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SINGLE CELL PROTEIN FROM COLLAGEN

One of the most exciting and forward-looking research developments of the past decade has been the production of single cell protein (SCP) from a variety of materials including certain petroleum fractions, cellulose of various types, molasses, etc. The use of collagen as a possible substrate for microbial conversion to a protein of high nutritive quality has been the subject of an FPRF-sponsored research project for some time (see the Director's Digest, January, 1969; July, 1969; May, 1970; March, 1971).

Research on the project has involved screening studies to select an appropriate microorganism, preliminary evaluation of the nutritive value of the protein produced, and tests using batch culture techniques to establish the optimal conditions of growth for the organism (substrate concentration, temperature, pH, supplementary energy source requirements, aeration levels, etc.). The results obtained clearly indicated that batch culture techniques would not result in a satisfactory conversion level of collagen to SCP. Consequently recent research has been directed toward establishing continuous culture conditions to obtain maximum conversion rates.

A recent report from Dr. Porsche and Dr. Brown on this project presents some very promising results. In these experiments different substrate concentrations and different dilution rates were studied. Best results were obtained using a substrate concentration of 1% and a dilution rate of about 0.25/hr. (Dilution rate is defined as the proportion of the total fermentor capacity that is replaced with fresh or recycled substrate per unit of time). On the basis of previous studies the fermentation was performed at pH7 (using glucose addition to control pH), a temperature of 34°C. and an aeration rate of 2 volumes air per volume fermentor per minute (higher aeration rates may be desirable).

Under these conditions the bacterial population was stable (without sporulation) at approximately 1.6 x 10^8 cells/ml. This corresponded to a biomass concentration of 2.5-2.7 g./l. The protein in the total biomass was in excess of 55%. Protein conversion was approximately 90%; that is, about 90% of the protein in the SP100 substrate was converted to SCP, based on the nitrogen present in the substrate and the nitrogen present in the bacterial cells.

Under these conditions productivity (biomass concentration X dilution rate) of the fermentation was 0.65 g./l./hr. This is greater than any reported values for bacterial fermentations but less than reported values for yeast fermentations using petroleum or carbohydrate wastes. It must be emphasized however that these are preliminary results. There is every reason to believe that much higher productivity rates can be obtained by careful adjustment of substrate concentration, aeration rates and dilution rates. Previous data from batch fermentation studies indicate that a cell population and biomass concentration at least three times as great can be obtained with an actively growing culture.

Research in progress will indicate whether or not these objectives can be attained. Best results obtainable will be used to determine complete material balance for the fermentation and to evaluate the probable economic feasibility of the process.