

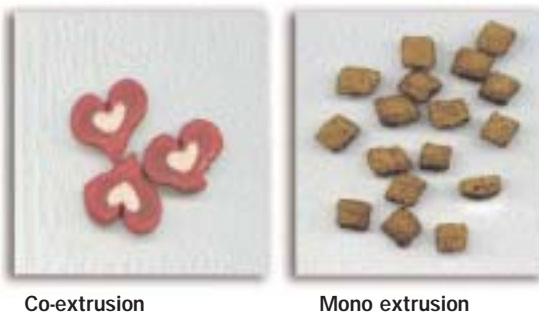
Cost aspects of technical applications in extrusion technology

The compound feed industry is a very traditional type of industry. Extrusion is already more sophisticated. In petfood extrusion air is the most important raw material, but causes costly problems. Controlling air can reduce costs.

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Cost aspects in extrusion technology are of course important but cannot be considered as a general item that can be used for comparison of different equipment choices. Extrusion lines can be so different that it does not make sense to have whatever discussion about equipment and production costs if we do not compare exactly the same production circumstances and the products we want to make. In practise this happens nevertheless very often if we talk about our extruder with our colleagues in the company or market.

What do you think if we compare next products?



Both products are made on an extruder but the set up of the production line is not comparable at all. Ingredients, shape, extruder configuration and extruder conditions, etceteras are completely different. Therefore it is better to discuss some unit operations that can be found in every extrusion line and the way they are used and how we can decrease their cost aspects.

Grinding

Grinding of the material to be extruded needs to take place in every production line. Often we see hammer mills installed as it is done in the traditional compound feed factory. In this example only one mill in a central production line has been installed. The mill is using a lot of air that has to be cleaned from dust and it cools down the ground meal. The air takes up odour compounds, which means that it can result in an extra need for odour abatement equipment.

A solution for this could be the design of a closed loop grinding system, where the air is circulated. There is no need for a filter and the energy is kept in the ground product. This is especially interesting if we grind just before extrusion. (Figure 1a)

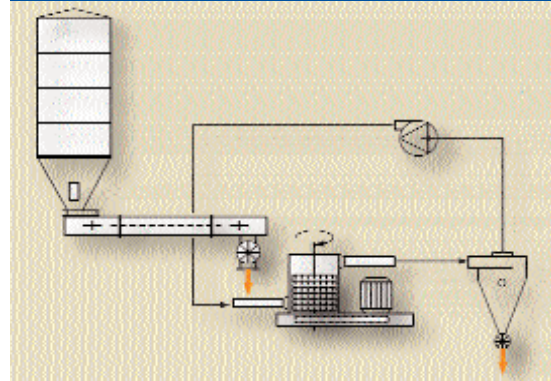
In larger production facilities we can think of a design with a central mixing and grinding line and for every extrusion line a second grinder that will give very fine meal, which is at the same time a mixing unit for premix addition and has some heat recovery.

Fine grinding can result in advantages with regard to cost reduction and quality improvement. It will result in:

- 10-20% extruder capacity improvement
- 1-2% less steam use in the conditioner
- Less wear of extruder barrel and screw elements
- Better and more equal shape of the chunks
- Higher quality

The grinder can also be used as a mixing unit for pre-

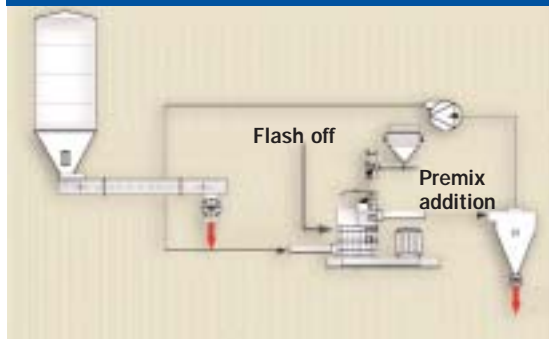
Figure 1a – Closed loop grinding on multi-rotor cell mill



Processing

mix addition and flash off energy recovery. The set-up in Figure 1b could result in the reduction of 2-3% steam. As we can see the grinder aspirates the flash off into the stream of ground product taking up the energy and at the same time the water vapour will condensate and the odour content will be decreased. This again will result in cost savings.

Figure 1b – The grinder as mixer for energy recovery



Multi component products

If multi component mixes have to be made we can design different production line layouts. As an example



we take next product. Here we see three different products and it is imaginable that one extruder makes batches of the different products. The products need to be separately stored and then weighed and mixed before packing. This

results in rather large storage, dosing and mixing facilities.

An option is to install three smaller extruders each running the same formulation but two of them have colour injection. The extruders are all connected to the same dryer, coater and cooler and it can be packed straight from this line. Only little storage is needed and mixing and dosing in this case are redundant. This set-up has the advantage that three extruders might have more flexibility than one large extruder. Cost saving in terms of lower investment can occur if several mixes of products need to be made. Figure 2a and 2b illustrate the above-mentioned principles.

Vacuum cooling

Traditional cooling needs lots of air. Petfood should be as sterile as possible. A general rule of thumb can be that for 10 tonnes of product 30,000 m³ of air is needed

Figure 2a – Three extruders, one dryer, cooler, packing/storage bins, packing line

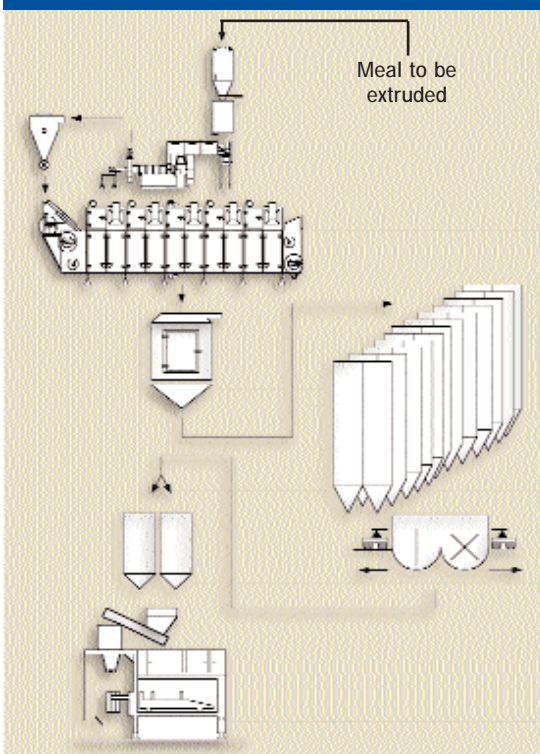
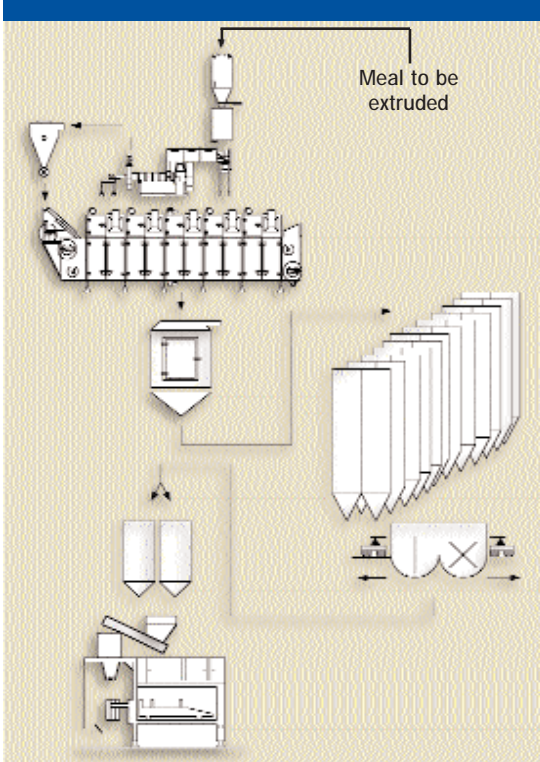


Figure 2b – One extruder, one dryer, cooler, multi-storage bins, mixer, packing bins, packing line



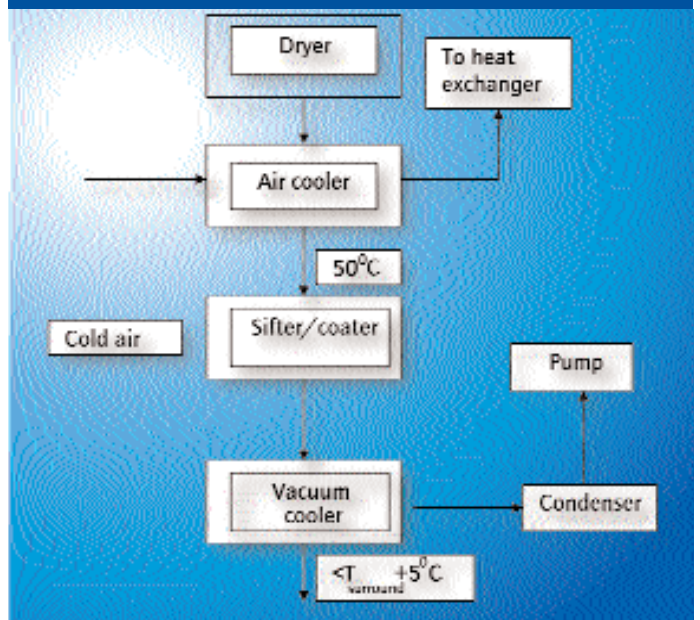
in a traditional cooler to cool down a product that has been dried to <10% water content. This air will not only waste energy but it will also need to be cleaned from dust and odour. A combination of air and vacuum cooling might give a solution for this problem. The amount of air needed could be reduced to almost 7,000 m³. The diagram in Figure 3 illustrates the processes involved. The final cooling step takes place by low pressure, resulting in evaporation of the water at the boiling point belonging to that pressure. By controlling the boiling point the final temperature can be controlled. Vacuum cooling can also save energy because it can also decrease the drying need in the dryer.

Air is difficult to clean; so air-free technologies remove the need for air cleaning, odour abatement units. Companies can spend this saved money on better drying technologies, where further development is needed.

Finally

So far some ideas has been presented that can result in very different investment and running cost. No calculations have been made available because it belongs to specific company know how. The message is that extru-

Figure 3- Process scheme of vacuum cooling



sion lines are sometimes so different that it does not make much sense to have long discussions about cost as long as we do not exactly meet comparable situations ●

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