

Manufacture of aquafeed - Future challenges and solutions



Twin screw extruder ZSK MEGAvolume PLUS of Coperion

Between 1960 and 2010, the global consumption of fish rose from 9.9 kg per capita to 18.6 kg per capita. The Food and Agriculture Organization of the United Nations (FAO) assumes that this trend will continue. By 2020, an additional 23 million tons of fish will be needed each year just to meet the demands of the current per capita consumption. As the supply of fish cannot be sustainably increased through fishing, the rising demand must be met through aquaculture. Aquaculture is hugely dependent on the availability of high-quality feeds in the quantities required (FAO, 2012). However, this presents aquafeed manufacturers with the challenge of achieving higher production capacities.

Nowadays, commercial aquafeed is predominantly manufactured using extrusion. This continuous process allows huge quantities to be produced. Single screw extruders reach their capacity limits at a throughput rate of around 15 t/h, whereas even higher throughput rates can be achieved with

twin screw extruders. Coperion GmbH, based in Stuttgart, Germany, is a pioneer in the development of co-rotating and closely intermeshing twin screw extruders and has already designed numerous large scale plants with screw diameters up to 420 mm and throughput rates of up to 100 t/h in different areas of application.

However, the maximum throughput rate on its own is not significant. It is also important to ensure that the selected extrusion system can manufacture a wide range of recipes to the desired quality. With its modular design, the ZSK twin screw extruder from Coperion is extremely versatile. Its process section and the screw configuration can be individually designed to the process task at hand.

With a 2013 new designed test lab for food and feed extrusion applications in Stuttgart, Coperion offers also aquafeed manufacturers a testing area that is well equipped to meet their extrusion needs. The test lab is fitted with a ZSK MEGAvolume PLUS twin screw extruder with 43 mm screw diameter and some appropriate plant periphery. A considerable number of customers make use of

the test lab to develop and optimize processes and recipes on a small scale, thereby acquiring reliable data for the scale-up to production scale.

Customers from the aquafeed industry have already been able to achieve throughput rates of more than 500 kg/h on the ZSK 43 MEGAvolume PLUS extruder with the desired product characteristics. These high throughput rates are primarily down to the high free volume in the process section of the ZSK MEGAvolume PLUS series. In a scale-up to a ZSK MEGAvolume extruder with 248 mm screw diameter that has already been built, this would correspond to a throughput rate of more than 40 t/h. Within the same tests it was possible to inject more steam directly into the process section compared to a set up including a preconditioner. As a result specific mechanical energy input (SME) was reduced, still reaching high product quality.

In future it can be assumed that some raw materials that are typically used today for industrial aquafeed production will not be available in the quantities required or will only be available to a certain extent. A good example of this is fishmeal, which is usually a main component in many kinds of aquafeed, especially in formulations for carnivorous species. Even today, the limited availability of this product is leading to higher prices and price fluctuations that are difficult to calculate. One option for reducing the dependency on fishmeal is to use

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substitutes from plant origin to lower the content of fish meal in aquafeed recipes.

First research projects focussing the use of untreated oil press cakes are currently being carried out at the Fraunhofer Institute for Process Engineering and Packaging (IVV) in Freising, Germany, on a Coperion ZSK laboratory extruder with 26 mm screw diameter. The tests are part of a project funded by the German Federal Office for Agriculture and Food (BLE) under the title “Use of plant-based residues from oil recovery to manufacture high-quality fish feed for rainbow trout” (Untersuchungen zum Einsatz von Ölgewinnungsrückständen zur Herstellung qualitativ hochwertiger Fischfuttermittel für die Aufzucht von Regenbogenforellen). As part of this scheme, the potential of plant-based residues from oil recovery (press-cake) as additives in feed for rainbow trouts is being researched in cooperation with the Bavarian State Research Center for Agriculture (Bayerischen Landesanstalt für Landwirtschaft, LfL).

It is vital to include the substitutes into the extrusion process while achieving the same product quality as with existing recipes. This can be realized by



Extruded aquafeed

customizing the extrusion process to the new ingredients. The ZSK extruder from Coperion is particularly well suited to processing the large number of substitutes with their varying product characteristics thanks to its high level of flexibility.

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