Method to Convert Whey Waste into Monosaccharides and Other Valuable Products

INVENTORS • George Huber, Mark Lindsay, Scott Rankin

The Wisconsin Alumni Research Foundation (WARF) is seeking commercial partners interested in developing a highly selective (>94 percent) method for converting acid whey streams into valuable whey protein and glucose/galactose syrup.

The new route can reduce the water, energy and carbon footprints of the U.S. dairy industry and may be used to treat other dairy streams that contain lactose.

OVERVIEW

The U.S. dairy industry currently produces more than 55 million tons of waste each year in the form of unused milk products and whey waste from yogurt and cheese processing. Of this, four million tons of acid whey, a byproduct in the processing of Greek yogurt and cottage cheese, are produced with nearly all of it discarded at a cost to manufacturers with notable impacts on the environment.

Currently there is no technology to profitably treat acid whey or otherwise convert lactose-rich streams resulting from dairy manufacturing. Consequently, there is a significant market opportunity to convert these materials into more valuable components.

THE INVENTION

UW–Madison researchers have developed a new catalytic approach for the conversion of lactose-rich dairy streams into whey protein, monosaccharides (glucose/galactose syrup) and water. The method includes the following steps:

First, the dairy waste stream undergoes ultrafiltration to separate it into retentate and permeate fractions. The smaller retentate stream goes through a standard protein extraction process to produce whey protein. The permeate (lactose stream) passes through a bed of activated carbon before being sent to the hydrolysis reactor. Activated carbon pretreatment removes 40 percent of the nitrogen-containing species that are responsible for undesired side reactions during the acid hydrolysis step. The ions are removed by a priority technology.
Hydrolysis is performed with either mineral acids or solid acid catalysts. The stream leaving the hydrolysis reactor is filtered with activated carbon to remove any solids and unwanted side products and then evaporated to make glucose/galactose syrup (see Figure 1 below).

**BUSINESS OPPORTUNITY**

The new method dovetails with the commercial production of Greek yogurt, which produces copious amounts of acid whey as a byproduct. Specifically, when the method is incorporated into a yogurt production line, three additional products are formed: glucose/galactose syrup, whey protein concentrate (WPC) and water.

The glucose/galactose syrup can be used as a sweetener for products such as ice cream, yogurt and chocolate milk, or sold. It is a useful replacement for high-fructose corn syrup and other sweeteners. The WPC could 1) be added to other dairy products to increase protein content or 2) sold to the existing 20 million ton per year (2018) market at a price of $1,760 per ton for use as a dietary supplement or food additive.

Water produced during evaporation of the hydrolyzed lactose stream and whey protein stream can be used in other products or operation of the plant.

**APPLICATIONS**

- Dairy/yogurt manufacturing

**KEY BENEFITS**

- Turns waste stream(s) into useful and valuable products
- High selectivity and yield

**STAGE OF DEVELOPMENT**

The researchers have achieved monosaccharide selectivities greater than 94 percent at conversions exceeding 90 percent. These results establish that acid whey has the potential to be effectively recycled to produce food additives instead of being disposed of in economically and environmentally unsustainable ways, which is current practice.

**ADDITIONAL INFORMATION**

**Publications**


**Tech Fields**

Food & Supplements - Processing

**CONTACT INFORMATION**

For current licensing status, please contact Mark Staudt at mstaudt@warf.org or 608-960-9845.
Fig. 1 Flow chart of catalytic conversion of acid whey into water, whey protein concentrate and glucose/galactose syrup.