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CONVERSION OF COLLAGEN TO MICROBIAL PROTEIN

Can collagen serve as an effective, economical substrate for the production of microbial protein of high nutritive quality? The answer to this question is being sought in a project, sponsored by FPRF, with Dr. Jules Porsche and ABC Laboratories (see Director's Digest, January, 1969, July, 1969 and May, 1970). Recent results on this project are summarized below.

Most of the research for the past several months has used a bacteria of large cell size that produces protein with an excellent amino acid profile. The organism grows rapidly on SP-100, a proprietary heat-hydrolyzed collagen, particularly if a supplementary carbon (energy) source is added to the medium. This bacteria, in contrast to the pseudomonad studied earlier, cannot utilize fat but can utilize molasses very well as a supplemental carbon source.

When grown in batch culture on a medium containing 5% SP-100, the organism entered the stationary phase at a population density of about 10^{10} cells per milliliter. At this point the conversion of collagen and molasses to bacterial dry weight was about 13 g. per liter. Additional growth on the spent medium could be obtained by (1) refortifying the spent medium to contain 5% protein or (2) subjecting the spent medium to mild acid or enzyme hydrolysis prior to reinoculation and growth.

During the past few weeks very promising results have been obtained using batch culture in an Auto-Fermentor of 15 liter capacity with high aeration rates (75 liters of air per minute). Glucose was metered into the medium to supply additional energy and control the pH at the optimum. Under these conditions the organism was maintained in the active growth phase and good conversion of protein and total substrate was obtained (Table 1).

Table 1. Bacterial Growth on SP-100 at High Aeration Rates

	Fermentation Time	
	1 day	2 days
Bacterial Cells per ml.	10^9	9×10^9
Protein Utilized, g./l.	5.2	14.8
Dry Biomass Formed, g./l.	13.0	18.2
Total Substrate Conversion, %	86	59
Protein Conversion, %	-	73

The substrate must be sterilized prior to inoculation and fermentation to prevent the growth of small contaminating organisms. Better aeration techniques need to be developed to increase the amount of oxygen supplied to the rapidly growing microorganisms. To obtain more precise material balance figures, methods for preventing evaporation and loss of media through aerosol effects must be found. When these operational difficulties are overcome, the conditions for optimum growth and maximum conversion of collagen to bacterial protein can be established.

Since the ultimate goal of the fermentation process is to improve the nutritive value of collagen, amino acid analyses and feeding studies must be used to assess the improvement of the product produced by fermentation over the initial substrate.