CLOVE PROCESSING

Introduction
Cloves are the unopened flower buds of the evergreen tree *Eugenia caryophyllus*. The tree is native to the Moluccas (Spice Islands), which are part of the Indonesian islands. It was taken to Mauritius and then on to the islands of Zanzibar and Pemba on the East African coast during the 18th Century. Zanzibar and Pemba are now the world's largest producers of cloves.

Cloves must be dried before they are stored and sold for market. This brief outlines the important steps that should be taken pre-harvest and post-harvest to ensure that the dried cloves are of top quality for the market.

Clove production
The clove tree is a small evergreen tree that grows to a height of 12-20 metres. It thrives in coastal regions with temperatures between 15 and 30°C, average rainfall and a distinctive dry season (the optimum level of rainfall is 1750 to 2500mm a year). It is a low altitude plant that grows best at altitudes lower than 300m above sea level although it will also grow at altitudes above 900m.

The young leaves of the clove tree are bright pink and change to a greenish yellow as they mature. The flowers develop in clusters of three to ten groups, each with three flowers per group.

Harvesting
Clove trees are first harvested when the tree is 6-8 years old. The timing of harvest of the clove buds is critical. The buds should be harvested before the purple or crimson flowers start to develop. The correct time of harvest is when the outer green leaves (the calyx) of the flower bud change from olive green to yellow pink and before the petals fall to expose the stamens. Clusters of flower buds are hand-picked from the branches. It is important that the branches are not removed or damaged as this will reduce the yield of future crops.

Pre-treatment
After harvest the buds are detached from the stalks by holding a cluster in one hand, pressing it against the palm of the other hand and slowly twisting so that the buds fall off. The hands of the processor and the room in which the buds are separated must be very clean to prevent contamination of the cloves. The stems and buds are separated and dried separately. The stems can be used for oil distillation.
Drying
The buds have to be dried quickly or they will start to ferment. They are usually dried in the sun, spread on clean mats. The cloves should be raked and turned frequently to ensure they develop an even brown colour. The colour of buds changes from pale russet to a darker brown as the clove dries. The drying process takes about four to five days. It cannot be speeded up or the cloves will become dry, brittle and withered rather than plump.

The final moisture content of the dried cloves should be 8-10%. Experienced clove driers will know when the cloves are fully dry as the buds will snap easily. During the rainy season, cloves should be dried using a mechanical drier such as a tray drier.

Badly dried cloves are pale brown and classified as khuker.

Winnowing
The dried buds are winnowed using a traditional winnowing basket to remove dust and other foreign matter. Small cleaning machines are available that use a blower to remove the dirt and dust.

Standards
The US Government and American Spice Trade Association standards for cloves are as follows:

- Moisture (% wet basis) <8%
- Extraneous matter <1%
- Mouldy buds <1%

Grinding
Grinding can be a method of adding value to a product. However, it is not advisable to grind spices. After grinding, spices are more vulnerable to spoilage. The flavour and aroma compounds are not stable and will quickly disappear from ground products. The storage life of ground spices is much less than for the whole spices. It is very difficult for the consumer to judge the quality of a ground spice. It is also very easy for unscrupulous processors to contaminate the ground spice by adding other material. Therefore most consumers, from wholesalers to individual customers, prefer to buy whole spices.

Dried cloves are usually sold whole.

Packaging
Cloves can be packaged in polythene bags of various sizes according to the market demand. The bags should be sealed to prevent moisture entering. Sealing machines can be used to seal the bags. Attractive labels should be applied to the products. The label needs to contain all relevant product and legal information – the name of the product, brand name (if appropriate), details of the manufacturer (name and address), date of manufacture, expiry date, weight of the contents, added ingredients (if relevant) plus any other information that the country of origin and of import may require (a barcode, producer code and packer code are all extra information that is required in some countries to help trace the product back to its origin). See the Practical Action Technical Brief on labelling for further information on labelling requirements.

Storage
Dried cloves must be stored in moisture-proof containers away from direct sunlight. It is essential that the cloves are fully dry before they are stored. Any moisture within the bags will cause the cloves to rot. The stored cloves should be inspected regularly for signs of spoilage or moisture. If they have absorbed moisture, they should be re-dried to a moisture content of 10%.

The storage room should be clean, dry, cool and free from pests. Mosquito netting should be fitted on the windows to prevent pests and insects from entering the room. Strong smelling foods, detergents and paints should not be stored in the same room as they will spoil the aroma and flavour of the cloves.
Equipment suppliers
This is a selective list of suppliers of equipment and does not imply endorsement by Practical Action.

This website includes lists of companies in India who supply food processing equipment.
http://www.niir.org/directory/tag/z,,1b_0_32/fruit+processing/index.html

Dryers

Acufil Machines
S. F. No. 1202, Kalapatty Post Office
Coimbatore - 641 035
Tamil Nadu
India
Tel: +91 422 2666108/2669909
Fax: +91 422 2666255
Email: acufilmachines@yahoo.co.in,
acufilmachines@hotmail.com
http://www.indiamart.com/acufilmachines/

Bombay Engineering Works
1 Navyug Industrial Estate
185 Tokersey Jivraj Road
Opposite Swan Mill, Sewree (W)
Mumbai 400015
India
Tel: +91 22 24137094/24135959
Fax: +91 22 24135828
bomeng@vsnl.com
http://www.bombayengg.com/contact.html

Premium Engineers Pvt Ltd
Plot No 2009, Phase IV, GIDC
Vatva, Ahmedabad 382445
India
Tel: +91 79 25830836
Fax: +91 79 25830965

Rank and Company
A-p6/3, Wazirpur Industrial Estate
Delhi – 110 052
India
Tel: +91 11 7456101/ 27456102
Fax: +91 11 7234126/7433905
Rank@poboxes.com

Industrias Tecnologicas Dinamicas SA
Av. Los Platinos 228
URB industrial Infantas
Los Olivos
Lima
Peru
Tel: +51 14 528 9731
Fax: +51 14 528 1579

Ashoka Industries
Kirama
Walgammulla
Sri Lanka
+94 71 764725

Kundasala Engineers
Digana Road
Kundasala
Kandy
Sri Lanka
Tel: +94 8 420482

Alvan Blanch
Chelworth, Malmesbury
Wiltshire
SN16 9SG
UK
Tel: +44 1666 577333
Fax: +44 1666 577339
enquiries@alvanblanch.co.uk
www.alvanblanch.co.uk

Mitchell Dryers Ltd
Denton Holme, Carlisle
Cumbria
CA2 5DU
UK
Tel: +44 1228 534433
Fax: +44 1228 633555
webinfo@mitchell-dryers.co.uk
http://www.mitchell-dryers.co.uk/
Packaging and labelling machines

**Acufil Machines**  
India (See above)

**Gardners Corporation**  
158 Golf Links  
New Delhi 110003  
India  
Tel: +91 11 3344287/3363640  
Fax: +91 11 3717179

**Gurdeep Packaging Machines**  
Harichand Mill compound  
LBS Marg, Vikhroli  
Mumbai 400 079  
India  
Tel: +91 22 2578 3521/577 5846/579 5982  
Fax: +91 22 2577 2846

**MMM Buxabhoy & Co**  
140 Sarang Street  
1st Floor, Near Crawford Market  
Mumbai  
India  
Tel: +91 22 2344 2902  
Fax: +91 22 2345 2532  
yusuf@vsnl.com; mmmb@vsnl.com;  
yusuf@mmmb.in

**Narangs Corporation**  
P-25 Connaught Place  
New Delhi 110 001  
India  
Tel: +91 11 2336 3547  
Fax: +91 11 2374 6705

**Orbit Equipments Pvt Ltd**  
175 - B, Plassy Lane  
Bowenpally  
Secunderabad - 500011, Andhra Pradesh  
India  
Tel: +91 40 32504222  
Fax: +91 40 27742638  
http://www.orbitequipments.com

**Pharmaco Machines**  
Unit No. 4, S.No.25 A  
Opp Savali Dhaba, Nr.Indo-Max  
Nanded Phata, Off Sinhagad Rd.  
Pune – 411041  
India  
Tel: +91 20 65706009  
Fax: +91 20 24393377

**Rank and Company**  
India (see above)

**Banyong Engineering**  
94 Moo 4 Sukhaphibaon No 2 Rd  
Industrial Estate Bangchan  
Bankapi  
Thailand  
Tel: +66 2 5179215-9

**Technology and Equipment Development Centre (LIDUTA)**  
360 Bis Ben Van Don St  
District 4  
Ho Chi Minh City  
Vietnam  
Tel: +84 8 940 0906  
Fax: +84 8 940 0906

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University of Science and Technology  
Kumasi  
Ghana

**Alvan Blanch**  
UK (see above)

Contacts

The following contacts should be able to provide further information:

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+91 495 2730294  
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Further reading

*Drying* Practical Action Technical Brief

*Spice Processing* Practical Action Technical Brief

*Labeling Food Products* Practical Action Technical Brief

http://www.clovescloves.com/process.htm A clove producer that outlines the stages of their processing.

This document was produced by Dr. S Azam Ali for Practical Action in May 2007. Dr. S Azam-Ali is a consultant in food processing and nutrition with over 15 years experience of working with small-scale processors in developing countries.

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Practical Action is a development charity with a difference. We know the simplest ideas can have the most profound, life-changing effect on poor people across the world. For over 40 years, we have been working closely with some of the world’s poorest people - using simple technology to fight poverty and transform their lives for the better. We currently work in 15 countries in Africa, South Asia and Latin America.