

SILVER NANOPARTICLE DETERMINATION IN FISH FEED SAMPLES

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INTRODUCTION

The use of nanoparticles is growing exponentially, and they can be found in many different fields. Specifically, silver nanoparticles (AgNPs) are the most widely used due to their bactericidal, fungicidal and antimicrobial activity. Their use as an alternative to antibiotics is being evaluated in the aquaculture industry. A possible route of administration of these nanoparticles is through fish feed. Therefore, it is necessary to develop analytical methodologies to quantify the amount of nanoparticles in this type of sample.

METHODOLOGY

In this project, an analytical method is developed for the determination and characterisation of AgNPs in fish feed using an ultrasonic-assisted enzymatic extraction method followed by the determination by single-particle inductively coupled plasma mass spectrometry (spICP-MS). The variables that affect the extraction process were studied and the analysis methods were validated. Finally, the proposed method was applied to samples of fish feed fortified with AgNPs.

RESULTS

Parameters related to the AgNP extraction procedure were optimised, including enzyme concentration, volume of enzymatic solution and extraction time. The effects of the use of ultrasonic energy or mechanical agitation in the concentration and size of AgNP extracts were also studied. The results obtained indicate that the most suitable conditions for this extraction are achieved using 10 mL of pancreatin-lipase enzyme solution 0.5:2.0 (g/L) and 10 minutes' ultrasonication.

The study of analytical performances of the proposed method show that the method presents a good analytical recovery, since the recovery percentages calculated for a size of 20 nm at concentration levels 4.9×10^8 NPs/mL and 9.9×10^8 NPs/mL, were 95 ± 26 % and 91 ± 13 %, respectively. The limits of detection (LOD) obtained by spICP-MS were 12 nm and 8.31×10^6 NPs/mL in size and concentration, respectively.

DISCUSSION

The results obtained during the optimisation of the extraction procedure show that the use of ultrasonic energy and the enzymatic solution selected do not modify the size distribution of AgNPs. The proposed analytical method for AgNP determination in fish feed samples by spICP-MS after enzymatic-assisted ultrasonic extraction is sensitive, precise and accurate.