Statement of Problem:
There is a need for a product that provides children with 20% of their daily fiber requirements and is aesthetically appealing while also adding flavor and sweetness to foods they are already consuming. To produce such a product, a process utilizing four separate unit operations must be designed to be implemented in industry by using or modifying existing machinery and processing techniques.

Background Review:
Based on research of previous inventions, there are currently no encapsulated soy products to provide protein and fiber in one’s diet. Similar encapsulated food products are currently patented to only release flavor additives to foods. A gel forming polymer and oil were used to form a water insoluble gel matrix around the product. There is no shrinkage with the freeze-drying method, and instead provides a porous structure that allows for rehydration and increased application with little flavor and color loss.

Alternative Solutions:
Different drying methods (shown below) were explored to determine and identify potential alternative process designs based on shelf-life, aesthetics of the final product, economic impact on storage and processing conditions, cost, and time.

Process Diagram:
A detailed economic evaluation of a small-scale plant is demonstrated below. Based on these calculations, recommendations for improvements can be made. The ager and oil method could be replaced by using calcium sulfate and activate ingredient cost; however, this may compromise the integrity of the product. Additional research may go into additional drying methods to reduce the cost of the freeze-drying. Alternatively, the product could be made and sold as a wet, chilled product to remove energy intensive drying steps.

Economics:
A Return on Investment (ROI) is calculated to measure the performance of one investment compared to another. ROI is a percentage that is based on returns over a time period, usually one year. The formula used to calculate the ROI is:

\[
\text{ROI} = \left( \frac{\text{Gain from investment} - \text{Cost of Investment}}{\text{Cost of Investment}} \right) \times 100
\]

For the dried and dehydrated fruit industry:

\[
\text{ROI} = \left( \frac{\$26.4 \text{ million} - \$20.7 \text{ million}}{\$20.7 \text{ million}} \right) \times 100 = 27.64\%
\]

This industry invested $26.4 million, but after one year, it’ll have a return of $5.7 million. For food supplement stores for protein and fiber:

\[
\text{ROI} = \left( \frac{\$94.2 \text{ million} - \$48.7 \text{ million}}{\$48.7 \text{ million}} \right) \times 100 = 97.05\%
\]

This industry invested $94.2 million, but after one year, it’ll have a return of $45.5 million. For FIBitz:

\[
\text{ROI} = \left( \frac{\$391,746,656 - \$391,086,351}{\$391,086,351} \right) \times 100 = 0.6626\%
\]

The profit would be smaller than other industries’ because the FIBitz industry starts as a small business with small-scale production. This industry invested $391,746,656, but after one year, it’ll have a return of $60,304.99.