

AQUAFEED HORIZONS 2017 - PRESENTATION SUMMARIES

NEW DEVELOPMENTS IN AQUAFEED PRODUCTION BY EXTRUSION

Joe Kearns, Vice President Aquafeed Division, Wenger Manufacturing Inc., USA

Aquafeed production methods continue to advance in order to keep pace with changes and requirements desired by the industry: high capacity sinking and floating feed machines are now capable of making products down to as small as 0.5 mm with production rates measured in tons per hour; AquaFlex designs are available for making a complete, wide range of all styles of aquatic feed; there are density control packages for instantaneous corrections of density while running; computer and In-Line measuring devices, all controlled automatically for speed and accuracy, thus avoiding costly rework and improving efficiency by reduced downtime and higher plant yield. Capacity increases in large single screw extruders also improve cost efficiencies by producing higher capacities per hour. Dryer improvements also reflect the industry's desire to improve efficiency in production with predictable results.

Joseph P. Kearns is Vice President Aquafeed Division, Wenger Manufacturing, Inc. Joe received his bachelor's degree from Kansas State University in Food Technology Engineering. He has been employed at Wenger since 1974. He has 8 patents for Wenger all with regards to aquatic feeds and/or machinery associated with production of same. He has more than 60 published articles on aquatic feeds production advantages by extrusion cooking through trade magazines. He has presented at countless events around the world on the topic of aquatic feed production.

UNRAVELLING THE MYSTERIES OF EXTRUSION DIE FLOW USING CFD

Daniel Stoffner, Bühler Nutrition, Product Management Aqua Feed & Pet Food, Switzerland

The flow in aqua feed extrusion is a very complex topic because it involves temperature dependent non-linear viscosities, viscoelastic fluid behavior, gas expansion and complicated flow geometries. Experimentally it is difficult, if not impossible, to determine the influence of each parameter. Computational fluid dynamics (CFD) methods on the other hand allow for the studying of effects separately, they are time-saving, cost-efficient and avoid wasting valuable raw materials. Today, with the power available in standard computer workstations it is possible to realistically model the flow through elaborate extrusion dies, even in an industrial R&D environment. In particular, we investigated the effects of viscous heating and shear-thinning viscosity on aquafeed die flow. Typical models spanned the final windings of a twin-screw, the transition from a twin-screw barrel to an axisymmetric die, as well as inserts and nozzles. However, more complicated aspects such as heterogeneous material, viscoelasticity, thixotropic viscosity of gas expansion have not been addressed.

Daniel Stoffner was born and raised in Zürich, Switzerland and studied Food technology at Zurich University of Applied Sciences. After some years of Quality Management and Process development in the meat processing industry he came to Bühler as a Process Engineer in Application Technology with the general focus on the Pet food and Aquatic feed market. After three years, he took over the responsibility for the Technology and Start Up group. During the eight years at Bühler he developed his knowledge about extrusion processes in those segments and solved a lot of problems around the world regarding product quality and plant performance.

EXTRUDED AQUAFEED QUALITY MANAGEMENT; RELATIONS BETWEEN TECHNOLOGY AND EXTRUDED AQUAFEED QUALITY

Thomas Ellegaard Mohr, Segment Manager / Sales Application Manager, ANDRITZ Feed & Biofuel, Denmark

Important keys to successful fish farming lie in correctly adapted feed formulas, high quality ingredients, controlled homogenous content and optimum physical feed pellet properties. To keep pace with these increasing demands, industrially produced feed is undergoing a continuous quality improvement process. The different types of feed are subject to different demands, the feed/food's functionality. e.g. on fish farms in terms of floatability or sinkability and the pellets durability to assist mechanical handling without generating fines. And as feed demand increases, so does the availability of traditional raw materials: this gives new challenges to ensure that extrusion technologies and process control are developed to adapt accordingly

Thomas Ellegaard Mohr joined ANDRITZ Feed & Biofuel in 2015, before joining ANDRITZ Thomas has been working within the process industry since 2008, as Installation & Commissioning Engineer, Technical Advisor and Sales Manager, before being hired as Sales Application Manager at ANDRITZ Feed & Biofuel, with focus on Petfood & Aqua Feed Extrusion.

ALTERNATIVES TO WATER-PLASTICIZATION IN THE EXTRUSION PROCESS – REDUCED DRYING COSTS AND IMPROVED PHYSICAL PELLET QUALITY

Rafiq Ahmad, Industrial PhD candidate, Cargill Aqua Nutrition, USA

Potential plasticizer candidates such as free amino acids and pH were evaluated in combination with moisture in a soy protein concentrate model system using a Phase Transition Analyzer (closed-chamber capillary rheometer). The study demonstrated that free amino acids and low molecular weight water-soluble peptides can replace moisture as a plasticizer in the extrusion process. Due to the need for higher moisture level during extrusion processing of the increasingly commonly used plant-based diets these require more energy for drying compared to fishmeal based diets. The use of protein based plasticizers opens up the possibility to obtain a satisfactory “cook” at reduced moisture level with a potential for significant reduction of the energy consumption. The results from this study documents the possibility to develop a new processing add for the fish feed industry, serving multiple purposes, such as nutrient, plasticizer and binder in extruded fish feed.

Rafiq Ahmad moved to Norway to pursue a Master degree in Chemical engineering at Norwegian University of Science and Technology (NTNU), Trondheim, Norway in 2010. He has more than two years of work experience from chemical process industries where his responsibilities involved operation of process plant equipment, process optimization, raw material handling and project planning and development in order to enhance the product quality and yield. In 2013, he started his industrial PhD project entitled “Thermal and rheological properties of protein feed ingredients and their impact on extrusion process and product quality” at the University of Bergen Department of Chemistry in collaboration with Nofima, Norway.

PROCESSING EFFICIENCIES FOR SUSTAINABILITY AND PROFITS

Scott Vallette, Market Manager, Bühler Aeroglide, U.K.

This presentation will introduce three opportunities for processing efficiencies in drying that can both ensure sustainability and improve bottom line profits: aquafeed processing lines, on average, experience up to a 5% loss in fines during processing; however, if they are continuously collected in the dryer, they can be carefully reintroduced upstream to eliminate waste, product loss and the need to introduce additional raw material for the same output as well as reduce the cost and time required for cleaning. Heat loss comes about because of inefficient operations or thermodynamic limitations on equipment and processes. Fortunately, it can be captured and reused with a heat recovery system. Many processors track the cost of fuel used in drying operations but they don't consider lost production compared to energy costs. Because most extruded feeds are sold by weight, over drying can mean a processor is sending water (at product value that could have gone to packaging), straight out the exhaust stack. The good news is a processor can raise discharge moisture and get more out of the production line with no additional cost or additional dry ingredients. The value of this recaptured production can be surprising.

Scott Vallette is a Market Manager for Bühler Aeroglide Europe where he supports a growing customer base in Europe, Middle East and Africa. Scott has deep knowledge and experience in thermal processing applied to food and feed production. Scott worked with National Drying Machinery Company before joining Buhler Aeroglide's U.K. office in the spring of 2005. He is a regular contributor to industry conference events where he introduces a long tradition of drying and engineering expertise to the unique needs of aquafeed processors, pet food processors, and the manufacturers of snack food.

HYBRID DRYER EXHAUST AIR PROCESSING; TOWARDS A SUSTAINABLE SOLUTION FOR ODOR ABATEMENT WITH CONCURRENT ENERGY AND WATER RECOVERY

Dr. Anders F. Haubjerg, Sr. Process Engineer, Graintec A/S, Denmark

Hot air drying is one of the most widespread drying methods in extruded feed production. The exhaust air from hot air dryers are malodorous, humid and warm. The ideal solution would integrate the goal of reducing odor, recover energy and reuse condensed water back into the process, in a single end-pipe solution. This has been the aim in a recent collaborative development project, subsidized by the Danish Environmental Protection Agency, between Graintec A/S and customers in aquafeed and pet food production. This presentation will highlight experiences from the project, and demonstrate applications and potential of the technology in future pet- and fish feed plants, as well as when retrofitted onto existing lines. A technical-economical comparison with conventional odor abatement technologies will be given, alongside results from pilot-scale experimental stages: condensation based odor abatement efficiency, energy recovery potential and feeding trials using feed produced with recycled water, condensed from the drying process.

Anders holds a M. Sc. in chemical engineering from the University of Southern Denmark and UCD Ireland from 2011, and an Industrial PhD degree within model based optimization of the drying process in extruded feed production. He has five years of industry experience within simulation and modeling of heat and mass transfer. Anders has published in national science magazines, trade publications and authored eight scientific articles on mechanical durability and

energy efficiency in extruded feed production. He has presented his research at seven national and international seminars and symposia, particularly related to the drying of extruded feed.

FEED AND FOOD PROCESSING – TECHNOLOGY TRANSFER AND NOVEL INGREDIENTS

Dr. Olav Fjeld Kraugerud, Manager, Centre for Feed Technology (Fôrtek), NMBU, Norway

The drive for new ingredients puts a timely pressure on processing evolution, with respect to both physical quality of the pellets, and nutritional quality. The talk will give some examples on processing of novel ingredients, and strategies to reach the goal. For example, the food sector has valuable knowledge on ingredients processing from which the feed sector can greatly benefit.

Dr. Olav Fjeld Kraugerud leads the Centre for Feed Technology at the Norwegian University of Life Sciences (NMBU), Norway. In this role he works with customers in both academia and industry. The challenge of always making feed in new ways leads to innovation, as new demands are imposed on both hardware and processes. As a previous scientist at the Aquaculture Protein Centre in Norway, Dr. Kraugerud was one of the demanding customers of the Centre from 2004 to 2012. In his thesis, he mainly examined the processing of novel ingredients, especially the carbohydrate fraction, and studied their nutritional effects. He received his PhD in 2008.

MYCOTOXINS IN AQUACULTURE: OCCURRENCE AND IMPACT IN RAINBOW TROUT (ONCORHYNCHUS MYKISS).

Rui Alexandre Gonçalves, Scientist - Aquaculture, BIOMIN Holding GmbH, Austria

To evaluate the consequences of mycotoxin contamination in European aquaculture finished feeds, two experiments were performed with rainbow trout (*Oncorhynchus mykiss*): the effect of short and long term feeding of *Fusarium* mycotoxins to rainbow trout, using natural contaminated raw materials and pure mycotoxins was tested and the influence of mycotoxins against *Yersinia ruckeri* susceptibility was evaluated. All experimental diets revealed the presence of other mycotoxins metabolites/toxins alongside added *Fusarium*. The presence of these naturally-occurring metabolites/toxins, highlights the high risk of mycotoxin contamination in aquaculture finished feeds within Europe. The effect of feeding *Fusarium* mycotoxins to rainbow trout resulted in a significant decrease in growth. Thermal growth coefficient decreased 17 % ($p = 0.001$) and specific growth rate decreased in 13 % ($p < 0.001$). Also important differences ($P > 0.05$) were found for protein efficiency rate or feed efficiency rate. Ingestion of mycotoxins resulted in gut and liver tissue destruction, confirmed by blood enzymes values and histology. Experiment results, confirms that the ingestion of mycotoxins, within the levels found on finished feeds across Europe (up to 1000ppb), can lead to an overall decline in performance which ultimately results in economic losses.

*Rui A. Gonçalves holds the position of Scientist – Aquaculture in the Research & Development of BIOMIN Holding where his main focus on Mycotoxins research in aquaculture species. Rui holds a BSc degree in Marine Biology and Biotechnology followed by a MSc in Aquaculture and a Post graduation in Pharmaceuticals sciences. Gonçalves worked for one of the major Gilthead Seabream and Seabass hatcheries in Europe where he was responsible for the larval rearing and weaning. Later he focused his objectives on nutrition of new species for aquaculture at University of Algarve, Being involved in several projects for determination of nutrient requirements for *Solea senegalensis*, *Sepia**

officinalis through radioactive (¹⁴C) tube-feeding methods.

BREAKING THE BOTTLENECK: FEED-BASED SOLUTIONS TO THE RECURRING CHALLENGES IN AQUACULTURE

Dr. Kabir Chowdhury, Global Product Manager - Aquaculture, Jefo Nutrition Inc., Canada

The spectacular three-decade long growth of global fed aquaculture has been slowing down in the last few years. A five-year average of annual growth rate showed a decrease from 7.2% in 2006 to 6.5% in 2014, a reduction of almost 9%. Despite the significant growth in the share of three major commercially farmed species - tilapia, shrimp and salmonids, issues such as poor consumer perception due to the lack of social responsibility, leadership and poor governance, and as well as environmental pollution and frequent outbreaks of old and new diseases remain major hindrances. These issues have been creating a severe bottleneck for the sustainable growth of the industry. The major contributing factors, which can be partially solved through dietary means are mainly environmental and health issues. Reducing waste output for better environment, and ensuing better performance and immune response are possible through various dietary means such as better formulation and using various in-feed additive based solutions. This presentation discusses recurring and upcoming issues that the industry is facing and highlights some of the commercially available feed-based solutions.

Trained in Bangladesh, Thailand and Canada, Kabir Chowdhury has been involved in aquaculture and aquaculture nutrition for more than two decades. His academic and research excellence are reflected in numerous scientific and popular articles published in all major aquaculture journals and magazines. After completing PhD from Fish Nutrition Research Laboratory of the University of Guelph, Canada and a brief stint as post-doctoral fellow at the same institution, he joined Jefo Nutrition Inc. of Canada as Global Technical Manager of Aquaculture. In this role, he currently leads activities related to providing nutritional based solutions to the aquaculture industry; the solutions designed to assist ensuring economically and environmentally sustainable development.

TOWARD HIGHER INCLUSION OF SOYBEAN MEAL IN SALMON FEEDS

Dr. André Dumas, Director of Fish Nutrition, The Center for Aquaculture Technologies Canada, Canada

The negative effects of soybean meal on Atlantic salmon reported in the literature are variable. Growth of Atlantic salmon is not always negatively impacted by diets containing relatively high levels of soybean meal. Moreover, the inducement of enteritis differed between soybean sources and we have demonstrated that soybean tolerance/utilization in this species is also influenced by genetics in a recent study. This presentation will address and explain further these discrepancies to ensure soybean meal is used increasingly in an optimal manner in Atlantic salmon feeds.

Dr. André Dumas (PhD University of Guelph) is Director of Fish Nutrition at the Center for Aquaculture Technologies Canada (CATC). Dr. Dumas served as Research scientist for a multinational feed company and Director of aquaculture at a research institute before joining CATC in June 2015. His area of expertise relates to ingredient development and testing, feed formulation, shadow pricing, mathematical modelling and nutrigenomics. His expertise encompasses warm and cold water species farmed in fresh or salt water. He has deep aquaculture nutrition business acumen,

disciplined managerial and leadership abilities, and well established network of trusting relationships with industry and academia.

EFFECT OF AN IMMUNO-MODULATING ALGAL EXTRACT ON DISEASE PREVENTION IN AQUACULTURE

Maarten Jay van Schoonhoven, Aqua Care Manager, Olmix SA, France

Marine algae are at the base of the food pyramid and are the fastest growing plant organisms in nature. Nutritional studies have shown that green, brown and red seaweeds possess good nutritional characteristics, and in addition, also have biological active compounds including proteins, polyunsaturated fatty acids, pigments, polyphenols, minerals, vitamins and polysaccharides. Biological activities related to these compounds include: antiviral antibacterial, anti-tumor, anti-proliferative and immunomodulatory activities. Olmix has specialized in working with polysaccharide extracts from wild harvested algae. Studies in collaboration with INRA have already demonstrated high immunomodulating activities. More recently University trials where shrimp were challenged with *Vibrio parahaemolyticus* bacteria causing EMS, showed long lasting effects that helped improving survival rates. Field trials in both fish and shrimp have confirmed the beneficial effects of these sulphated polysaccharides from marine algae.

Maarten Jay van Schoonhoven has worked for various companies involved in aquaculture in Europe, USA and Thailand. After starting with sales and account management, he was able successfully to introduce new products in different aquaculture markets. This involved working closely between the end users and the R&D group to find the best product and the best possible application. He now works for for Olmix, which is introducing a new range of innovative products into the aquaculture market.

DEFORESTATION-FREE AND SUSTAINABLE VEGETABLE FATS AND PROTEINS FOR AQUACULTURE FEED

Dr. Norbert Schmitz, Managing Director, ISCC, Germany

Protein and fats sources of vegetable origin (e.g. soybean meal, soybean oil, rapeseed oil and palm oil), gained relevance supporting the traditional fishmeal for the satisfaction of the growing aquaculture feed demand. The use of these feed sources has though potential negative effects on the environment, as most of the fishmeal alternatives are cultivated in highly bio-diverse tropical and equatorial regions and could derive from unsustainable deforestation practices. With this contribution we would like to present an innovative system based on remote sensing data (Global Risk Assessment Services), able to verify whether unsustainable production practices are used for the production of raw materials in aquaculture feed. The system allows the identification of agricultural land obtained through deforestation. In addition, the several stages of the feedstock preparation and processing can be mapped, offering a complete traceability of the supply chain of the feed products. Cases based on soybean meal and palm oil production are presented in this contribution.

Norbert Schmitz obtained a PhD in business administration from the University of Cologne in Germany. He worked several years for a leading European management consultancy before developing, in a multi-stakeholder initiative, ISCC (International Sustainability and Carbon Certification). Since 2010, he is Managing Director of ISCC System GmbH. Today, ISCC is a globally leading certification scheme with system users in 100 countries. 3,500 companies are using ISCC to proof sustainability along supply chains – from agricultural production, trade and conversion to the consumer markets.