

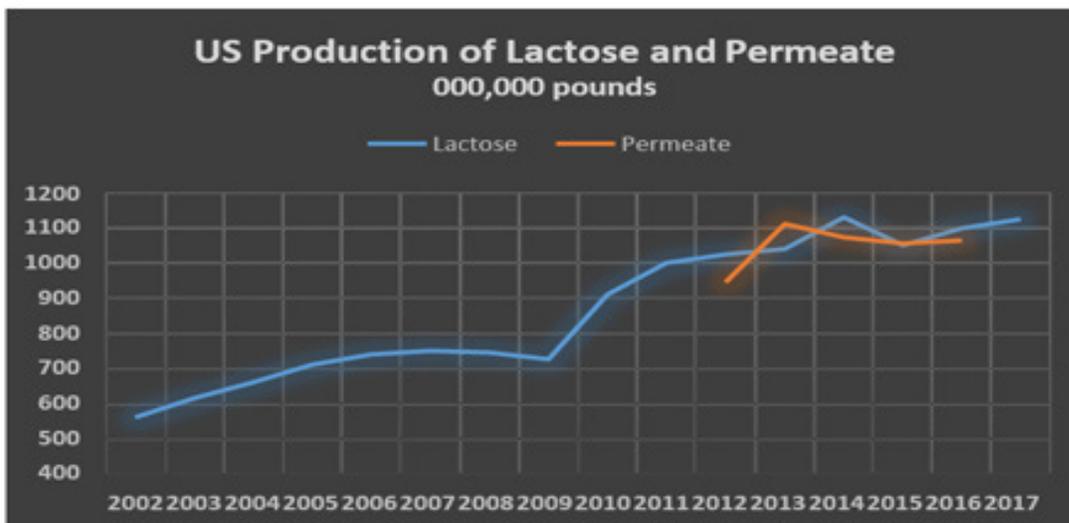


Developing Substantial New Uses for Permeate and Lactose – Opportunities in the Market for Plastics and Bio-based Chemicals

Industry Background and Need for a Solution

The US dairy industry currently generates a large surplus of unprocessed lactose solids. In 2016 an estimated 31.6% of available whey solids went unprocessed, an amount equivalent to 14.1% of milk solids used in the manufacture of cheese. Rates of raw material conversion to finished products have decreased in recent years and production has plateaued (Figure 1).

If the current pattern continues the dairy industry will face a growing structural surplus of lactose solids resulting from cheese and milk protein manufacturing. The situation results in a cost burden because of overhead incurred in managing disposal of surplus material. Furthermore this is a barrier to industry growth because of the constraints to development arising from the difficulty in generating value for this portion of available milk solids. It is not only a question of direct costs incurred and opportunity forgone, there is the added matter of business sustainability and corporate social concerns to be considered by individual companies and the industry as a whole.



Source: ADPI Dairy Products Utilization and Production Trends.

As Figure 1 indicates, processing of lactose solids into finished products, primarily permeate powder and lactose grew significantly during the period 2002 – 2012. Output of lactose itself effectively doubled over these years. Unfortunately the favorable circumstances for demand that prevailed during this period of expansion have diminished and are now having a substantially reduced beneficial impact in the market.

A major part of the engine for growth in the decade to 2012 can be attributed to the emergence of net new demand in several key areas. This included usage for milk powder standardization, confectionery and animal feed applications. These were unique developments in terms of market growth where substantial reservoirs of demand were created over a relatively short time period. Those conditions provided the basis for what was actually a step change in the volume of business for lactose and permeate products.

However these pipelines for consumption are now largely filled. Barring breakthroughs such as major new demand in feed uses, future growth in demand from these sectors will be typically incremental in nature. Business development for lactose based dairy products will hinge on opportunities for organic growth across existing markets including those mentioned above and small number of additional areas such as infant formula and food manufacturing. The market has shifted to a lower rate of growth compared with the step change seen earlier.

Opportunity in Bioplastics

Faced with the situation described above, there is a compelling case for development measures that address the need for new applications and new markets. The plastics market has the potential to provide significant new space for the utilization of permeate and lactose. Until a little over a decade ago plastics were almost entirely manufactured from petroleum based materials. Driven by a range of factors this situation is changing with the introduction of more environmentally friendly raw materials and the advent of bioplastics as a new category. Bioplastics are made from renewable materials such as corn, wheat, potatoes and soy bean, raw materials which provide a source of sugar and vegetable oil for conversion to the polymers used in plastics production.

The plastics sector is a huge industry in which packaging, automotive and construction businesses are the principal customers. Packaging constitutes the largest segment and is projected to have a global market value of \$975 billion in 2018. The food and beverage sector is the single largest user of plastics within the packaging market. There is a good fit with food and beverage consumers and the use of green packaging materials manufactured from bio-based feedstocks.

Growth rates for bioplastics are encouraging. Global production was in 1.62 million tons in 2013 and output grew at CAGR of 6% between 2013 and 2017 to reach 2.05 million tons. Supply is forecast to grow at a 4% rate between 2018 and 2022 reaching of 2.44 million tons in five years. The sector has reached a scale that makes it a potentially attractive outlet for permeate and lactose based products. Investment in production capacity may be viable if a competitive manufacturing platform can be established for conversion of lactose based raw materials.

Conclusion

Lactose rich permeate is a potentially suitable raw material for the manufacture of two types of plastic polymer – Polylactic Acid (PLA) and Polyhydroxyalkanoate (PHA). Both of these products can be produced from other natural raw materials such as corn which are competitive sources, recognizing that the underlying economics for all products are always predicated on oil cost. Taking account of this background, the business and technical conditions necessary for conversion of permeate to bioplastic need to be evaluated compared with the economic competitiveness of alternative sources for raw materials.

Challenges will always exist for initial investment in novel and groundbreaking business sectors. Achieving competitiveness depends on the framework on which business is established. The criteria necessary for viability should be determined. From this it will be possible identify options and strategy to advance dairy industry investment in the manufacture of bioplastics. The industry as a whole and the cheese sector in particular will certainly benefit from controlling what is a burdensome problem today and ultimately turning this to a profitable business opportunity.

Outside the box ideas will be helpful, for example arrangements that incorporate the full measure of economic benefit will contribute to viability. Collaborative approaches not currently envisaged may help in finding solutions that lower the threshold for investment. While the immediate goal concerns bioplastics, the core technology may also lead to additional business opportunities and value added product streams, this potential should be examined.

Further information is needed to measure benefits for the dairy industry from improved permeate utilization. The implications of doing nothing should also be assessed. The conclusions obtained from the evaluation can be employed to determine feasibility and to focus industry efforts on developing measures needed to support viable investment strategies.

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