Innovation in co-development
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A global pioneer by initiating in 1956, the conception and the industrialization of corotating twin-screw extruders, CLEXTRAL is known, since then, as an innovative company, serving the development of this technology in different markets, such as the chemistry-plastics processing industry, the food-processing industry, the cellulose and paper processing industry. CLEXTRAL is the only company in the world, capable today to deliver twin-screw extrusion systems to all of these industries.

Driven by a long-term vision, associated on a daily basis with the operational agility of an hyper-specialized company of human size, active on the five continents, CLEXTRAL had pushed its partners to start thinking about the “health-Environment” challenges during the scientific seminar organized for its 50th anniversary in 2006.

What new answers could we bring to these problems by innovating in co-development, with a clear understanding of the stakes in Sustainable development?

New market opportunities have appeared, new cooperation was organized, with Clextral historical customers, and also with new partners in new application fields. This issue of Clextrusion provides some concrete cases.

Other dynamics have accelerated in 2009, which we’ll start communicating in 2010: The results of the new R&D platform dedicated to extrusion-porosification, installed in Australia, for instance. Therefore, Clextral R&D investment was historically high in 2009, relying on its enriched and internationalized team of experts which loyally facilitates a cooperation of quality with you.

Our strategy, durably and determined direction toward innovation, will allow Clextral to amplify its capacity of development, with you and for you, benefiting from heavy trends more and more in line with the intrinsic sobriety of its technologies. In a degraded world economic context, CLEXTRAL will be profitable in 2009 for the 17th consecutive year, while preparing so, more strongly than ever, its future.

Finally, the Clextral, Management Board, facing the future with enthusiasm and eager to serve you with the best possible quality, presents you its best wishes for 2010.
Product innovation
Co-development in Saskatchewan

In Canada, SFID chose Clextral EV 32 Twin-screw extruder for developing new products

Food processors wanting to explore new extruded products have a full service partner to help them with a new alliance between R&D institute Saskatchewan Food Industry Development Centre, Inc. (SFIDC) and extruder manufacturer Clextral.

SFIDC specializes in “concept to commercialization” of products for the food industry. According to its president Daniel Prefontaine, “We do more than helping companies develop and commercialize products, as we offer a truly unique advantage: we can produce and package the product for test market trials, allowing the company to test and fine-tune the product without the time and expense of full production.”

While SFIDC enjoys great success in the concept and commercialization of traditional food products, it was looking to diversify to meet the increasing demands from consumers. “As the population ages and becomes more health conscious, consumers are focusing on the benefits that can be derived from food ingredients, like added protein, fiber, and whole grains,” says Mr. Prefontaine. “But they still want to have fun and enjoy their food. We took note of the cereal industry, which has done a good job using extrusion technology to make tasty, healthy, value-added products.”

SFIDC saw the twin extruder as a way to expand their Food Centre capabilities and make products that meet the varied demands of today’s consumers. “We saw extrusion as a key to diversifying and helping our clients add value to their products,” explains Mr. Prefontaine. “Since it was a new processing tool for us, we knew that we needed a partner with global experience, a depth of knowledge in the extrusion process, and the same philosophy we have on building value-added products. Clextral shares our vision of how extruder technology can be profitably adapted to many processes and the amazing possibilities the technology holds for the food industry. We also share the goal of offering clients a full range of services. Clextral doesn’t just sell extruders. They help companies advance by using extrusion technology to develop new products and processes.”

SFIDC purchased Evolum 32 twin screw extruder in March 2008 and shortly afterwards, began working closely with Clextral’s product development team.

Clextral’s extruder clients who lack test plant capabilities often team up with Clextral at their pilot plants in
Training seminars

Clextral Inc organized this year two seminars in its Research Center of Tampa, FL with record attendance:

« Transform your raw materials into high value-added extruded products » on October 28th and 29th, 2009, gathered more than twenty participants from United States and Canada mainly. The team was able to demonstrate a complete line for extruded snacks including an EV 53 twin-screw extruder, the EV 300 dryer and the coater to apply oil and seasoning on finish products. The short course was focused on snacks and cereals applications alternating within the 2 days between lectures in the morning and demos in the afternoon. An additional day on demonstration on HMEC (High Moisture Extrusion Cooking) was also organized for people that were particularly interested in learning more about this product.

The speakers based at Clextral Inc were Bill Butler, Anne-Sophie Le Corre and Mike Shaw assisted by the local R&D team recently strengthened by Anne Perenon’s presence. Professor Jean Marie Bouvier also came from the French headquarters for this short course intended to explain the fundamentals of the twin screw extrusion technology and its applications. The participants declared to have particularly appreciated this: “very good mix of theoretical information and practical guidelines”.

Spanish short course « Extrusión de alimentos expandidos » welcomed on March 26-27th a group of 35 attendees from Mexico, Central and South America willing to learn more about extrusion and evaluate the new product opportunities the technology represents.

Attendees learned extrusion theory and practice during morning classroom sessions, and received hands-on instruction during afternoon demonstrations at Clextral’s Tampa R&D facility. The Latin American visitors were very appreciative that the technical course was offered in their native language. During the session, dryer processing was presented, including an introduction to the Rotante dryer, a unique dryer design from Clextral.

Even in its infancy, the partnership has far exceeded expectations. “While confidentiality prevents me from supplying details,” confides Mr. Prefontaine, “Since we’ve had our EV32 we’ve already had the opportunity to develop a product that is associated with a patent and help the client test their product. This success story wouldn’t have been possible without Clextral’s input and technology.”

The partnership has already opened many doors for SFIDC. Says Mr. Prefontaine, “When you invest money in capital, developing a partnership is a key element of being successful. Our partnership with Clextral is mutually beneficial. Extruder technology is not a flash in the pan. It’s a proven technology that we can use to continually innovate and bring new products to the marketplace.”

Bill Butler
Sales manager
Clextral Inc

Anne-Sophie Le Corre
Process Engineer
New Products Development

Tampa, Florida, or Firminy, France for new product development. The new partnership with SFIDC gives Clextral's clients access to SFIDC's wealth of complementary expertise in areas such as baking and recipe modification, in addition to their precommercialization process.

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Clextrusion: Mr Karl-Heinz Driller, you are Managing Director of KAMPFFMEYER Food Innovation. Could you tell us a few words about KAMPFFMEYER?

K-H Driller: “The company Kampffmeyer Food Innovation was formerly called Extruna GMBH. It is a joint venture between the biggest European milling group (VK Mühlen AG, Germany) and Palsgaard AS in Denmark.

KAMPFFMEYER Food Innovation is active in the field of refined grains and European leader in ready to use blends and premixes for the bakery, sweet, snack and soup industry as well as for the snack industry. Also KFI develop and manufacture functional & customized food ingredients.”

Clextrusion: What about the drying equipment which is in line with the extrusion?

K-H Driller: “In 2000 when the project of new plant was started, not only twin screw extrusion was selected in the range of equipment supplied by Clextral but also the drying technology. The Rotante dryer was chosen based on the gentle smooth and homogeneous drying it guarantees. It achieves indeed high efficiency without disturbing the surface of product. It can run short times (20 min) up to longer residence times (1 h 30) and is therefore very flexible in terms of residence times and also of temperatures.”

Clextrusion: Did you know the Rotante dryer before?

K-H Driller: “I did not know about the Rotante technology before and heard from it through Clextral. I understand that it was mainly used in the production of couscous and pasta before. The trials we made in Clextral Research Center showed a very efficient drying and advantages compared to the belt technology we knew. Indeed the biggest problem we had to face was the stickiness of some products we process, which is a major problem with “normal” belt dryers. We were happy to see that it was a big success to run sticky products in the Rotante dryer. The big advantage of the Rotante is indeed that the product is always moved gently in the Archimede’s screws which gives a good drying of the surface with no problems of stickiness.”

Clextrusion: What is the range of the products that you are drying?

K-H Driller: The size of products we dry varies according to the screen/grid used around the Archimede’s screws. We can dry products up to 15-20 mm diameter with no problem of blocking. They can be very sticky products with 50% moisture. The products are mainly cereal based sometimes in combination with other ingredients like milk or others. We could for example notice that the drying system allowed to increase the binding for ingredients used then for soups.
This technology is also fine to dry breakfast cereals. We thought at the beginning that constantly moving the product would generate a lot of fines but our tests proved that on the contrary we did not generate a lot of fines and obtained a perfect surface drying. Once again the “gentle” movement has its importance. We made some trials with corn germ breakfast cereals and it was very conclusive for the crispiness aspect and for the fact that the surface was not broken or disturbed.

Clextrusion: In addition to these big sticky products, I heard that you also dry very small products?

K-H Driller: “The smallest products are special rice Crispies which have a diameter of approx. 3 mm. We don’t have any problems also here and enjoy the even and gentle drying. We also have only very low abrasion at this sensitive product in the Rotante”.

Clextrusion: What are the benefits of the Rotante drying according to your experience?

K-H Driller: “The benefits of the Rotante are a really gentle and homogeneous drying all over the time and no disturbing of the surfaces of extruded products. Another advantage worth mentioning is that it offers good cleaning possibilities. In fact there is no need to clean often. The products do not stick in the cage as it runs and if fines go to the bottom we can separate them. No product is retained. All product is going out and nothing stays in the Rotante dryer. No need to say that for this reason of cleaning and easy maintenance, operators like the equipment very much. It is very user friendly. Also, efficiency is high with less energy to dry due to the system.”

Clextrusion: What about the installation of the equipment?

K-H Driller: “Even if the space requirements and the very special feature of the building were difficult to handle, it was very quickly installed.”

Clextrusion: Did your choice meet your expectations?

K-H Driller: “Production people and operators think it was the right decision to choose the Rotante.”

Clextrusion: Thank you very much for this interview Mr Driller.
Soya and Twin-Screw extrusion technology

Protein fibration in China
In Harbin province of China, new soya based products are developed on Clextral EV 25 Extruder

Soybeans have long been a valued food because of their nutritive and disease-preventive qualities. It is indeed the only vegetable that contains a complete protein, plus dietary fiber, high levels of vitamins A, B, calcium, and iron; this healthy product has been consumed in China for over five thousand years.

It is in Harbin, capital of Heilongjiang province where soybean growing is one of the most important in China that the Testing Center for Quality of Cereals and their derivative Products (ICCMA), the Ministry of Agriculture and the Heilongjiang China Cereal Quality Research Center, expand new soya-based products using HMEC (High Moisture Extrusion Cooking) by using Clextral Twin Screw technology.

This process developed by Clextral transforms raw soy vegetable protein into meat analogs with a wide range of appealing textures, flavors, colors, and mouthfeels. Nuggets, patties, portions, slices, cubes, flakes, and crumbles are all created with HMEC. Formulas range from 50-90% protein, and added ingredients may include animal protein, corn starch, egg white, dairy protein, fat, vitamins, minerals and salt. The raw materials are mixed and cooked in the extruder, then fed to the fibration die where the fiberization takes place. After exiting the extruder, final flavoring and coloring are added, and the product is shaped as desired. The process ensures optimum food quality as the ingredients are heated to sterilizing temperatures during extrusion, ensuring microbiological safety.

Back to the history, in 2005, when Clextral was promoting the development of HMEC to academic institutions in China, ICCMA showed a strong interest in Clextral’s twin screw extrusion technology and equipment for the development of HMEC products as well as other extruded products suitable for Chinese markets. Since that time, Clextral’s teams have worked closely with the ICCMA to finalize a sales contract for Clextral’s new EV25 twin screw extruder end of 2007. The EV25 was installed and commissioned successfully in Harbin, marking a breakthrough in the food industry in China for processing soybeans thanks to the twin screw extrusion technology.

The twin screw extruder is part of an impressive facility committed to the development of various new products to be adapted to local markets. ICCMA is indeed fully equipped with 1500 sqm of laboratory space housing 252 pieces of advanced equipment and different laboratories for inspection and control of cereals quality.

As the Chinese proverb says, “a thousand mile journey starts with the first step.” With this successful first step, and with great expectations, both parties are expecting to write new pages of history for extrusion technology in China.

James Chen
Sales manager
China Operations
Mr. François GATEL, of France Export Cereals talks about this non profit organization set up by French cereal producers.

Thanks to its climate, the quality of its soil, and the technical knowledge of its farmers, France is a leading world grain producer. With about 10% of its global land surface dedicated to wheat growing and regular yields among the highest in the world, France is the 5th largest world producer of wheat behind China, India, USA and Russia. Besides, of two tons of wheat produced in France, nearly one is sold abroad, in particular in neighbouring countries of the European Union (Benelux, Iberian peninsula, Italy) or of the Southern part of the Mediterranean Sea (Algeria, Morocco, Tunisia, Egypt) and in West African countries. Most of these countries, structurally cereals importers, are close to France either geographically or by the type of bread-making practised. If we take into account the intra-community trade, France is the second world wheat-exporter, behind United States of America.

Conscious of the importance of exporting as an outlet for their crops but also for the equilibrium of the world balance sheet, French grain producers set up France Export Cereals, at the end of the 90s. This non-profit organization mission is to promote the French cereals in the international markets by referencing the French grains in the importing countries, optimizing their use by the buyers and collecting information on markets for the French grain network: quantitative and qualitative needs of the markets and their evolutions. To carry out these objectives, France Export Céréales chose to be directly present or close to the target countries and representative offices are therefore installed in Casablanca in Morocco, Cairo in Egypt and Beijing in China.

One of the activities of France Export Céréales abroad is the regular organization in Casablanca, Algiers, Tunis, Tripoli, Cairo, Teheran, Beijing, of seminars presenting the French cereals offer with subjects like presentation of the French harvest quality, export availabilities and France position in the market as well as conditions of use of the French wheat. These seminars in which take part our partners of the French grain network (producers, collection and marketing agencies, exporters, equipment suppliers,...) are also opportunities of exchanges between the French operators and the foreign buyers to show them the French grain network organization and know-how, to offer them the widest range of grains of French origin.

France Export Céréales also communicates towards the French network to inform its members about the export markets needs and about how French wheat is used abroad. Answering the evolution of the uses of French wheat these last 15 years, producers have evolved by clearly increasing the varieties suitable for bread-making in the wheat acreage, a substantial increase of the proteins content of wheat produced, and an increase of the proportion of semi hard wheat to the detriment of the soft wheat.

François Gatel
Director of France Export Céréales
Banknotes with BIVIS
A sustainable and cost-saving process

The Bank of Spain opts for Clextral’s Eco-friendly Twin Screw technology for their banknote production

CLEXTRAL is a renowned world leader in supplying high tech equipment for the production of paper pulp from cotton fibers, especially for the production of banknotes and security paper. After France, England, Russia, China, Clextral has successfully started a paper pulp line for producing banknotes from cotton fibers for the Bank of Spain.

The continuous process developed by Clextral in collaboration with CTP (Centre Technique du Papier – Centre for Paper Technology) and the Bank of France allows to obtain a paper pulp with the high quality necessary for the security paper production while contributing to the protection of the environment. The first industrial units were started in 1990.

The process applied to paper pulp production for banknote and security paper offers the advantage of reducing consumption, and therefore costs, of raw material, water and chemical products as well as energy compared to the traditional methods used before. These advantages build up to render considerable cost savings for the manufacturers, a figure estimated to be around 10% of the cost price of the pulp.

Since 1990:

Direct water savings estimated to 40 million cubic metres achieved thanks to the technology used and to process applied to pulp production.

Indirect water savings estimated to 200 million cubic metres, owing to the greater efficiency of BIVIS technology (output superior by 5%) with reference to the consumption of cotton raw material.

Energy savings estimated to 70 Million kWh.

Significant savings in terms of vegetal raw material and chemical products i.e.:
- 50 kg of cotton fibers raw material saved per ton of pulp produced.
- 10 to 20% of chemical products not used compared to traditional processes (consequential ecological benefits as a result of minimized production of these agents, their transportation, …)

Reduction of the pollution load of the effluents generated by the pulp production: the substantial economy of process yield (having properties identical to that of the final pulp) and a reduced use of chemicals results in reduced levels of pollution in the effluents generated by the BIVIS technology. This is therefore a major ecological benefit owing to the low energy consumption in the water purification plants, less chemical additives used in the basin, etc.
Since its creation in 1984, the Centre de Valorisation des Glucides et Produits Naturels (Centre for the use of carbohydrates and natural products) which specializes in the non-foodstuff use of biomass still relies on innovative technologies to propose solutions to its industrial clients in order for them to gain a real competitive advantage.

As a user of Twin Screw extrusion equipment from Clextral’s BC range through which in our pilot study workshops have passed a large number of food and feed developments over the last twenty years or so, we decided in 1996 to explore the possibilities offered by this continuous process in the context of the chemical modification of plants and their derivatives.

Several years later and after several industrial developments which were crowned with success, particularly in the domain of the modification of polysaccharides, CVG decided to reinforce its teams and equipment in this area.

To add to our technical team, our new «REACTIVE EXTRUSION» division directed by Dr Pierre Ferchaud now has use of two Twin screw extruders (BC 21 and EVOLUM 32) with adapted metallurgy (Hastelloy C267) modified in partnership with Clextral’s Technology development department. This partnership which has been in existence over a long period has now increased through the collaboration initiated in the «SYNTHONS - Intermediate products of Chemical Synthesis» program which has enabled, among other things, a line sampling device to be developed which can be adapted to the various thermochemical zones of the material, together with a mathematical model applicable to certain reactions which have already been tested (Caspeo / Centrale Paris partnership).

Hydrolysis, oxidations, grafting or hemisynthesis in a molten environment without forgetting the enzymatic catalyses now made possible by the appearance of certain heat-resistant enzymes are so many avenues to explore: there is absolutely no doubt that reactive extrusion will play its future role in the mix of technologies fuelling the growth of Green Plant Chemistry.

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Dr Pierre Ferchaud
Comparison of the two technologies
Exemple of application in the feed industry

It has been fully recognized that over the last 30 years cooking-extrusion technology has brought decisive advantages to the feed manufacturing industries in the pet food and fish farm sectors: Robust, reliable, flexible and versatile technology, easy-to-operate industrial plants using low staffing levels and with moderate operating costs. All these advantages have contributed to the tremendous development of these industries worldwide.

Technological concepts cooking-extrusion equipment

Industrial cooking-extrusion is based on two different technological concepts: The single-screw and twin-screw extruders. They consist of a thermostatically regulated barrel in which one screw (single screw extruder) or two intermeshing screws (twin-screw extruder) rotate.

The single screw extruder comprises a unique screw turning inside a cylindrical barrel. The screw is either one-piece (the simplest and least flexible version), with a constant pitch and a depth of thread which decreases from the feed section to the cutting section, or made up of modular elements (the most complex but most flexible version) with a constant depth of thread but variable pitch. The screw is driven by a reduction gear which transmits the power from the drive motor. The drive assembly of a single screw extruder, i.e. the reduction gear and the screw-barrel assembly is mechanically of a relatively simple and robust design.

The twin-screw extruder consists of 2 intermeshing self-cleaning screws made up of modular screw elements (with constant thread depth and variable pitch) assembled on 2 fluted shafts turning in a barrel whose internal cross-section is in the shape of a figure 8. In cooking-extrusion mode, the screws co-rotate and are driven by a unit which transmits the power and divides the torque symmetrically between each of the screws. The drive assembly of a twin-screw extruder is of a mechanically advanced and complex but very reliable design.

Because of its mechanical simplicity, the single screw extruder is less difficult to build and its investment cost lower than the twin-screw extruder.

Transformation process Process functions

The single screw and twin-screw extruders are used to transform starchy and proteinaceous raw materials in a continuous process consisting of, from the feed end to the die end, a high capacity solid and particulate raw material transport section, a
compression section where the material is compressed and changes from solid state to viscous liquid state, and at least one viscous fluid working section where the material is transformed and pushed through a shaping die.

The single screw extruder has virtually only one working section (Figure 1). In this section, both the rate of cooking the material and the adjustment of its physical characteristics (its temperature for example) must be carried out at the same time which is not easy for the users in spite of efforts by manufacturers as regards the designs and profiles of the screws. The single screw extruder gives limited process flexibility.

The twin-screw extruder has several working sections arranged in series (Figure 2). It is possible therefore to combine several functions such as mixing, shearing, degassing, cooling, addition of ingredients on-line, etc. as the screw profile allows the filling rates of the screws to be varied along the barrel thus enabling several independent pressurized subsections to be created. Also, each time a component of the screw-barrel assembly resists the movement of the materials (in the case of strip loins, mix elements, the die for example), the material accumulates upstream and creates a filled working subsection whose function depends on the design of the component. This characteristic gives the twin-screw extruder a high level of process flexibility.

As the single screw extruder has only one working section, it has little flexibility and is more suited to simple formulations and products with lower quality requirements. On the other hand, the twin-screw extruder gives a high level of flexibility and is consequently very suited both to simple formulations and those rich in ingredients (different types of proteins, presence of fatty materials, ...) and to high-quality products (surface appearance, regularity of structure and texture for example).

**Flow mechanism**

**Mix intensity**

We will concentrate on the flow mechanisms in the working section(s) where the material is in the viscous liquid state. It is under these conditions that value is added to the products emerging from the cooking-extrusion process (physico-chemical characteristics, usage properties).

In the single screw extruder, the threads of the screw (equivalent to an Archimedes screw) move the viscous material from one end of the machine to the other under the effect of friction forces whose efficiency depends mainly on the friction achieved on contact with the wall of the barrel. The adhesion of the material to the wall of the barrel prevents it rotating with the screw this allowing the positive pitches of the threads to push it along the barrel. The result is a shearing flow whose speed is directly proportional to the speed of rotation of the screw: If the material fully adheres to the barrel wall, the shearing effect develops normally and a maximum flow is achieved. On the other hand, if there is no friction with the wall, the material turns with the screw to the detriment of the shear effect and the flow rate which may go down to zero.

The shear effect in the screw channel together with the flow rate of the single screw extruder are therefore proportional to the speed of rotation of the screw and increases the more the viscous material adheres to the barrel wall.
Moreover, as Figure 3 shows (cross section through the channel), the fluid flow patterns through the channel show a low interaction. This observation shows that the intensity of the mix in the single screw extruder is relatively low and consequently the heat transfer in the screw-barrel assembly is limited. This reduces the efficiency of the processes which generally require good temperature control of the material. Lastly the speed profiles in the screw channel (Figure 3) differ greatly depending on whether the fluid particles are in the central or outer regions of the channel. So fluid particles in the central region of the channel move quicker and are subjected to lower shearing conditions and vice versa for the fluid elements on the outside. This results in huge differences in the residency time and a marked lack of uniformity in the thermomechanical treatment of the material.

In the twin-screw extruder, the intermeshing of the screws creates a positive displacement of the viscous material whatever its behaviour. The flow rate and the speed of rotation of the screws are independent within a broad operating range which allows the shearing conditions of the material to be varied at a constant flow rate. For this reason, the speed of rotation of the screws is a very valuable operating variable which contributes greatly to the flexibility of the twin-screw extruder. Moreover, as shown in Figure 4, the fluid flow patterns interact strongly within the intermeshing zone. This shows that the mix intensity in the twin-screw extruder is high and consequently that the transfer of heat in the screw-barrel assembly is encouraged thus giving a high level of control over the temperature of the material. Furthermore, the intensity of the mix results in both a low residency time dispersion and a uniformity of thermomechanical treatment of the material.

The major difference between the single screw extruder and the twin-screw extruder lies in the difference in the mix intensity which has a very large impact on the performances of the processes implemented. In practice, the user will aim to maximize the flow through the single screw extruder which reduces the mix intensity. On the other hand, the twin-screw extruder develops an intensified mix throughout the screw-barrel assembly, in the intermeshing zone and in the various work subsections. The intensity of the mix increases with the viscosity of the material, however it behaves. The intensity of the mix in a twin-screw extruder (corotating screws) leads to higher efficiency in the basic process functions such as heat transfer, distribution of residency time and uniformity of thermomechanical treatment and lastly the production of much higher quality products. Because of the dissociation of the flow rate from the screw rotation speed, the production yields of the twin-screw extruder remain high whatever the mix intensity and magnitude of the shearing action in the work subsections over a broad range of operating conditions including when screws wear develops. This advantage gives the twin-screw extruder a much higher industrial efficiency with regard to productivity and product quality.

In the single screw extruder, the mix of ingredients of a formulation takes place mainly in the single working section just upstream of the die. There, the intensity of the mix can only be high if the die opening is reduced which is counter to a high production capacity. This means that the yields from the single screw extruder are very sensitive to the mix intensity and the shearing action in the work section. The higher the mix and shearing action, the lower the production capacity of the extruder. The situation becomes even more critical when screw wear increases. As screw wear develops, mix and shearing levels tend to be reduced.
Conclusion: Economic consequences

The preceding sections have shown that the single screw extruder represents a simple technology having little flexibility while the twin-screw machine is well suited to processing all products from the simplest to the most sophisticated giving a higher level of throughput.

If we compare the general economics of both processes, we can say that:
- For the single single screw machine, the investment is 1.5 to 2 times less than that of the twin-screw extruder.
- The overall energy outlay required to manufacture an end product is identical.
- Thanks to progress made in «premium» metallurgy, the impact of wear costs remains slightly in favour of the single screw option.
- The operating costs of a twin-screw extruder are less than those of the single screw due to better productivity, a more constant flow rate and increased ability to adapt to different raw materials and recipes to give a palette of high-quality and regular products. These characteristics largely compensate for the difference in investment costs between the two machines, spread over between 1.5 and 3 years depending on the end users.

In terms of the overall return on investment per tonne of extruded product (figure 5), the part dedicated to the extruder alone (excluding the complete line) is of the order of 0.5%. It is consequently more profitable to invest in a potentially innovative and flexible technology which makes cost savings.

Alain Brisset
Process Engineering
Food & Feed Manager

Figure 5

Pet food : Production cost per ton

Raw material : 81%
Coating : 14%
Amortization : 2%
Maintenance : 0.50%
Consumption & employees : 2.5%

The couscous line CC 500

The youngest of Clextral was born

The world leader for the supply of couscous production lines widens his range to meet the needs and the expectations of the market and his customers. The development team of Clextral worked to suggest a 500 kg / hour production line with the guarantee to obtain the manufacturing quality of the industrial lines with the following objectives:
- In countries which do not produce yet couscous, allow new manufacturers to test the potential of this product recognized for its gustative and nutritional qualities and for its ease of preparation.
- For the already established manufacturers, dedicate a small capacity line for productions of specialty couscous (without gluten, organic, barley, …)
- For all the players, develop new rolled and precooked products with new raw materials and new recipes.

In the heart of this new production line remains naturally the production unit (mixing and rolling section) and the Rotante dryer, the key elements for the recognized quality of the Afrem/Clextral couscous. This compact and operators-friendly production unit is designed to be transported, installed and started very quickly for a very short time-to-market.

Christophe Dupont
Pasta, Couscous & Drying Products Manager

News
Birth of Clextral Pacific

A new subsidiary was born at Clextral with the creation on March the 3rd in Alexandria (Sydney) of Clextral Pacific Pty Ltd managed by Emmanuel Perroton. Emmanuel, who took in charge the creation of this new Australian subsidiary, has already 20 years experience at Clextral among whom 16 years in expatriation. After starting his career in France, he spent 6 years within Clextral Inc. in Florida (from 1992 till 1997), and after a one-year training period in the French Research Center, he worked six years in Singapore (from 1999 till 2005). He was the manager of the Shanghai office during the last four years.

Clextral hires 17 new people

Clextral team reinforces in 2009.

New faces at Clextral Inc

In may 2009, Didier Thevenet has been appointed President of Clextral Inc, the US subsidiary based in Tampa - (FLORIDA) since 1986. Didier worked several years for an American company before joining Clextral in 1990. From Tampa, the CLEXTRAL INC team offers sales and services to numerous customers, including major food groups, in North and Central America.

With regards to innovation, CLEXTRAL INC has been working for many years on R&D programs in collaboration with its American customers, thanks to the Tampa Research Center, specially designed for product and process development.

Since October, 2009 Anne Perenon also joined the team of Clextral Inc to back-up Anne-Sophie Le Corre as R&D-Process Engineer. Anne integrated the Process Development team of Clextral in Firminy in 2005 to work on a specific project of co-development with a customer. She gradually took charge of other R&D projects and the development of new extruded food products.