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Justification of the use of ultrasonic processing technology in obtaining protein isolates from sunflower meal

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The global populace is experiencing an unprecedented increase in the consumption of animal-derived proteins, an issue that is highly attributed to the rapid population growth and improved living standards [1]. Importantly, the demand for protein foods surpasses the supply, thereby creating a significant protein gap. As a result, the food industry is exploring alternative sources of proteins to supplement the animal-based proteins currently prioritized by the global populace. In the recent past, food experts have shifted their attention towards exploring the plant-based proteins as a viable alternative source of the nutrient to avoid over-dependence on animal-based proteins.

According to [2], sunflower meal contains a significant amount of proteins of between 30 and 50%, and may reach 66% subject to the efficiency of seed defatting and dehalling process. These proteins present considerable benefits compared to animal proteins, including high biological value as well as high digestibility [2]. This study sought to extract proteins from sunflower meal, a by-product of the sunflower oil production, often used to feed animals. The extraction of proteins from sunflower meal was two-fold; first step involved the treatment of the sunflower meal with ultrasound technology under optimum conditions, including frequency range of between 40-55kHz and alkaline conditions due to their low solubility in mild and neutral acidic conditions as reiterated by [3]; and secondly, the extraction of phenolic compounds using ethanol solution for 60minutes. Contrary to the conventional food extraction, processing, and preservation technologies, ultrasound technology utilizes cavitation and mass transfer phenomena [4], thereby presenting a broad array of benefits such as increased yield and production rate, enhanced quality, and environmental friendly [3].

The study sought to investigate the effect of ultrasonic treatment on protein extraction from sunflower meal.

The sunflower meal used for this study emanated from Samara Agroprom Processing plant. The chemical composition of the meal was determined within the laboratory of the plant in accordance with GOST Standard specifications. The biochemical composition of the sunflower meal in terms of dry matter comprised of the following components; proteins (39.82%); moisture (10%); Fiber (16.95%); ash insoluble in HCl 0.1%; oil content (0.9%); and total ash (6.5%).

Mortar and thistle were used to crush and grind the sunflower meal into smaller particle sizes. The resultant material was then sieved using 1mm-diameter mesh to obtain a fine material for further treatment. Four samples of the sunflower meal of 5g each were taken from the ground sunflower meal and mixed with distilled water to make 20ml each.

The four samples were subjected to ultrasound treatment process of frequency ranging between 40-55 kHz for different time limits; 5mins; 10mins; 15mins; and 20mins. The pH of the samples was measured using pH Meter and results recorded. The pH of the solutions was adjusted using NaOH solutions, where the amount of the latter solution was recorded. The samples were

then mixed homogeneously using centrifugation at 4500rpm for 20mins and the pH of the samples adjusted using fulvic acid.

Ethanol solution was added to the samples at the ration of 1:2; a sample to ethanol solution and left for 60mins before filtration with the filter paper. This step was intended to extract phenolic compounds from the sample solution. The precipitate was retrieved and dried.

The biochemical characteristics of the samples were different after the ultrasound treatment, particularly between the sample treated for 5mins and the other three samples. Notably, the 5-min sample recorded a pH of 6 while the rest recorded 5.7 each. The colour of the samples post-treatment was greenish, depicting the presence of phenolic compounds. However, the colour disappeared after the addition of ethanol solution to the samples.

While the outcome affirmed the positive impact of ultrasound technology in protein extraction from sunflower meal, there is a need to ensure efficiency in the application of the technology. For instance, the phenolic compounds present in the sunflower meal inhibited the effective extraction of the proteins in the meal, thereby calling for the pursuit of more comprehensive and empirical future studies by extracting phenolic compounds prior to the extraction of protein isolates to ascertain the degree of efficiency in the latter process.

References

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