

Sorbitol and Ascorbic Acid (97/98S11)

Sorbitol (also known as D-glucitol) was first discovered in the late 19th century in wild berries. Sorbitol has many uses in addition to being the chemical feedstock for the production of ascorbic acid. These end-uses make use of the properties of sorbitol such as its hygroscopicity and its inherent sweetness.

Liquid and solid grades of sorbitol are found throughout the food industry as well as in the production of pharmaceuticals. Sorbitol can function as a moisture stabilizer, softener, carrier and general conditioning agent. Powdered grades are used as a sugar substitute in the production of diabetic food products. Examples include chocolates, chewing gum and various sweets. Sorbitol is usually complemented with high performance sweeteners in the manufacture of reduced calorie foodstuffs. The confectionery industry uses liquid and syrup forms as softeners and moisture stabilizers. Use is not restricted to sweets, but is also in found in savory products.

The global demand for sorbitol exceeds 800,000 metric tons per year and is growing at an average rate greater than 3.5 percent. This growth is being driven, in part, by increased food use as an alternative to sugar and in diabetic foodstuffs. This growth is encouraging investment in new projects, especially in Asia. Technology improvements above and beyond the batch CSTR approach can reduce capital and operating costs substantially. Major producers are highly integrated and combine sorbitol production with that of other high and medium performance sweeteners.

Ascorbic acid (Vitamin C) was first isolated in 1928 by Szent-Gyoryi and in 1933 the chemical structure was determined by Haworth and Hirst. The chemical structure is shown on the next page.

The most useful chemical property of ascorbic acid is its redox capability. This property, together with its nutritional value and low toxicity, is responsible for its widespread use in the food and pharmaceutical industry.

The global demand for ascorbic acid is about 55,000 metric tons per year growing at about 3.0 percent. The Reichstein process remains the major production method for ascorbic acid with Hoffman La Roche and Takeda the main producers. Ascorbic acid is produced using biotransformation technology in China. Low price material from China is being exported to all regions and is gradually gaining market share in the major regions. In response, major producers have been finding ways to cut costs though revamping their processes (or stronger measures as necessary). The costs of producing ascorbic acid via

Reichstein and biotransformation processes are comparable. The economics of worldscale production tend to favor the Reichstein process. At smaller scales of operation biotransformation processes costs are marginally lower. Given current prices, operating rates and likely returns, investment in new plants in the short term is unlikely. Over the medium term, after 2000, additional capacity will be needed in all regions and a biotransformation-based process is a likely candidate for such a plant especially if back-integrated into the corn/cornstarch value chain. At the time of publication, BASF, Merck and Cerestar are collaborating in the development of a commercial biotransformation process to produce 2-keto-L-gluconic and, a key intermediate in vitamin C production.

