

Traceability and critical control make safer ingredients

Food safety challenges over recent years have emphasised the fact that in order to provide consumers with safe food and drink it is essential that good practices start to be applied from as early in the food supply network as possible.

The growing of cereals and their primary processing is of critical importance. If you consider barley, for example, it is used, or provides ingredients that are used, in a huge range of products from simple drinks to complex bakery and ready meal products. Should any food safety issues arise early in the process and pass up through the food network the impact on a wide range and a large volume of finished products and the consumers could be serious.

Many of the finished products in which barley based ingredients are used do undergo critical control processes that should remove many risks, but a number do not, such as unprocessed breakfast cereals like muesli.

Even when a product is processed not all risks can be removed by that manufacturing and potential risks such as those posed by mycotoxins may carry through into the finished product.

Understanding the risks

Understanding these risks and successfully applying the appropriate management and process procedures is one of the reasons why the malt production company Muntons has thrived since its creation in the 19th century as Munton & Baker Ltd.

Today, the company is the UK's largest malted ingredient manufacturer and one of the UK's top five maltsters. It supplies ingredients to a number of diverse further producing food and drink industries.

- Drinks – brewing, distilling, malted beverages, home beer and wine making.
- Baked products – biscuits, pizza bases, breads, crackers, cakes.
- Breakfast cereals – cornflakes, rusks, cereal bars.
- Confectionery – chocolate, toffees, ice cream.
- Health and nutrition – malt extract and cod liver oil, baby food, cough syrup.
- Other food applications – sauces/gravy,



meat substitutes, soups, ice cream, pickles, vinegar, crisps, ready meals.

Muntons is based in Stowmarket, where it produces 80,000 tonnes of malt per year and 40,000 tonnes of malt/barley originated ingredients, and also at Flamborough, near Bridlington, where 40 staff convert 123,000 tonnes of malting barley into 95,000 tonnes of malt.

The company supplies the British brewing, distilling and food industries with a wide variety of malt based products from traditional malted grains through to flours, liquid extracts, powders and crumbs.

International Food Hygiene was recently invited to visit the Bridlington site where Guy Newsam, the company's general manager, and Tim Wakeley, compliance manager, explained the processes and the systems used to protect the quality and reputation of their products and customers.

The site was opened in 1964 with a capac-



ity of 45,000 tonnes and this has been expanded to today's level of 95,000 tonnes. The most recent investment being a modern barley intake, drying and cleaning facility together with 24,000 tonnes of storage which was helped by a grant of £780,000 via Yorkshire Forward from the European Agricultural Fund for Rural Development.

The company's decisions for such investment, whilst based on sound financial principles, also take account of environmental impact, sustainability, health and safety and food safety.

Environmental awareness

Decisions with significant environmental impact have included the establishment of a reed bed to treat waste water, a new kiln heating system and the development of a rail freighting system to reduce road haulage impact. All Muntons sites comply with the ISO 9001:2008 quality assurance standard and are certificated to the ISO 14001:2004 standard for environmental management.

At Stowmarket where the company's ingredients range is produced the site has consistently achieved a Grade A certification under the BRC Global Standard For Food Safety (Issue 5) and complies with ISO 22000:2005.

The malting process operates to a HACCP system based on the principles of Codex Alimentarius which, in turn, forms the basis for HACCP in ISO 22000:2005, BRC and Maltsters Association of Great Britain (MAGB) HACCP protocol.

The delivery of grain is a carefully controlled and inspected process. Each lorry load of 30 tonnes arrives at the intake/ weigh bridge with a 'passport' which identifies the variety, harvest date and the source farm of the grain.

The load is then subjected to a number of inspection criteria. The experienced intake staff first apply their eyes and nose as they oversee the rollback of the trailer's top sheeting. At this point they are able to see evidence of pest infestation and see and smell indications of mould contamination. They then take eight samples using grain spear samplers across the load at varying

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depths. The samples go through a number of tests using equipment such as the Foss Infratec 1241 to establish moisture and protein levels. From November onwards, when grain stored from harvest can be at higher risk, a Charm Rosa system is used for mycotoxin testing. The objective is to identify agents such as deoxynivalenol (DON) and ochratoxin A (OTA).

The visual inspection is able to identify the enlarged and blackened grains with ergot (the fruiting body of *Claviceps purpurea*), one single grain of barley with ergot will result in the whole load being rejected.

Testing targets both quality and safety factors. Water levels are measured to ensure the grain is less than 15% by weight immediately after harvest and below 14.5% after October. This is not only critical from a commercial value point of view, but it is very important in protecting the grain during storage.

The grain's potential to germinate is key to the success of the production of the malted grain so a germination test using a Vitascope is used to measure the amount of 'live' viable grain with a minimum standard of 98% of grain capable of germination being acceptable. These tests are usually completed within 15 minutes.

The load is then allocated for storage according to the variety of barley, the protein levels, and the crop/year. Grain when harvested goes through a natural period of dormancy and the different varieties recover at different rates and whilst a considerable amount of grain is delivered relatively soon after harvest, large quantities are in storage off site awaiting delivery.

Farm Assured schemes

Though the incoming grain is subject to this range of tests the standards of delivered grain is usually very high. The farms supplying Muntons are operating under recognised Farm Assured schemes such as the Assured Combinable Crops Scheme (ACCS). This scheme registers suppliers who have met stringent standards for crop safety management. These include a number of areas critical to quality and safety including pesticide



application, pest control, storage and handling and they are regularly inspected by UKAS Accredited Certification bodies.

The approved grain is then unloaded through a choke feed into the drying and dressing plant.

The first process in the drying and dressing plant is pre-cleaning. This removes contaminants such as straw and stones, and other 'foreign' bodies before it is placed in transient storage. The new Cimbria precleaner also takes out some small grains that can be sold back into the animal feed chain.

As necessary the barley is dried to bring the moisture level below 12%, but at temperatures not above 40°C to protect the grain viability. This modern unit is a highly efficient system capable of saving over 650 tonnes of carbon dioxide per annum compared to previous systems.

The dried grain then goes through a fine cleaning process or 'dressing' which removes the light dust and remaining small gains before it is put into storage where it is monitored for temperature stability.

Significant variations could be an indicator of excess or increased levels of moisture or of insect infestation.

As much as excess moisture and pest infestation is to be prevented, higher ambient temperatures could also have a negative effect on the viability of the grain so lower

temperatures are preferred to maintain or improve the quality. An out sourced pest management contractor is used primarily for rodent control, and this is provided by Connaught.

Insect monitoring is carried out 'in-house' using a variety of methods. Empty stores can be monitored by using bags filled with seed such as Carob. Once a filled store has had chance to settle, pitfall cone traps are placed upon or within the seed and checked every two weeks. Temperature checks would be anticipating a stable measure of 15°C or below as an ideal indicator. Any increase in temperature is a potential indicator of insect activity.

Three main steps

There are three main steps in taking the grain through the malting process: steeping, germination and kilning; and modern systems enable the process to be carried out automatically, but under close supervision.

The first stage of malt production, or steeping, involves soaking in water and this is carried out in a set of four stainless steel tanks in batches of 200 tonnes at a time.

The objective is to revive the grain by raising the moisture level from the dormant/ storage level of 12% up to 40-45% over a period of 40 to 45 hours. The process involves two or three water changes and corresponding air rests to stimulate the grain into life.

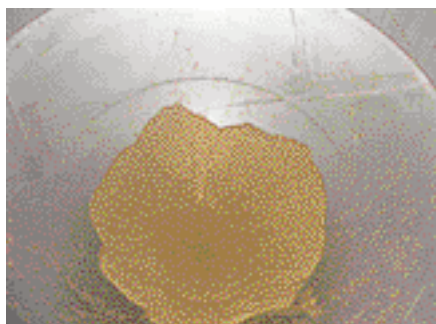
There are two sets of four process vessels used in cycles with a clean in place (CIP) system that cleans between batches. The cleaning process is usually based on simple water pressure, with an occasional requirement to use hypochlorite. With the completion of steeping each vessel is emptied and cleaned and available for the next batch within three hours. A video inspection system is being installed to provide remote monitoring of this process.

Once steeping is complete the barley is transferred to one of four germination vessels using augers and belt conveyors.

Over the next 4-5 days the grain is encouraged to grow under controlled conditions. It is during this time that natural

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enzymes are produced that will start the conversion of starch into sugars. The process involves the control of temperature and humidity combined with gentle mechanical turning action to keep the germinating grain loose and ensure that germination takes place. The process reaches the critical point when the rootlets have formed but the grain has not produced any shoot. This 'Green Malt' then goes through the kilning process.

In the kiln the malt is first dried starting at about 40°C to stop further changes within the grain. The curing temperatures can be as high as 105°C depending on finished product requirement in terms of flavour and colour. The process is tightly controlled using variable combinations of air flow and heat according to the type of malt being made. For example, a lager brewery

requires different malt compared to an ale brewery. The kilning process takes around 36-48 hours and during this process the malt takes on its distinctive flavour and colour.

On leaving the kiln the malt has a water content of 3-6%, and is now processed to remove the small rootlets that have emerged from each kernel during germination. This co-product is used for animal feed because it has higher protein content by weight than the original barley.

Muntions then dress the malt removing small and large particles and malted grain then passes over magnetic extraction plates to remove loose ferrous metals.

A Mettler Toledo system is then used to extract non-ferrous material and when identified a 20kg batch containing the foreign material is diverted into a waste bin. The rejected material goes to compost.

Samples of kiln output are sent for analysis to the laboratory at Stowmarket which carries out a number of quality and food safety tests targeting malt performance, pesticides, mycotoxins and heavy metals.

The malt is then put into store for a specified period before being sent to the customer. Muntions keep 1 kg per despatched truck for 18 months.

The whole process is carefully monitored from the farm supplying the initial batch through to the finished product delivered to the brewery, distillery or bakery.

Tim Wakeley acknowledged a well known UK advertising slogan when he described the objective of the screening process as 'graded barley makes finer malt'. He and Guy Newsam could certainly expand that idea because, at Muntions, 'traceability and critical control make safer ingredients'.

✉ office@muntions.com