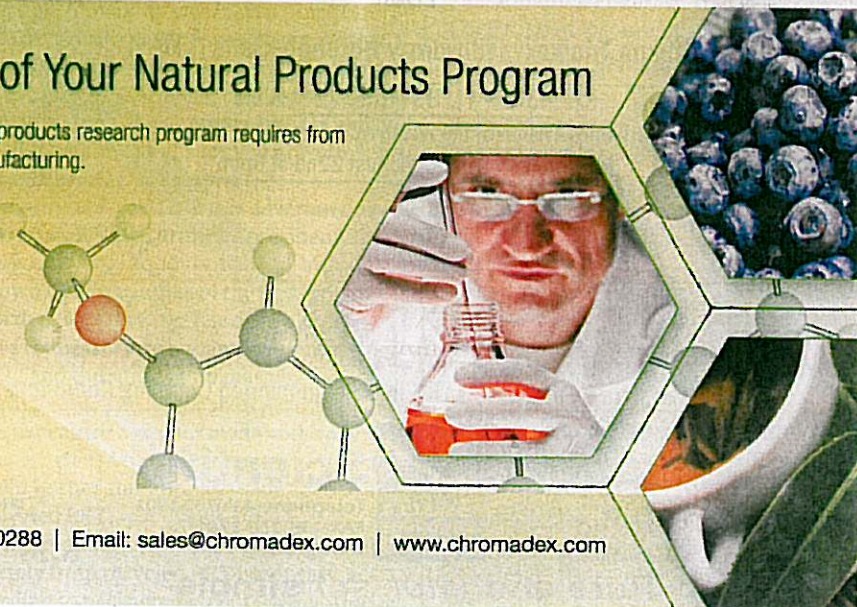
Two of the most difficult aspects of the Ghanaian project have been convincing palm growers to continually improve soil conditions and getting operators to keep records. “You really want people to maintain their lands and improve quality,” Leson says. For local growers and processors to see the benefits of the new practices, they have to adopt record keeping, which is a foreign concept to many, Leson acknowledges.

In spite of the difficulties, David Bronner confirms that the company’s tropical oils are now 100% organic and fair trade. And Leson says the work is well worth the effort. Dr. Bronner’s products are now carried in Target and Whole Foods, and sales have grown about 400% since 2001. “The visibility we have as champions of organic and fair-trade products has been very important,” he observes.

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Mainstream brands will soon get more scrutiny from consumers about what is in their products.

Maintaining brand integrity is also important at Aveda, a maker of personal care products with a reputation for being careful about its ingredients. "With the marketing position Aveda has, our customers expect all of our products to be naturally obtained—for example, to be made with organic essential oils," says Cindy Orr, Aveda's executive director of hair color development. That expectation extends to Orr's division, although hair color products still depend on some synthetic ingredients.

Orr says Aveda has made strides in developing color products with a high percentage of botanically derived inputs. "If you look at an ingredient label on our box of hair color versus a competitor's, the names may read the same and it may be the same substance," she says. "But Aveda was diligent in tracking back and identifying the actual source of the

ingredient." She says the firm works directly with chemical companies and distributors, as well as with farmers in some cases.

In one example, Aveda tracked the origin of its supply of cetearyl alcohol, used to add viscosity to its hair colors. Cetearyl alcohol can be derived from petroleum or animal tallow, but Aveda knows its product comes from coconut oil.

Hair color formulators at Aveda take advantage of the company's center of excellence, which looks for renewable sources of ingredients all over the world. The center has promoted the use of a surfactant derived from the babassu tree nut, which grows in the Brazilian Amazon. The surfactant, called babassu betaine, improves foaming and emollient properties in shampoos and soaps—and in hair color, where it's a rinse aid.

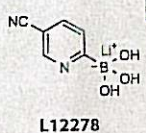
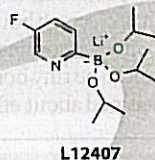
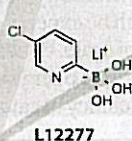
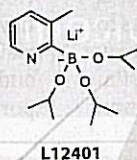
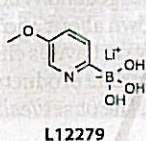
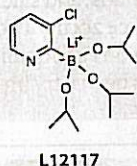
Like Dr. Bronner's, Aveda has found it important to monitor the way agricultural products are grown and processed. "The babassu nuts are gathered in a sustainable way by indigenous people," Orr explains. "They crack the nuts and press the oil. We are supporting the community financially but also getting a sustainable source, without a negative impact on their environment."

The proportion of naturally derived ingredients in Aveda's hair color products ranges from 93 to 99%, Orr says. To make a functional hair color product still requires synthetic ingredients, including dyes to provide the color and chelating agents to stabilize the product and deliver consistent results.

Introducing new dye ingredients is challenging, Orr acknowledges. In certain markets, including Asia and Europe, regulatory bodies maintain a list of allowable dyestuffs and it generally contains very few natural dyes. "We're really restricted in what's allowed," Orr says. "Aveda is continually searching for replacements that perform in the same way that traditional synthetic dye do that are more naturally sourced."

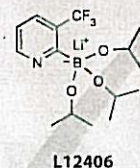
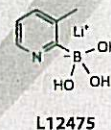
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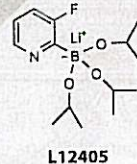
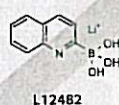
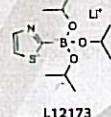
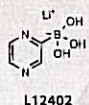


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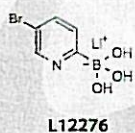
See Frontier's LTBS Poster #244 in the Organic Division of the 240th ACS Annual Meeting in Boston on Sunday, August 22nd at 8pm.



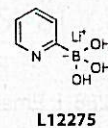
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Pure and (not so) simple

HOME CLEANING PRODUCTS firm

Method also relies on a combination of naturally derived and synthetic ingredients in its new Method laundry detergent, introduced in January. According to the firm, which touts its green credentials, the detergent is 95% plant-based.

In developing the detergent, however, the ingredient that Method was determined to phase out was plain old water. Less water means less plastic, less material to ship, and a big difference in the carbon footprint.

The main dilemma for the firm's product developers, says environmental formulator Kaj Johnson, whose official title is "green chef," was that "creating a super-duper concentrated product without water changes a lot of things you wouldn't expect." In the end, the company was able to pack enough detergent for 50 loads into a 20-oz bottle, about a quarter the size of leading brands' containers.

Method relied on its suppliers to help it source ingredients that would work well together in a small dose and clean as well as leading brands. One supplier was enzymes maker Novozymes. "One of the primary benefits in using enzymes for a super-concentrated product is that you can do an awful lot with a very small volume of enzymes," Johnson relates. But the savings



comes with challenges. “We have to also carefully select other ingredients that work well with the enzymes,” he says.

Method and Novozymes worked together closely on the formula. One of their first tasks was to sign a nondisclosure agreement so they could share proprietary information. Then, “we opened up the discussion and asked a lot of questions. We put the pieces together to set up stability, compatibility, and performance testing,” Johnson recalls. “Novozymes has some tools we don’t, and we have a very synergistic back-and-forth relationship.”

Working with Method was an important opportunity for the firm, says Novozymes Marketing Manager Teresa Neal. From Neal’s perspective, enzymes can handle almost anything a detergent is supposed to do. “People used to look at enzymes as only doing stain removal. What Novozymes has done in the last five to 10 years is to create enzymes with multiple functions, including fabric care and whiteness maintenance.”

Neal boasts that enzymes can boost the performance of surfactants, replace synthetic optical brighteners, prevent soil redeposition, and even remove pills from fabric.

In the end, Method selected a cocktail of protease, amylase, and cellulase enzymes for overall stain-removing power. The enzymes also aid in overall fabric care, making the finished laundry feel and look better, Johnson reports.

In choosing the ingredients for its detergent, Method took care to stay true to its brand identity. It wants to attract consumers looking for products that “clean like

DEHYDRATED

Enzymes in Method laundry detergent take the place of bulkier ingredients such as water.

director of sustainability, Drummond Lawson. “Step one is to match the performance of any mass brand and find ways to do that with safe chemistry, renewable materials, and sustainable innovations. Then we work to make the experience more enjoyable for consumers.”

FOR ANOTHER COMPANY, the leap toward sustainability was in choosing materials that go into product packaging rather than the product itself. In 2009, Weston, Mo.-based McCormick Distilling began bottling some of its newest vodka brand in 100% postconsumer recycled polyethylene terephthalate (PET) resin.

The brand, 360 Vodka, is advertised as eco-friendly. McCormick’s president, Jim Zargo, says the liquor is made from grain grown within 19 miles of the firm’s plant north of Kansas City. The distilling process reduces waste by capturing and using CO₂, and the spent grain mash is sold as animal feed. The larger sizes of 360 Vodka are packaged in bottles made with 75% recycled glass, but for the 50-mL airplane-sized bottles the company wanted to use recycled PET.

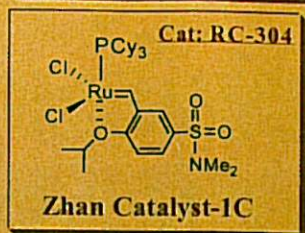
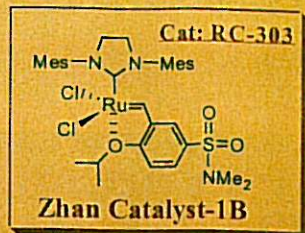
But making an attractive package completely from recycled PET is not easy, according to packaging manufacturer Amcor,

heck and smell like heaven,” as its website reads. “For sustainability to achieve mass relevance, it has to achieve the mark of a high-quality product,” says Method’s



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McCormick's supplier. When food-grade bottles made with recycled PET were introduced in the mid-1990s, most contained no more than 10% recycled content. Today, recycled content is still typically less than 25%, says David Clark, Amcor's director of sustainability.

Reaching 100% recycled content involved some technical challenges for the

partnership. The most important issue is trying to get as clear a bottle as possible. "Every time you melt and re-form PET, the heat makes it a little more yellow," Clark explains. In addition, recyclers rely on people to sort plastic, and the PET stream usually contains impurities, including small amounts of nylon or polyvinyl chloride, which can alter clarity.

McCormick and Amcor found a way around the color problem. "If you can make the recycled bottles colored or tinted you can hide the yellow. The McCormick bottles are tinted a green shade. That helps," Clark says. The color of the plastic bottles matches the shade of the recycled glass bottles, Zargo adds, and both containers signal that the buyer has purchased environmentally friendly vodka.

The second common problem is that microscopic bits of metal or sand attached to recycled plastic can enter the stream. "When you go to blow bottles, that little bit of impurity can form a hole," Clark explains. He points out that McCormick's request for all-recycled bottles has put a new emphasis on Amcor's own supply chain. "We spend a lot of time working with our suppliers to develop a cleaner stream."

Zargo says his company is pleased with the little recycled bottles and is working with Amcor on four larger sizes to be made with tinted, 100% recycled PET. In addition, the company is phasing in 15% recycled PET into its clear plastic packaging.

THE STRIDES that Amcor has made on behalf of McCormick will create benefits beyond the vodka maker, Clark says. McCormick's success means that more mainstream companies, such as soda makers, can also confidently inch up their use of recycled PET.

Similarly, the ingredient prospecting pursued by firms such as Method, Aveda, and Dr. Bronner's may smooth the way for mass-market brands to improve the sustainability of their raw materials. In fact, that's just what the smaller companies would like to see happen.

Dr. Bronner's has already completed the work of setting up sustainable sources of coconut and palm oil. David Bronner predicts that mainstream brands will soon get more scrutiny from consumers about what is in their products, and when changes are demanded, they will move. "It's just a matter of time," he says.

At Method, Lawson sees development of the new laundry detergent as a learning process for everyone. "Suppliers get a lot out of the questions we ask. It helps them recognize where things are going," he says. Through Method's relationships, knowledge gained from its experimentation will spread, he expects. "Although there are bigger players in the market, we can be a helpful tool in getting the whole category to a better place." ■



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