Proteins of the future in feed for recirculating aquaculture systems (ProffAqua) (39274)

There is an increasing shortage of available high quality proteins for feed. More than half of all aquatic species is now produced by aquaculture. Aquaculture production will double in the next 15 years and so will the need for protein into aquafeed. As substantial amount of worldwide wild fish catch is processed into fishmeal and fish oil for feed production, raising concerns regarding the sustainability of this arrangement. The industry’s growing need for feed therefore requires new approaches. This project focuses on turning waste streams into valuable products. Organic chemicals found in pulp mills steams for cellulose fibre production can be used to grow fungi and turned into Single Cell Proteins (SCP), suitable as protein-rich components in fish feed. Due to the low protein content of waste materials from agriculture and fish processing, this raw material is not suitable for direct use in fish feed. The black soldier fly larvae (BSF) are very efficient in transforming such waste streams into high quality protein and oil ingredients. Based on the available waste streams, several thousand tonnes of both SCP and BSF can be produced at a very favourable price compared to the current price and quality of fish meal.

The role of DTU Aqua in the project is to evaluate BSF and SCP as protein sources in fish feeds by performing digestibility and growth trials using the two types of protein sources at several inclusion level in the diets. DTU Aqua participates in the project by performing feeding trials using contaminated feed for Atlantic salmon and seabass respectively. Furthermore, the project also investigates potential effects of microplastic incorporated into feed pellets, on accumulation and elimination of the selected priority contaminants. The feeding trials consist of a 12 week to 15 week accumulation period for seabass and salmon respectively and a 8 week depuration period where all groups are fed control feed. The results obtained from the trail will be the used to develop mathematical models estimating accumulation and elimination of priority contaminants in filet.

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Aquaculture is the globally fastest growing food producing sector, and extruded fish feed is the largest expenditure in the production of carnivorous fish.

The quality of the different protein raw materials used in fish feed varies considerably, and even small differences in the nutritional quality can have large effects on fish performance, their degree of feed utilization and consequently the environment.

The production of high quality, nutrient-dense fish feed requires that the dietary matrix is extruded into pellets. However, the extrusion process can alter and deteriorate the nutritional quality of proteins. Currently, the extrusion process is based entirely on empirical learning, and little is known about the chemical reactions and physical processes that take place inside the extruder, i.e., the extruder is largely a ‘Black Box’. In addition, little is known about concomitant effects on feed utilization.

The aim of Exipro is to optimize the extrusion process by clarifying the changes and damages on different protein ingredients that happen in the extruder, and to use the knowledge to improve the quality of fish feed. Hence, the objectives of the project are to:
- Determine the effects of extrusion on the physicochemical and chemical properties of proteins in fish feed
- Determine the effects of these changes on fish growth performance, metabolism, protein retention, and nitrogen excretion
- Develop a generic extrusion optimization tool for different protein ingredients.

The project is coordinated by University of Copenhagen.

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