SUSTAINABLE PHARMACEUTICALS CAN OUTPERFORM THROUGH NATURALLY DERIVED INGREDIENTS AND DEEP EXPERTISE

In this article, Rina Chokshi, Global Commercial Marketing Leader, Pharma Solutions at DuPont Nutrition & Biosciences, discusses the benefits of naturally derived, sustainable ingredients and their benefits to the environment and pharmaceutical industry.

As industries around the world look to become better stewards of a sustainable future, pharmaceuticals are ripe with opportunities to embrace sustainability. In addition to ways to reduce their carbon footprint and enable sustainable practices within their organisations, drug formulators can also rely on excipient suppliers to provide naturally derived, plant-based ingredients with impressive sustainability stories. But only through deep manufacturing expertise can those materials be harnessed to optimise performance. After all, an abundance of quality, sustainable ingredients means nothing if those ingredients cannot be converted into safe and effective drugs that promote patient compliance.

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Using plant-based ingredients is no longer just a matter of social consciousness – in many instances, these natural substances outperform their less sustainable counterparts, and thus are in greater demand. In the capsule market alone, demand for plant-based solutions has grown twice as much as that for their animal-based analogues. Over 375 million people around the world identify as vegetarian, and even more consumers possess a desire to better the planet through their dietary choices.[1] As the global population trends towards more sustainable and non-animal options, ingredients like gelatine have become undesirable.

Pharmaceutical and dietary supplement manufacturers have several viable ingredients at their disposal to help promote holistic sustainability, including those derived from seaweed, which can be used in gummies, soft capsules and other delivery formats; pectin, a natural hydrocolloid present in citrus fruit peels that provides gelation, viscosity, texture and protein stability in a range of pharma and dietary supplement applications; and cellulose, which is responsibly sourced from wood pulp to improve compression, flow and act as a filler in tableting applications.

Sustainability plays a part at every stage in the lifecycle of these ingredients, and, by implementing them into their portfolios, pharmaceutical manufacturers can position themselves to thrive in a more sustainability-focused market.

PERFORMANCE STARTS AT THE SOURCE

For years, formulators have used gelatine, an almost tasteless substance made by boiling down animal byproducts, to produce pharmaceuticals and dietary supplements in a variety of formats – from hard and soft gel capsules to the increasingly popular gummy format. It produces a familiar mouthfeel that resembles the gelatine-based foods consumers may have grown up eating – such as gummy candy, jellies and marshmallows – and allows manufacturers to encase bitter-tasting ingredients in capsule form. However, its inclusion in products can be a turn-off to a growing population of vegans and vegetarians, not to mention the many generations of people who follow halal or kosher diets.

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Formulators have access to several high-performing vegetarian alternatives to create safe, sustainable drug products and dietary supplements. Carrageenan, for example, is sustainably sourced from red seaweed and can replace gelatine in the production of soft gel capsules and gummies. With centuries of safe use as a food product behind it, carrageenan can help to overcome many of the most daunting sensory challenges in formulating vegetarian pharmaceuticals.

In soft capsules, carrageenan has superior thermal stability to gelatine, allowing the capsules to maintain their integrity throughout processing, transportation and, ultimately, on the shelf. Soft capsules made from carrageenan do not melt or stick together within the bottle, staying true to form throughout their lifecycle. Soft capsules with carrageenan can be developed into various shapes, colours and sizes depending on a manufacturer's brand strategies. And, as an added benefit, these ingredients incorporate easily into existing gelatine manufacturing operations, which means only minimum capital investment is required to switch from animal-based to plant-based soft capsules.

As previously mentioned, gummies are growing in popularity as a delivery format to combat pill fatigue. Carrageenan can reduce stickiness to the teeth while chewing and create an overall pleasant mouthfeel – building a compliant consumer base is all but impossible without checking both of these boxes. Plus, with carrageenan maintaining structural integrity under high temperatures, it can deliver a pure, superior quality gummy product, time after time.

Seaweed-based alginates can be used as a gelatine substitute to coat capsules, both hard and soft, as well as tablets. The naturally derived alginate helps to reduce unpleasant flavours and odours and improve the consumer experience, while protecting APIs against the stomach's acidic environment, where they are often prematurely digested. Alginates have even gained popularity as an API to combat acid reflux as either a premier raft formation in liquid products or in the form of alginic acid for chewable products.

In addition to mouthfeel, gelatine gives products a familiar sheen that appeals to end-users. Pectin is a plant-based stand-in derived from the discarded peels of oranges and other citrus fruits that can match or exceed the sheen of gelatine to ensure patient compliance.

Wood pulp-based cellulose has a long track record of safe use as a naturally derived polymer in food. Cellulose has become increasingly popular in the pharmaceutical space for addressing a wide range of applications, from tablet coatings, granulation and controlled release to drug layering, vegetarian hard-shell capsules and amorphous drug stabilisation.

NOT JUST "WHAT" BUT "HOW"

These naturally derived ingredients certainly perform, but they also leave a positive sustainability impact before even reaching the drug formulation – embodying the environmental, and even social, aspects of sustainability.

For instance, the red seaweed used to source carrageenan is a naturally occurring ocean plant that is sustainably cultivated on small family farms, primarily off the coast of Southeast Asia and East Africa. Due to the low cost of production, farming carrageenan is a viable solution for small family seaweed farmers around the world. Additionally, the process of farming carrageenan bolsters the surrounding environment rather than depleting it – it requires no arable farmland, needs no pesticides or special fertilisers and helps protect coral reefs and fish populations. Seaweed farmers benefit by not only making a living, but also securing a better quality of life for themselves and for their children. They can send their children to better schools, gain access to better technology – including mobile phones and electricity – improve sanitation and develop specialised knowledge in coastal marine ecology that increases their income.

Alginates are derived from brown seaweed, which grows in colder waters and is often harvested sustainably by large trawler boats. Compared with the practice of logging, which takes an exacting toll on forests, removing most if not all trees in a designated area, alginate harvesting takes only a very limited portion of seaweed per harvest. In fact, depending on how hilly the seabed is, a harvest vessel might catch as little as a quarter of the seaweed. This means that much of the seaweed in a harvesting field is left untouched; only the adult plants are captured by the trawl, leaving young seaweed plants behind to grow rapidly in the newly accessible sunlight. This still allows fish and marine organisms to find sanctuary, even in fields that have been recently harvested. In line with current regulations, four to five years must pass between harvests, ensuring the re-establishment of seaweed beds before the next harvest can take place.

Pectin is made from the discarded rinds of citrus fruits, such as oranges and lemons. These byproducts typically end up in animal feed with a suboptimal nutritional profile for the intended livestock, or go straight to the landfill. Pectin demonstrates a circular economy and a simple way that manufacturers can utilise the earth's natural products to deliver high-quality drugs and dietary supplements. In addition to reducing environmental waste, pectin products can support at least four of the United Nations Sustainable Development Goals: good health and wellbeing, responsible consumption and production, climate action and life on land.[2] By choosing to use pectin instead of gelatine, manufacturers contribute to a more sustainable world by repurposing waste in a safe and effective way.

Cellulosics are sourced from wood pulp, a process that depends largely on stringent sustainability initiatives to minimise environmental impact and protect our precious woodlands. A reputable supplier of the wood pulp must have established sustainability initiatives, as well as strong environmental and health and safety policies to actively improve their impact on the environment and the communities

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they serve. Also, they must be able to provide third party certifications for forestry practices and wood-sourcing chain of custody practices.

GREAT INGREDIENTS DEMAND GREATER EXPERIENCE

Nature's finest ingredients are far from uniform in their consistencies, bringing a high variability to the table that can make manufacturing difficult. Quality ingredients mean nothing if they are not manufactured and applied by a team of knowledgeable experts. And the most sustainable sourcing leads nowhere if consumers do not like the end product. To take full advantage of plant-based ingredients, formulators should partner with an ingredient supplier with a solid track record in traditional pharmaceutical application development, technical service and quality manufacturing that meets worldwide regulations and can handle inconsistent natural ingredients. In other words, a partner who can help formulators deliver the right product to meet present-day market challenges and capitalise on future opportunities.

But, how can an excipient supplier live up to those standards and earn the trust of pharmaceutical manufacturers in the arena of sustainable ingredients? A successful strategy to achieve this goal hinges on securing critical ingredients in support of various product lines. This involves ongoing evaluation of raw material suppliers to ensure quality, safety and regulatory standards. Without this solid framework in place, bringing safe and sustainable pharma ingredients in-house will remain nothing but a good intention, and the raw materials so carefully cultivated from nature will never meet their full potential.

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PROMOTING A GREENER WORLD

Sustainable business practices in the pharmaceutical space must come from responsible ingredient manufacturers, whose deep expertise can lead to indispensable ingredients that outperform traditional ones. Only then can formulators take full advantage of plant-based ingredients to impact our oceans, farms and landfills in a positive way.

By utilising plant-based products instead of gelatine or chemically manufactured polymers, the pharmaceutical industry can reduce its dependence on ingredients produced through carbon-heavy factory farming, or products that might be unsustainably manufactured, as well as satisfying the requirements of a growing population of vegan and vegetarian consumers. And when you consider the socially promotive nature of carrageenan farming, the thoughtful process of alginate harvesting, the ingenious repurposing of pectin production and the careful creation of cellulose, it only compounds our need as an industry to fully embrace these sources. We have much to gain by making the most of these versatile ingredients, creating a sustainable world without giving up performance or profit.

ABOUT THE COMPANY

DuPont (NYSE: DD) is a global company with technology-based materials, ingredients and solutions that help transform industries and everyday life. DuPont's employees apply diverse science and expertise to help customers advance their best ideas and deliver essential innovations in key markets including electronics, transportation, construction, water, health and wellness, food and worker safety.

ABOUT THE AUTHOR

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