

Flora-Based Milk Protein: No Cows About It!

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The dairy industry awaits a paradigm shift as a growing number of consumers question their daily intake of animal-derived products, including meat, eggs and milk, over concerns about their own health, environmental damage and animal welfare. Within the dairy industry, a scenario is unfolding that sales of milk is under attack by makers of plant-based milk alternatives made from soy, rice, pea, oat, cashew and hemp.

In the US, 1 out of 7 bottles of milk is now formulated using plant ingredients. At the same time, global demand and use of milk protein—especially whey protein isolate—keeps growing and the valuable ingredient is used in a plethora of food and beverages ranging from protein smoothies, nutri-bars, sarcopenia, wellness, weight management, sports performance and infant nutrition.

Although dairy milk sales are gradually declining in the western world, the opposite is true for consumers enjoying increasing amounts of yoghurt, cheese and ice cream. Ecologically and environmentally speaking, it will be a hard sell to justify ever-increasing output of dairy by continuously adding large amount of dairy herds.

Environmentally speaking, pushing traditional dairy production into uncharted territory is increasingly seen as a main contributing factor of greenhouse gas emissions, irresponsible clean water waste, and a host of other negatives that surround large-scale traditional factory-farms dairy operations and economics.

At Long Last

It is no longer the imagination of futuristic cellular agriculture, but rather the great momentum revolutionizing and disrupting the legacy dairy protein industry, as it is known today. Creating premium quality dairy protein ingredients, such as casein and whey, can now be accomplished without the use of cows.

Perfect Day has mastered the art to make superior protein that is nature identical to milk protein through fermentation. In other words, ecologically sound sustainable premium nutrition from a bioreactor, not a cow.

Using biotechnology in combining milk's essential genes and nature's microflora together with sugar and subsequently fermentation at predetermined conditions such as time and temperature makes animal-free dairy protein.

The process for producing animal-free milk protein involves adding genes essential to culture the microflora and subsequently allow the dairy flora to ferment plain sugar into the main dairy protein constituent's casein (=cheese curd) and whey. Microbial fermentation is the new buzzword, which now is well on its way to make a large part of the traditional dairy protein industry obsolete.

The specific flora ferments sugar to make milk proteins that are chemically identical to its components casein and whey. The resulting protein is considered acellular, because no cells are present in the final product. This process is exactly the same DNA blueprint which cows use every single day.

These animal-free flora-based milk proteins are identical as found in cow's milk without compromising on protein purity in terms of quality, DIAAS and PDAAS—as well as organoleptic and functionality performance like parameters such as dispersion, solubility, gelation, whipping and emulsification. A little bit further in the future, synthetic enzyme and fungi modulation technology will also allow the creation of hypoallergenic versions of flora-based milk protein, as well as further refinements in its amino acid profile, most notable increased contribution of leucine.

The Flora-based Protein Vocabulary

Flora is a catchall term for many kinds of microorganisms that include yeasts, bacteria, and fungi that all play an important role in every day's life like probiotics that are essential for human's digestive health.

Although Perfect Day's flora-based vegan milk protein seems science fiction, its technology by using microorganisms has been used since ancient times. For example, everyone knows that yeast is needed to bake bread and craft beer. Fewer people know that yeast is used to produce human-identical insulin for hundreds of millions diabetics, or vanillin or rennet for that matter.

Flora-Based Milk Protein: Clean And Green

Come to think about it, the science behind the creation of animal-free milk protein has much resemblance with modern medicine, pharmaceuticals and vaccines. Thinking out loud, the advance of cellular agriculture –and protein in particular- it is likely that new words will enter the vocabulary. One of these words is “flora protein”, a word that fills the space between the traditional identification names of “animal protein” and “plant protein”.

Unlike the legacy dairy proteins derived from cow's milk, the innovative flora-based proteins are free from hormones, cholesterol, lactose, antibiotics, pathogens and chemicals such as dioxin, all disruptors that can affect short term and long-term human health and well-being.

Flora-based milk protein ingredients –made by Perfect Day, a Silicon Valley startup- is a culmination of a more sustainable food security for the health of plant, people and animal well-being.

These premium proteins mean also less water, energy, greenhouse gas emissions and sparing lots of valuable land.

Feeding the world of tomorrow will require more efficient use of plant's resources to secure more sustainable food choices. Nutritious plant-based and flora-based products such as animal-free dairy protein are crucially important for human health as well as provide environmentally sustainable foods that are satisfying, tasty and commercially viable. All signs are clear that some plant protein ingredients together with flora-based milk protein ingredients are potential game changers that allow sustainable sourcing for large food conglomerates and deliver cost-efficient, high quality options at the desired quantities at scale.

These transformational changes across the entire agriculture food value chain is needed to prevent threats to human health aimed at mitigating or adapting to the effects of climate change. Irreversible changes which may have wide ranging impacts on many aspects of health, including to the potential burden of malnutrition, disease and general well-being. Not only for the happy few, but also ultimately for mankind.

Climate Change Is Imminent

The food security of tomorrow must ideally provide healthy and sustainable tasty diets for everyone. Agricultural cell biotechnology will be the key to accomplish these noble goals, especially when debating the huge disparities of why hunger persists in some countries while unprecedented obesity levels flourish in others. Social inequality and the depletion of world's natural resources within the context of climate change are on a head-to-head collision course.

It is clear that a few hurdles still have to be taken. Especially the consumer needs to be convinced that the new form of protein does not come from animals yet is completely identical. To accomplish this, a major task in consumer education will be necessary even though consumers have been using this technology in their daily life for several years while making and consuming foods and medicines. Being an animal protein but not delivered by an animal will preferably require a new descriptive name. Looking at the ancient and time-tested methods of food fermentation, the

innovative technology to create “cow-less” milk protein ingredients, the word “flora” most accurately and appropriately describes the product.

The flora-based milk protein ingredients is naturally lactose-free and avoids the huge environmental footprint of dairy cows, including land use, feed waste, and eliminating phenomenal amounts of methane gas from the cow belches and manure. Actually, these new flora-based proteins are a true-life saver for the large food manufacturers –many of whom have set goals for steep cuts in greenhouse gas emissions. The early indications of yield-efficiency ratio’s show flora-based milk protein production require >95 percent less water and a whopping >60 percent less energy, not to mention the huge savings in labor and veterinarian expenses.

Legislative Questions

Regulatory reviews by the FDA and EFSA will certainly address possible GMO issues that are part of the initial process of creating the designer-flora used to kick-start the protein culturing in fermentation tanks. Since the animal-free flora-based milk proteins are made without the use of animals, the protein is classified as vegan. It is important to know that the flora-based milk protein does not contain active GMOs. Although genetic modification is part of the initial process to modulate the protein production in microflora once the proteins are produced, the modified flora is filtered out with no trace left in the final protein product.

Although the flora-based milk proteins are self-affirmed GRAS, both the FDA and EFSA still have to go through thorough process review and classification and rulemaking in terms of name identification on a food label. Looking in the crystal ball, it is likely that the recommended label declaration will be something like “non-animal whey protein”. However, as rapidly increasing foods made by using cellular synthetic biotechnology takes on a stronger position in world’s food sustainability and security, flora-based protein likely will eventually become the words of choice.

More Than Just One

There are quite a few similarities between the Silicon Valley upstart companies Impossible Foods and Perfect Day. The real “secret” of the Impossible burger is its flora-based version of heme. By transferring the roots of the soy plant into leghemoglobin by means of genetic modulation, the Impossible burger not only gets its natural appearance simulating ground lean beef, but especially creates the great taste and flavor of the traditional American burger.

Better Tasting Vegan Foods

Although consumers are increasingly aware that food choices are directly correlated with health and well-being outcomes in later life, if the plant-based alternative does not taste good, it will lose its attraction pretty fast, even if it carries added health-promoting advantages. Taste is subjective and can evolve over time, but the taste-factor is overwhelmingly the number one reason why consumers find it a challenge to stay long-term committed to plant-based nutrition. In addition, on a global scale, consumers do not consume as much plant-based formulated foods due to its higher costs and lower availability.

Many existing vegan foods have issues with plastic-like textures or cardboard-like taste and flavors. Many consumers, who try to change their diet and incorporate more plant-based foods, dislike the products for these reasons. To boost the trend of increased plant-based nutrition it will therefore be necessary to improve taste and overall organoleptic experience.

Using vegan cultured dairy protein ingredients can now solve most of these organoleptic texture and or flavor issues. Flora-based protein is the innovative way forward, not just to improve the sensory values of existing vegan foods, but also create superior taste improvements in traditional dairy formulated foods –without the need for animals.

Only milk proteins have the unique capability to give cheeses their stretch and texture. The same is true when using milk protein ingredients in ice cream and fat-filled powders like coffee creamer because of its unique creamy meltiness and superior taste.

The Value for Mankind

Perfect Day is planning to quickly ramp up the production of flora-based milk protein ingredients. Commercial manufacturing is projected to reach 20,000 tons of whey protein isolate by 2025. With the global reach of companies interested in manufacture and distribution such as ADM, these quantities can turn into reality quickly. These quantities of flora-based proteins can increase more quickly as manufacturing in larger bioreactors for fermentation spreads throughout the world.

Not only will the modern affluent consumer benefit, but also especially when these “flora-protein” fermenters are built in world regions that are currently economically depressed and who traditionally have spent billions of dollars to import dairy based ingredients. Perhaps the biggest value of Perfect Day’s invention will be their contribution to provide premium nutrition to all those billions of people who are currently malnourished because of lack of affordable food.

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