"The Rose Sheet"
COSMETICS, SKIN CARE & FRAGRANCES

Biodegradable Debate Could Affect PHAs' Viability As Microbead Stand-Ins

By Ryan Nelson / Email the Author Posted: June 11 2015 1:35 PM

https://www.pharmamedtechbi.com/publications/the-rose-sheet/36/24/overreaching-microbeads-legislation-would-be-disservice--terraverdae

Executive Summary

Without a broadly recognized standard for plastic biodegradability in marine environments, some states are reluctant to adopt Illinois' microbeads legislation, which would allow biodegradable plastic alternatives, such as PHAs, to replace widely used polyethylene microbeads.

A growing selection of ingredients is available to personal-care manufacturers working to phase out use of synthetic plastic microbeads, including biodegradable plastic options, but current legislation under consideration could render such options inviable.

Under laws in Illinois, New Jersey, Maine, Colorado and others taking shape around the country, firms must stop manufacturing personal-care products containing non-biodegradable plastic microbeads measuring less than five millimeters in size by Jan. 1, 2018, and cease sales of such products one year later, due to concerns about plastic pollution in U.S. waterways.

Firms including **Procter & Gamble Co.**, **Johnson & Johnson** and **L'Oreal S.A.** have committed to discontinuing use of polyethylene microbeads in advance of regulatory bans, and ingredient suppliers are working to answer demand for environmentally friendly options that provide comparable exfoliating benefits.

Des Moines, Iowa-based **Kemin Industries, Inc.** says its *XFoliPEARL* is a natural exfoliating bead made from a blend of waxes that is compatible with benzoyl peroxide, natural and synthetic emollients, silicones and silicone alternative, "while remaining an eco-friendly, biodegradable ingredient."

Lipo Chemicals, the personal-care division of **Vantage Specialty Chemicals**, offers *Jojoba Scrubeads*, positioned as "a natural, affordable biodegradable alternative to polyethylene beads," and *Jojoba Spheres*, touted as a "premier mechanical exfoliant derived from fully hydrogenated jojoba wax." Both come in various colors and sizes for "outstanding visual effects in formulations," according to the Warren, N.J. company.

Botanical ingredient supplier International **Flora Technologies, Ltd.** (Floratech), operating out of Chandler, Ariz., similarly offers *Florabeads Jojoba* for "gentle and effective exfoliation," with customized colors and sizes available upon request.

Other options include *Cellulobeads* from **Kobo Products Inc.**, headquartered in South Plainfield, N.J., and *Celluloscrub* from French supplier **Lessonia**, which says its cellulose-based alternative has been evaluated for stability in shower gel, exfoliating cream, scrubbing gel and other cosmetic products and "has no impact on the product" in terms of compromised functionality.

Biodegradability Central To Regulatory Debate

Alternatives to conventional plastic microbeads also are emerging from the bioplastics industry. **TerraVerdae BioWorks** issued a release June 3 announcing the launch of biodegradable microspheres derived from polyhydroxyalkanoates (PHAs) for use in personal-care products.

According to bio-plastics.org, a project of bioplastics research and consulting firm Franz-Patat-Zentrum, PHAs are "bacteria-synthesized, intracellularly accumulated polyesters" that "scarcely differ" from non-degradable petroleum-based plastics, making them effective alternatives across a range of industry uses.

TerraVerdae CEO and founder William Bardosh stated in the release: "Our biodegradable, environmentally safe microspheres have all the performance characteristics that cosmetic manufacturers demand of current polyethylene plastic products, but they rapidly and safely break down in the marine environment, leaving behind no harmful solids."

Under Illinois' microbeads bill, which was signed into law in June 2014 and has served as the model for other states' legislation on the subject, such materials presumably would be permitted alternatives for use in cosmetic products, given that they are not "non-biodegradable" and are characterized as natural by suppliers.

According to Bardosh, "PHA is a plastic material, but 'plastic' is just a description of its physical properties, and not a term of its functionality."

This gets at another definitional challenge in microbeads legislation, in that "plastic" can refer to the polymerized structure of various materials – i.e., materials consisting of long chains of repeating molecular units – that dictates their moldability, or plasticity.

Naturally occurring polymers include cellulose, silk, wool and human DNA. The term "plastic" often is restricted in its use to denote synthetic polymers derived from petroleum that are notoriously resistant to degradation. References to "synthetic plastic" in Illinois' legislation ostensibly designate the latter.

Microbeads legislation in New York reportedly has stalled due to debate over terminology and the bill's scope, with lawmakers and stakeholders hung up on what it means for plastic to be biodegradable. Some policymakers suggest that without a clear definition or industry standard, next-generation plastic alternatives could do little to address plastic pollution and its health implications for marine life and, ultimately, humans at the top of the food chain.

California has taken a similar position with its proposed microbeads bill, A.B. 888, which is now under consideration in the State Senate after having passed the State Assembly May 23. In a departure from Illinois' trendsetting bill, A.B. 888 would ban biodegradable plastic alternatives as well as conventional plastic microbeads in wide use for decades ("'Plastic Is Plastic' Under California's Pending Microbeads Bill" — *"The Rose Sheet,"* Jun. 4, 2015).

According to a legislative aide for State Assemblyman Richard Bloom, D-Santa Monica, who introduced the bill in February, "plastic is plastic" from California's point of view, as there currently is no accepted definition for plastic biodegradability in aquatic settings, versus in composting facilities for example.

TerraVerdae agrees that not all bioplastics are equal when it comes to biodegradability, but maintains that overreaching legislation banning all such materials would be a disservice to industry and consumers.

Even traditional natural exfoliants such as shell nut grit could be problematic if widely adopted by industry players in the absence of other alternatives, given increasing rates of allergy to nuts and other natural materials, the firm points out ("Overreaching Microbeads Legislation Would Be Disservice – TerraVerdae" — *"The Rose Sheet,"* Jun. 11, 2015).

Revised ASTM Standard Issuing 'Soon'

ASTM has developed a Standard Specification for Non-Floating Biodegradable Plastics in the Marine Environment, and firms including TerraVerdae and**Metabolix, Inc.** cite the standard as the basis for their testing and compliance work for biodegradable PHA materials.

The latter announced a partnership in March under which it will develop replacement microbead ingredients using *Mirel* PHA biopolymers, which **Honeywell International, Inc.** will market as part of its *Asensa* personal-care additives line.

Metabolix noted in its release that ASTM test methods show "the marine biodegradability of Mirel PHA biopolymers … to be similar to that of cellulose and paper [and] faster than other commercially available biodegradable polymers."

Some legislators have questioned the relevance of the ASTM standard (D7081-05), noting that it was withdrawn in April 2014 for review under the organization's policy requiring standards to be updated after eight years.

In an email, TerraVerdae's Bardosh said a revised version of the standard reportedly will be introduced "soon." He added, "At this time, we are unaware of any anticipated modifications that will adversely affect the compliance of PHAs."

According to the exec, the withdrawn ASTM standard specifies that plastic samples must be exposed to aerobic marine water conditions of 30°C, and plastic must be shown:

- to sufficiently disintegrate so that no more than 30% of the original dry weight of the plastic remains after 12 weeks;
- to sufficiently biodegrade so that at least 30% of the carbon in the plastic material has been converted to CO2 after 180 days..

Further, plastic must pass specified toxicity testing under the ASTM standard's criteria, he said.

A study conducted in March 2012 by California's Department of Toxic Substances Control and Department of Resources, Recycling and Recovery examined the "fate and persistence" of PHA bioplastic during biodegradation in the marine environment, using ASTM's standard for testing.

Investigators used two samples of Mirel PHA and found that after six months, 38% and 45% of the samples biodegraded into carbon dioxide, comparable to the rate shown by a cellulose sample that served as the positive control.

They concluded that "Mirel PHA plastic material behaves similar to cellulose in marine water" while noting that further research is needed to understand the time required for complete marine biodegradation of PHA plastic and the effects on marine life.

Bardosh said TerraVerdae's PHAs also are "fully compliant" with ASTM D7081 and that "tests of PHA microspheres have shown that up to 80% of their mass will disintegrate within as little as 14 days."

Other resources for firms striving to demonstrate their materials' biodegradability in marine environments are scarce and potentially ill-suited for firms testing bioplastic. On its website, Lipo Chemicals says components of Jojoba Scrubeads and Spheres have been tested via protocols based on U.S. Environmental Protection Agency guidelines for assessing the aerobic aquatic biodegradation of pesticides and toxic substances.

The ingredients' degradation after 28 days indicates that they exhibit the characteristics of "inherently biodegradable materials," according to Lipo Chemicals.

Biodegradability may have to be defined on the federal stage, where the Microbead-Free Waters Act currently is under consideration in both houses of Congress. Currently, the bill would ban synthetic plastic microbeads beginning Jan. 1, 2018, which could prohibit biodegradable plastic alternatives to polyethylene microbeads unless "synthetic" is defined, or universally understood, to mean plastics manufactured from petrochemicals.

The Personal Care Products Council is among stakeholders seeking a firm definition for ingredients that would be prohibited under federal law to ensure predictability for manufacturers reformulating products ("Industry Weighs In On Federal Microbead Bill At Committee Hearing" — *"The Rose Sheet,"* May 7, 2015).