

Production of γ -tocopherol Rich Mixtures

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Executive Summary

The primary focus of this project is to analyze the methods available for processing soybean oil deodorizer distillate, SODD, to produce various concentrations of tocopherol mixtures for vitamin E dietary supplement uses. An enzymatic distillation process utilizing *Candida rugosa* lipase process SODD to produce an α -rich tocopherol mixture currently sold on the market. The plant will have the capacity to produce 16,500 kg/day of an α -rich tocopherol mixture. The α -rich tocopherol mixture will be processed by column chromatography, in order to produce γ - δ -rich tocopherol, and 99.9% pure γ -tocopherol. The plant will be capable of producing 1,000kg/yr of pure γ -tocopherol, and 15,100 kg/yr of γ - δ -tocopherol mixture. The quantity of γ - δ and γ -tocopherol produced may be varied as sales prices fluctuate.

In order to determine the profitability of producing pure γ -tocopherol, five plant designs were considered.

- Design 1 produces 1kg/yr γ -tocopherol, and 5,510,585 kg/yr γ - δ -tocopherol
- Design 2 produces 10kg/yr γ -tocopherol, and 5,510,563 kg/yr γ - δ -tocopherol
- Design 3 produces 100kg/yr γ -tocopherol, and 5,510,344 kg/yr γ - δ -tocopherol
- Design 4 produces 1,000kg/yr γ -tocopherol, and 5,508,148 kg/yr γ - δ -tocopherol
- Design 5 processes 0 kg/yr γ -tocopherol, and 5,510,588 kg/yr γ - δ -tocopherol

Design 5 is used as a basis of comparison in order to determine the relative profitability of the γ -tocopherol production process. In general, as the production rate of pure γ -tocopherol increases, the net present worth and annual return on investment increases. Design 4, which produced 1,000 kg/yr γ -tocopherol, had a net present worth of \$1.2 billion, whereas Design 1, which produced 1 kg/yr γ -tocopherol, had a net present worth of \$928 million. The net present worth of Design 5 was \$930 million, slightly higher than the net present worth of Design 1, because the revenue generated annually is not substantial enough to make up for the increased capital investment. In order for γ -tocopherol production to be profitable, a minimum of 8.61 kg/yr γ -tocopherol must be produced.