Camelina Protein

Agricultural Utilization Research Institute

Minnesota Overview

Camelina, a Crucifer seed and a member of the Brassicaceae family is a short-season oilseed cover crop high in both oil/fat (30-38%) and protein (25-30%) Thus, it can be used for the production of both oil and protein ingredients.

Rainfall and soil nitrogen both influence camelina, with poor yield resulting from limited rainfall. Although higher soil nitrogen levels positively impact camelina yields, very little fertilizer is actually needed for production. This, along with camelina's natural pathogen-resistance, insect-resistance, and potential for farming with equipment for canola and mustard, minimizes production costs.

Nutritional quality

The amino acid composition and hence the nutritional quality of camelina protein is similar to that of canola protein, which in turn is comparable to that of soy protein. Specifically, it meets the World Health Organization's essential amino acids requirements for those over the age of one. Heat treatment, can reduce or eliminate antinutritive factors and improve camelina's nutritional value. New winter varieties of camelina possess particularly low concentrations of glucosinolates, below those of canola (Murphy 2016).

Protein components

Camelina proteins constitute mainly albumins (10.5%, water-soluble fraction), globulins (17.7%, salt soluble), and glutelins (64.6%, alkaline soluble). Legumin-type globulins, cruciferin (11S), and napin-type albumins, napin (2S), are the major storage proteins (~80-85% of total seed proteins) of Brassicaceae seeds, including the Crucifer seed, camelina.

Currently available protein ingredient forms

As of yet, there is no commercial production of camelina protein. Camelina meal, a by-product from oil production, is rich in protein (40-45%). Thus it is necessary to explore extraction techniques to produce a functional protein ingredient for food applications. A recent study demonstrated that camelina protein isolated following salt extraction resulted in higher protein yields compared to isolates from alkaline extraction. The camelina protein concentrate (70-80% protein) produced following salt extraction had better overall functionality.

Camelina Facts

- High in Protein
- High in fat/oil
- Nutritional quality comparable to canola and soy proteins
- Highly adaptable crop
- Grows in less fertile areas
- Requires less water and fertilizer
- Natural resistance to freeze-thaw cycles
- Natural resistance to insects

Potential functionality and applications

The functionality of the salt extracted camelina protein concentrate CPC was comparable and sometimes better than that of soy protein isolate (SPI). Specifically, the solubility (~70%) of the salt extracted CPC at pH 3.4 was significantly higher than that (~50%) of SPI. Additionally, salt extracted CPC had significantly higher emulsification capacity and foaming capacity than SPI. This demonstrates the potential of camelina as a novel source of functional plant protein that might gain a position in the protein market place, and possibly compete with soy protein for several applications targeting the use of plant proteins.

Advantages

Camelina is highly adaptable and production is possible under a variety of soil and climate conditions, so it can be produced in less fertile areas and requires little water or fertilizer.

The environmental benefits of camelina could include reduced soil and water erosion, reduced soil nitrate leaching, increased carbon sequestration, and reduced inputs of energy and pesticide. These environmental benefits could make camelina attractive to farmers as well as to consumers seeking sustainable crops in their food products.

Barriers

Being a new crop under development, many areas require further investigation before considering it as a viable choice for protein production. Crop yield and availability for industrial use is a considerable barrier. Additionally, research on the properties of camelina proteins is extremely sparse, making it difficult for manufacturers to optimize isolation and processing methods. Therefore, researching protein isolation, functionalization, and modification is necessary.

Feasibility

Camelina has a great potential for production at a low cost and in a variety of soil and environmental conditions, the only restrictions being heavy clay or organic soil. Camelina can also withstand drought conditions better than canola and has a natural resistance to insects, frost, and freeze-thaw cycles. This limits the risk of crop loss. However, farmers require economic incentive to plant this crop, and it is important to find a market value for this crop, such as its utilization as a protein ingredient source. For camelina to be a feasible source for plant protein, more research is necessary on extraction methods, processing technology, functionality, and nutritional quality.

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