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CHARACTERIZATION OF CRUDE CORN ZEIN MICROSPHERES OBTAINED BY ANTI-SOLVENT-DIALYSIS METHOD WITH/WITHOUT THE AID OF ULTRASOUND

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Introduction and objective: Corn zein is a protein of the prolamines classes of cereals present about 8%(w/w) in the endosperms of corn kernels. Zein consists of large amounts of hydrophobic amino acids, which makes it insoluble in aqueous, soluble only in hydroethanolic medium(70-95%), and other polar organic solvents, such as, methanol, isopropanol and acetone, but ethanol is easier to find[1]. In addition, the advantage of this process is that in the same extraction solvent of zein can use to make the microspheres, so eliminating the subsequent steps to form particles, optimizing time and spending of energy for purification.

Methodology: 25cm of cellulose dialysis tubes (Viskase) were activated in 1L of deionized water for 4h at 25°C, before dialysis. 5g crude zein (purchased from Wilson Oshiro) were dissolved in 100mL (75%EtOH), placed in this tubes (16kD) and sealed on both sides to prevent spillage, then was placed in the dialyzer containing 1L of deionized water as antisolvent with/without ultrasonic bath for 30min. The dialysis system was left in continuous magnetic stirring for 36h at 25°C. After this time, the dialysis contents were obtained and lyophilized. White zein powder was stored at room temperature for future characterization and compared with Aldrich zein. The microspheres size and morphology were analyzed by scanning electronic microscopy (SEM) after sputtering with gold.

Results and discussion: After dialysis, there was the formation of a whitish substance at the bottom of the dialysis tube (purified zein) and at the top the presence of carotenoids (yellow-orange color). They presented a very large amount of zein still present in these carotenoids giving a low yield of purified zein in the form of spheres, but it may be possible to perform the purification using a system of reverse osmosis in nanomembranes. This system that are used for desalination of seawater or brackish, but for hydroethanolic medium, which will be carried out in the future on a pilot plant scale. The crude zein concentration at 5.0% (w/v) in hydroethanolic solutions at 75%, has the whiter zein than 10% after dialysis and Aldrich's zein. The SEM photomicrographs show that the zein microspheres obtained with 5% (m/v) crude zein are uniform, free and smooth than those obtained with 10%, because the latter contained more carotenoids agglutinated in the microspheres. Any nanospheres were't seen in any photomicrographs, because they agglutinated with carotenoids. Millimeter spheres of zein with nanoparamagnetic magnetite are very interesting to obtain immobilized amylases to produce ethanol from starch.

Conclusions: Antisolvent dialysis may be the future purification method with a similar process on an industrial scale, type reverse osmosis membranes compatible with hydroethanolic solutions. Not only get the purification, but also have an extraction process to reduce the price of zein, even if it's raw (80% purity) at a level of about U\$3.00 – 4.00/kg and not U\$300.00 from Aldrich[2]. This method to produce easily microspheres maybe also nanospheres to delivery drugs or immobilized enzymes to recovery and reuse. This work follows the premise of the SDG 9.

References

1. Rodríguez-Félix F. *et al.*, Food Sci. Biotechnol. 29(5), 619-629, 2020.
2. Jaski A.C. *et al.* Industrial Crops & Products, 186, 115250, 2022.