

Agricultural processing brochure

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Processed meat groups:

- **Whole** meat products
- **Minced** meat products
- **Emulsified** meat products

Yield:

1.464 kg
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South African farmers facing current economic realities are searching for new options to maintain or expand their businesses. One of the many opportunities to grow markets, turnover and profits is by adding value to farm produce. Options need to be selected carefully based on sound information and knowledge of the opportunities presenting themselves, taking into account the strengths and weaknesses of individual farms.

Introduction

Product group: Meat products

The deregulation of the meat industry has provided for livestock farmers the means to slaughter, process and market their own animals. Abattoirs on farms are quite common these days.

Alternatively, approved meat can be brought in for processing. Meat is a very versatile food substance with a wide variety of processed product possibilities.

Processed meat products are classified into three broad groups, based on the size of the meat particles used:

- **Whole meat products** – muscle tissue is still clearly recognisable and defined in the end product (e.g. ham, bacon, pressed pork or beef);
- **Minced meat products** – meat structure has undergone a degree of breaking up, for example, in a mincer and the meat is no longer in a fibre form, but particle form (e.g. salami, fresh sausage, hamburger patties, meat balls etc.); and
- **Emulsified meat products** – the muscle tissues have been finely minced and are not recognisable any more in the fibrous or particle form (e.g. frankfurters, viennas, polonies and meatloaves).

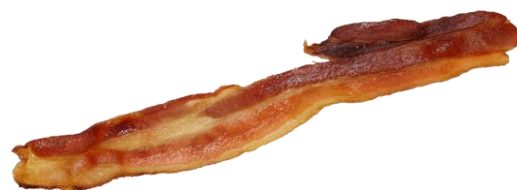
Product description: Wiltshire bacon

There are basically three types of bacon that can be produced, namely *Wiltshire bacon*, *sweetcure bacon* and *canned bacon*.

Wiltshire bacon is the generic term given to tank cured bacon. The traditional Wiltshire process involved curing the entire side of bacon; i.e. a trimmed half pork carcass. In modern practice, it is common to break down the carcass into primal joints, usually shoulders, middles and hind legs and each joint is cured separately.

Yield: 1.464kg of pork carcass will yield approximately 1kg of Wiltshire bacon. This is based on the following assumptions:

- 11% weight loss during deboning
- 20% of the carcass is trimmed and used for other cuts
- 10% weight gain during curing
- 10% weight loss during smoking



Process description: Wiltshire bacon

Raw meat preparation

The condition of the pork meat before curing has a great influence on the final product. The meat of stressed pigs tends to be pale, soft and watery with reduced water-holding capacity. Exhausted pigs produce dark, firm and dry meat which is also undesirable since the meat has a high pH value (>6.2) and enlarged fibres which restricts the penetration of curing agents. The pork carcass should be cooled to 4 - 5°C directly after slaughter and dissection.

Trimming and deboning of meat for bacon

The pork carcass requires trimming prior to bacon making. Trimming involves removing the head, feet, cervical vertebrae, sternum, scapula, pubic bone and caudal bones. The fillet is also removed and can be used for Kassler ham. The jowl and belly are also removed. The rib is normally deboned.

Modern bacon is manufactured from primal joints such as shoulders, ribs and hind legs in separate curing operations. The primal joints are preferably deboned before curing, since it is more convenient to handle, permits better control of curing and produces more economic slices.

Preparation of brine for meat

Powdered brine mixtures can be obtained commercially and require minimum preparation prior to use. As an alternative, brine can be prepared by selecting, weighing and mixing specific ingredients such as those listed below.

Ingredient	Reason for inclusion
Salt	Improves taste, acts as a preservative, enhances solubility of meat proteins *
Nitrate/Nitrite	Colour development, taste development, preservative**
Polyphosphate	Water binding, buffer systems **,*
Sugars	Balance saltiness, colour stabiliser *
Citrates	Water binding, buffer system **
Non-meat proteins	Water binding, texture improvement *,**
Gums	Water binding **
Sodium ascorbate	Colour fixing **
Flavourings	Taste improvement **
Starches	Water binding **

* Requirements of South African Standard specification must be adhered to.

**Requirements of the regulations published under Act 54 of 1972 must be adhered to.

There are a few general rules that should be kept in mind when preparing your own brine:

1. The water temperature must not exceed 10°C.
2. A high-speed mixer is the most effective way to dissolve brine components.
3. The phosphate must always be added before the salt. If the salt is added first, the phosphate will not dissolve.
4. If soy isolate is used as a non-meat protein, it must be hydrated with water before any other brine component is added. If salt is added before the protein, it may lead to incomplete protein hydration.
5. After all the above rules have been complied with, the other components may be added in any sequence.

The brine ingredients can also be applied dry, where it is rubbed on or mixed with meat cuts.

Injection curing:

Pumping the meat with approximately

12 – 14 %

brine, followed by a

2 – 3

day immersion

in brine, without nitrate.

The temperature should be maintained at **4 - 5°C**, while the maturation chamber should be kept at a **relative humidity of 82.5 - 85% RH.**

Curing of Wiltshire bacon

There are several methods of curing meat. Traditionally, meat was preserved in heaps of dry salt - the so-called *dry cure method*. The curing agents are solubilised in the natural moisture present and penetration is as a result of diffusion (1 – 1.5 days per kg product at 2 - 4°C). This method is seldom used nowadays due to possible microbial growth and associated risks.

The first major departure from this practice was the introduction of a solution of curing salts, called a *brine* or *pickle*. The meat is rubbed with salt and immersed in the brine for 3 - 5 days at 4 - 5°C (*tank curing* or *Wiltshire curing*). The traditional Wiltshire cure process involved curing the entire side of bacon - i.e. a trimmed half carcass.

The curing process is even further shortened through the injection of the brine into the meat. *Injection curing* involves pumping the meat with approximately 12 - 14% brine, followed by a 2 - 3 day immersion in brine without added nitrates. This ensures more uniform diffusion of brine. Injection can be done with a single needle (small-scale production), or multi-needle mechanical injectors (large-scale operations).

Injectors make use of a process called "stitching" or "pumping" whereby the brine is injected at pressures of no more than 4 bar, 400 kPa or 60 psi. Manual injection is very effective when carried out by a skilled operator in a small-scale operation, but multi-needle injectors are specially developed for highly uniform injection of meat cuts of similar weights.

Brine diffusion in bacon

Products prepared according to the tank curing method or injection method require a storage or maturation period to ensure even distribution of the brine throughout the meat. Naturally, this is necessary for even curing, colour, salt concentration and pH. Brine equilibrium can be achieved by simply storing the meat in the brine solution so that the process can take place naturally followed by a draining and surface-drying period, which allows further equilibration.

Sides and primal joints are stacked in large stainless steel tanks and immersed in brine. This immersion process can last for up to 5 days. Smaller joints require shorter periods. Cuts that were injected also require a short maturation period of a few hours or overnight.

The temperature should be maintained at 4 - 5°C, while the maturation chamber should be kept at a relative humidity of 82.5 - 85% RH.

Brine diffusion can be hastened by tumbling or massaging. Tumbling and massaging involves rolling meat inside a machine to bring about mechanical tenderising and distribution of curing solutions throughout the product. Tumbling of deboned bacon takes place prior to a short maturation period of 1 -2 days. Take note: massaging and tumbling is only suited for deboned meat cuts.



Home cured bacon

Smoking of bacon (optional)

Smoking enhances the flavour of the bacon. Smoking can also cause partial cooking of meat, depending on the temperature at which it is performed. The majority of Wiltshire bacon is, however, not smoked and is sold as green bacon.

Smoking was originally done in barrels over burning wood. Today, smoking is a much more controlled process that requires a smoking cabinet where smoke can be generated by controlled combustion of moist sawdust or a rapidly moving steel plate against a log. The smoke is then carried into the smoke chamber by fans. Smoke can be given an electric charge and electro-statically deposited on the meat surface. Cold smoking is used with smoked meats in combination with other techniques such as salting and drying.

Oxygen is one of the factors which need careful control during smoking since it has a definite effect on the amount of smoke generated and thus the colour and flavour of the meat. Other important process parameters are the temperature of smoke and the humidity inside the smoke cabinet. Air circulation is also critical since it influences oxygen supply, temperature and humidity.

A smoke room at 57°C can be used to give the bacon an internal temperature of about 54 - 60°C for 2 - 10 days with a relative humidity of 25 - 45%. The product must be heated to an internal temperature of 48.9 – 51.7°C. The low temperature is required for optimum colour development and to ensure that the fat is not rendered out and lost.

The recent interest in alternative methods of smoke application arose from the consumers' demand for non-carcinogenic containing food products. Air pollution, time constraints and the need for more critical quality control were also contributory factors to finding alternative smoking methods. Liquid smoke flavouring in the form of an aqueous or oil solution of natural hardwood smoke has recently been successfully introduced to the market. Liquid smoke is available in various acid strengths. As the acidity increases, so does the smoke flavouring potency. It may be applied directly into the meat (or formula) or used as a surface application. The penetration of surface applied liquid smoke is greatly enhanced at temperatures around 37°C. Although liquid smoke has its advantages, it is left to the processor to decide which method is preferred, and the product must be labelled correctly to ensure that the consumer is correctly informed about the smoking method used.

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Smoking bacon at home

Cooling bacon

Cabinet-smoked bacon must be cooled as quickly as possible. Cooling takes place under cold water showers, followed by storage in cold rooms with good ventilation.

Slicing of bacon (optional)

Bacon to be sold as rashers is sliced before retail packaging for consumer convenience. The thickness of the slices can be:

- Thin – 0.08cm
- Regular – 0.16cm and
- Thick – 0.32cm

The slicing operation must be carefully controlled to ensure neat cuts with maximum consumer appeal.

Problems can arise due to variation in the cross-section of bacon joints and the lack of rigidity in the meat.

This can be overcome by slicing the meat in a partially frozen state (-1 to -2°C). Slabs of half-frozen bacon are easy to slice with electric meat cutters. Slicing machines are notorious vehicles of cross-contamination and must therefore be cleaned and sanitised regularly.

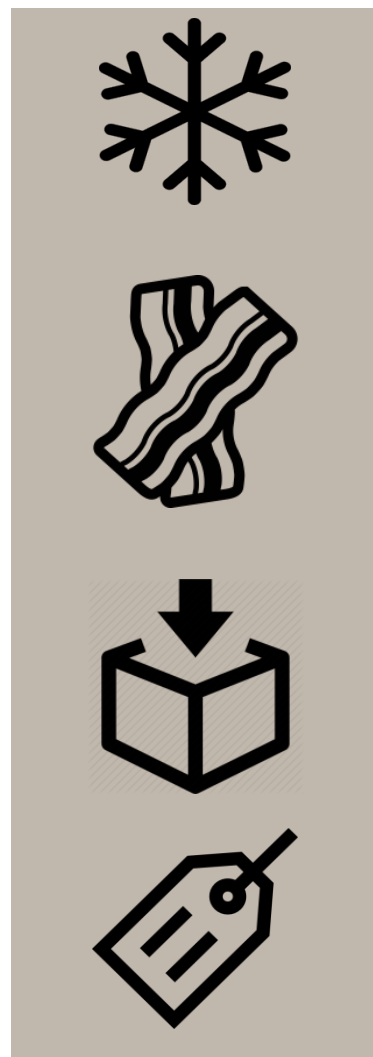
Packaging of bacon

Most bacon is retailed as rashers, but some may be canned. Rashers are vacuum-packed in plastic films with good oxygen barrier properties. Whole bacon joints can also be vacuum-packed.

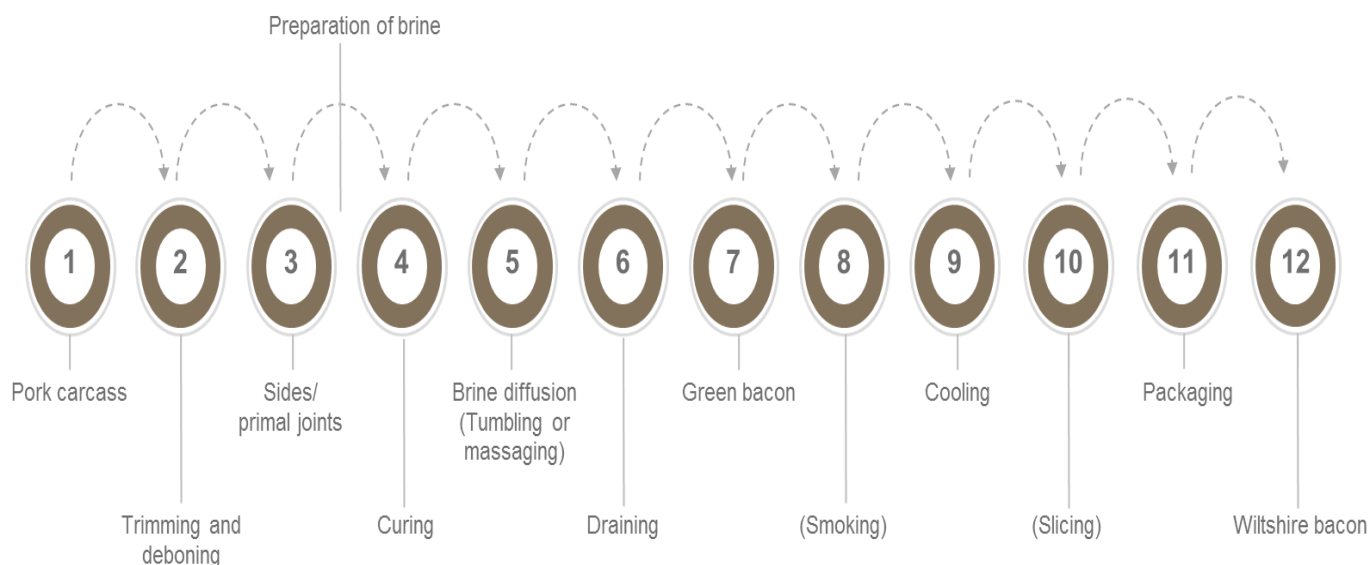
Labelling of meat products

The products are labelled/printed with the necessary information. Labelling in South Africa is controlled by legislation. Anyone who wants to use the information

provided in this document must familiarise him/herself with all the applicable laws that apply to the producing, processing, manufacturing and storage of the products referred to in this document.



Process overview



Other process options

Listed below are other processing options for *whole muscle meat* products not covered in this report, but available from Eskom. Other processed meat products are also available from Eskom.

Bone-in ham or Gammon is the pickled whole hind leg of pork. The skin and fat can both be removed, or both are retained or only the skin removed. Smoking of the ham is optional.

Canned bacon is Wiltshire or sweetcure bacon that may be sliced or chopped into pieces and canned with or without added ingredients.

Canned corned meat products are cured beef or mutton cuts that are cooked and canned and may contain seasonings and added starchy ingredients.

Cooked ham is usually deboned and reshaped ham that is cooked to coagulate the meat proteins and retain the new shape, although bone-in-ham can also be marketed as cooked ham.

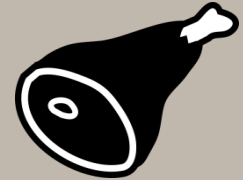
Corned meat products include beef and mutton cuts that have been adequately cured, and prepared as a cooked vacuum packed product.

Deboned ham is a pickled whole muscle meat product made from the hind leg of a pig. The skin and fat can both be removed or both retained or only the skin removed. The bones are carefully removed with the minimum damage to the meat. The meat is then reshaped into any desired shape.

Dry-cured ham is manufactured using the traditional curing method whereby the meat is covered with dry salt. The salt and other curing agents are solubilised in the natural moisture present and penetration is as a result of diffusion.

Kassler ham is a cured, whole muscle meat product that is made from the pork fillet.

Sweetcure bacon is the boned rib and loin chops of pork with no fat removed. It may be either dry salted or brined and then smoked. It is sold raw and sliced. The meat to fat ratio should be no less than 3:1.



Energy Advisory Services

Eskom's role is to aid the client with basic information in the decision-making process. Thereafter the Eskom Advisor will fulfill the role of energy advisor part of the team that the farmer selects.

Optimise your energy use:

Eskom's Energy Advisors, in regions across South Africa, offer advise to business customers on how to optimise their energy by:

- Understating their energy needs.
- Understanding their electrical systems and process.
- Investigating the latest technology and process developments, including electric infrared heating and drying systems.
- Analysing how to reduce energy investment costs.
- Optimising energy use patterns in order to grow businesses and industries.

Call **08600 37566**, leave your name and number and request that an Energy Advisor in your region contacts you.

Alternatively, e-mail an enquiry to

advisoryservice@eskom.co.za

Alternative funding

Five alternative funding product offerings are available to help reduce your investment costs for new agro-processing or agro-beneficiation businesses or to expand/improve an existing agro-processing or agro-beneficiation business.

For more info visit:

<http://www.eskom.co.za/sites/idm/Business/Pages/Alternativefunding.aspx>.

Literature sources

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