

Potato Protein



Agricultural Utilization Research Institute

Minnesota Overview

Estimates of Minnesota's potato yield and sales in 2016 were 400 cwt/acre and \$152 million. Compared to the national average price in 2016 of \$8.90/cwt, Minnesota potatoes were priced slightly higher at \$9.05/cwt. Potato production in Minnesota is feasible, as demonstrated by the high yields and sales for 2016. With the development of effective methods of protein isolation that limit protein denaturation and functionality loss, the commercial production of potato protein may potentially increase.



Nutritional quality

Potato fruit juice, a byproduct of potato starch manufacturing, contains about 1.5 percent protein. In terms of protein quantity, potatoes are inferior to other plant protein sources, such as legumes, which have more than 20 percent protein. On the other hand, many find potato protein to be superior to other vegetable and cereal proteins, having a PDCAAS of 0.93, and high levels of lysine and branched-chain amino acids. Threonine may also be limiting, depending upon cultivation, storage conditions and potato variety. Protein quality is also influenced by nitrogen fertilizer use. Increases in nitrogen fertilizer use results in higher overall nitrogen content, yet lower concentration of essential amino acids and, consequently quality. Potato variety, however, is the main determinate of quality.

Currently available protein ingredient forms

While some companies do manufacture potato protein products, the small amount of protein present in potato juice limits its commercial use. A large potato starch manufacturing company in The Netherlands, however, introduced a number of potato protein ingredients as part of their line of Solanic products. Similar to other potato starch manufacturers, they aimed at valorizing potato fruit juice, which is the byproduct of starch production.

Potential functionality and applications

Published research on potato protein solubility and other functional properties is limited. Some findings suggest the protein fractionation process impacts functionality. Proper extraction methods also generate potato proteins with Solanic potato proteins, specifically that demonstrate high solubility, good foam overrun and a foam firmness equal to, or better than, egg albumin. Similar to other protein isolates, pH changes can negatively impact the functionality and solubility of Solanic products, restricting their possible applications. Solanic potato proteins have been found suitable for meat analogues, gluten-and/or dairy-free products, pasta, protein beverages and a variety of other foods.

Potato Facts

Inferior protein content

High in Branched Chain Amino Acids and Lysine

High PDCAAS score

High use of nitrogen fertilizer causes lower quality

Allergenicity is rare

Currently available potato protein is a byproduct of starch production

Advantages

Potato protein is an added-value ingredient produced from a byproduct of starch production. It has superior nutritional quality and functionality compared to other plant protein sources. Additionally, allergenicity to potato protein is rare.

Barriers

Potatoes have an extremely low protein concentration compared to other potential plant protein sources. With a protein concentration of 1.5 percent, using potato fruit juice for protein ingredient production would require an extremely large quantity of potatoes. Establishing a steady potato fruit juice supply stream of this magnitude may present barriers to potato protein ingredient manufacturers. Processing methods to remove certain compounds without affecting protein solubility and functionality will have to be developed, and will likely increase production costs. Protein isolation processes will also have to be further researched, as the acid and thermal treatments that are often used cause protein denaturation and reduced functionality. Commercial potato protein manufacturing is currently limited, and will likely not expand much outside of Europe.

Feasibility

As demonstrated by the high yields and sales in 2016, potato production in Minnesota is feasible. With the development of effective methods of protein isolation, the commercial production of potato protein may potentially increase. Relatively recent research showed that using processes such as precipitation with $(\text{NH}_4)_2\text{SO}_4$, FeCl_3 or ethanol, instead of acid and thermal treatments, results in higher yields and purity, and reduced sensitivity to pH and temperature changes.

Despite advances in processing, potatoes have limited potential as a popular and profitable plant protein source. Having very low protein concentrations, the quantity of potatoes needed for commercial manufacturing could be a prohibiting factor. Obtaining the amount of potato fruit juice needed for large-scale potato protein production could deter entrepreneurs and established large-scale manufacturers. Additionally, limited supply is associated with higher ingredient cost compared to other sources.



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