## OUR INDUSTRY TODAY

# Whey Utilization and Whey Products[1]

FRANK V. KOSIKOWSKI
Department of Food Science
Cornell University
Ithaca 14853

It always has been that way. Since about 5000 B.C. when man started cheesemaking, the secondary product, whey, has shown up to challenge him to put it to some use, any use initially as long as this yellowish-green, slightly sticky liquid was not there on the following day to plague him.

During early centuries and into the recent past our forefathers, with primitive facilities and equipment, made a valiant effort to utilize whey in different forms. For example, in the middle ages whey was applied as a pharmaceutical drug, a component of soothing salves for burns, a skim balm, a potion to inspire vitality and to restore hair, but rarely was it used as a food for humans.

As cheese grew in popularity, an increasing volume of fluid whey accompanied it for which there was little demand. It became customary to divert much of this mass of whey into the nearest stream or river, and many cheese factories were built over or near such waterways for this purpose. Little fuss was made of the resulting odor or lethal effects upon fish, which were competing for the available oxygen, until the age of conservation. Then the cheesemaker came face to face with strong new regulations prohibiting the dumping of whey, because of its corrosive nature, into streams and rivers and even into municipal sewerage systems. A new order evolved, and many chseesemakers who could not or would not adapt were to find their plants closed to production. Of course, some fluid whey over the years was fed to farm animals, spread over fields, or locally processed, but certain limitations of the period tended to restrain such outlets.

In modern times the adaptable cheese manufacturer was faced with a need to understand the nature of whey, to concentrate or modify whey, to organize collection centers, and finally, to dispose of whey so as not to offend his fellow citizens or, better still, to utilize it for the betterment of mankind. The challenge was met. Much has been done, but it is not nearly enough, and utilization of whey remains perhaps the most serious problem facing the dairy industry worldwide. A report of a widely representative regional committee, sponsored jointly by the United States Department of Agriculture and the National Association of State Universities and Land-Grant Colleges (68), recently identified the whey processing and utilization researchable problem to have the greatest urgency for solution among all the current problems in dairy technology and production.

It is my intent here, based on my own personal research, to explore the present state of whey utilization, types of products available and current research, and to comment on the future.

### NATURE AND AMOUNTS OF WHEY

What is this product called whey, and why does it cast such a heavy shadow over an otherwise exuberant and dynamic cheese industry?

Whey is the watery portion or serum that separates from the curds during conventional cheesemaking or casein manufacture (42). It constitutes about 85 to 90% of the volume of the milk used for transformation into ripened cheese, and it retains about 55% of the milk nutrients. These, among the best that milk can offer, include soluble proteins, lactose, mineral elements, and vitamins (Table 1). Additionally, whey contains variable amounts of lactic acid and nonsoluble nitrogen.

From ripened cheeses the whey is sweet, pH 5.9 to 6.3, but from unripened, fresh cheeses the whey is acid, usually pH 4.4 to 4.6. There is more lactic acid, calcium, phosphorus, and lactose in acid whey and more resistance to acceptance by consumers because of the acid

Received December 14, 1978.
[1] Presented, in part, as an invited lecture at the 20th International Dairy Congress, Paris, France, June 30, 1978.