



SMALL-SCALE SPICE PROCESSING

Introduction

The processing and trade of spices has a long and important history. Spices are a valuable commodity and have a significant impact on the economy of many countries. Small-scale processing of spices can be economically viable and socially successful.

Most dried foods are comparatively low-risk 'safe' products in terms of causing food poisoning and are therefore suitable for production at the small-scale. However, spices are an exception to this. They often contain high levels of micro-organisms that cause food poisoning and quite frequently are contaminated with foreign matter.

Because spices are delicate products that are damaged by high temperature and extreme processing, special care should be taken to ensure products are of top quality. There are several key quality control points that small-scale processors need to be aware of.

Correct harvesting time

It is not possible to produce a high quality spice from low quality, inferior material. Harvesting spices at the correct point of maturity is the key to producing good quality products. Quite frequently spices are harvested when they are immature and before the flavour and aroma compounds have fully developed. This results in spices with an inferior taste and aroma. Early harvesting is usually through fear of the crop being stolen or because the farmer requires money urgently. Every effort should be made to wait until the spices are fully mature before harvesting.

Cleaning

Spice crops are quite often contaminated by dust, dirt, pesticides, insects, animal hair and droppings and a range of microbes. The crop must be cleaned before processing. The first stage is to remove dust and dirt using a winnowing basket. This can be made locally from bamboo, palm or other leaves. Someone used to this work can remove the dust, dirt and stones quickly and efficiently (eg they could clean 100kg of pepper in an eight-hour day). Small machines are available for cleaning but they are rarely cost effective.

After winnowing the crop should be washed in clean, potable water. Washing should be quick so that the spice is not soaked in water as this reduces the quality. The washing water must be changed regularly to prevent recontamination of spices by dirty water. It is essential that clean water is used as spices are not heat treated later on during processing. Dirty water introduces more bacteria, many of which cause food poisoning.

Drying

This is by far the most important part of processing to ensure good quality spices. Inadequately dried produce will lead to mould growth. The sale value of mouldy spices can be less than 50% of the normal value. In addition, the growth of food poisoning bacteria on some spices is a real danger if proper washing and drying is not carried out.

See the Practical Action Technical Brief on *Drying of Foods* for further information.

Spices contain volatile oils that are adversely affected by high temperatures. Therefore the temperature of drying must be tightly controlled to ensure a high quality dried product.

Most small-scale processors dry the crop by spreading it in the sun. This is another opportunity for the crop to become contaminated. All efforts should be made to ensure that the crop is dried in a clean place, away from animals, insects and birds.

Drying during the dry season

During the dry season, sun drying is usually adequate to dry the produce. The simplest and cheapest method is to lay the produce on mats in the sun. However, there are problems associated with this method. Dust and dirt are blown onto the crop and unexpected rainstorms can re-wet the crop. Drying in direct sunlight can adversely affect the colour of some of the more sensitive spices.

A solar dryer can be used to overcome the problems of contamination and spoilage by rain. The simplest type of solar dryer is the cabinet dryer (see Figure 1) which can be constructed out of locally available materials such as bamboo, coir fibre or nylon weave. For larger units (over 30kg/day) a Brace type of solar dryer could be used (Figure 2). However, the construction costs of this type of dryer are greater and a full financial evaluation should be made to see if it is economically viable.

See the Practical Action Technical Brief on *Solar Drying* for further information.

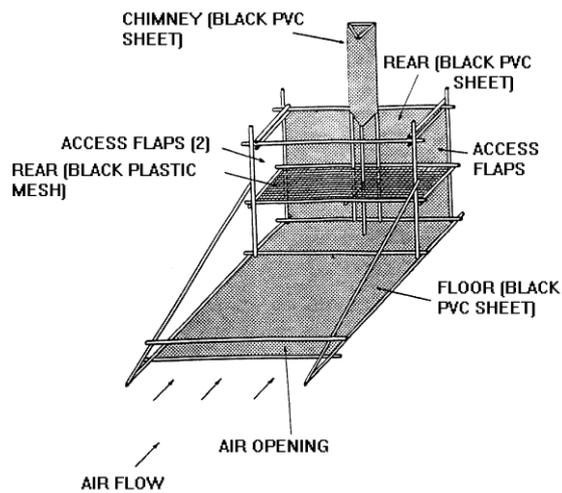


Figure 1: The Exell cabinet solar dryer.

Drying during the wet season

During the wet season or times of high humidity, which often coincides with the harvest of the spices, sun drying or solar drying cannot be used effectively. An artificial dryer that uses a cheap energy source is necessary. This may be a wood or husk burning dryer or a combined wood burning and solar dryer.

See the Practical Action Technical Brief on *Small-scale Drying Technologies* for further information on types of dryer.

It is important to control the temperature and time of drying. The maximum drying temperature for most spices is 50°C. At higher temperatures than this the volatile compounds that are responsible for the flavour and aroma are driven off. Spices should be dried quickly until they reach their final moisture content. They should not be overdried as this also has a detrimental effect on the final quality. The final moisture contents for several spices are shown in Table 1. Some spices require special drying conditions. For example, cardamom should be dried in the dark to help preserve the green colour.

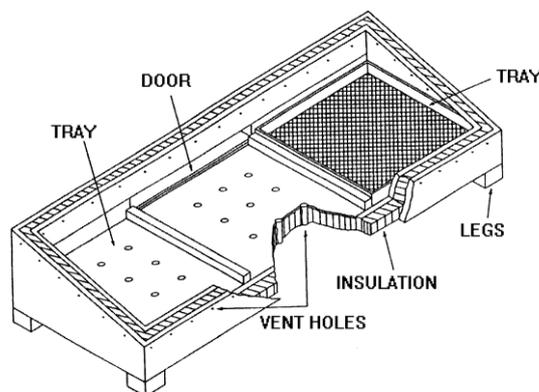


Figure 2: The Brace solar dryer.

Grading

Spices can be graded by size, density, colour, shape and flavour. Machines are available for larger scale production units.

Spice	Maximum final moisture content (% wet basis)
Mace	6.0
Nutmeg, cloves	8.0
Turmeric, coriander	9.0
Cinnamon	11.0
Pepper, pimento, chillies, ginger	12.0
Cardamom	13.0

Table 1: Spice moisture content

Grinding

Spices can either be sold whole or ground into powder. Grinding can add value to the product, but it can also detract from the quality of the product. Many consumers are wary of ground spices since they are frequently contaminated or adulterated. There is no easy way to determine whether ground spices are pure or have been adulterated. In general, ground spices are made by grinding inferior and broken spices. Also, ground spice has a much shorter shelf life than the whole spice. Once it is ground, the flavour and aroma of spice soon deteriorate. It is better for the small-scale processor to sell whole spices. This also removes the need for moisture proof packaging materials and sealing machines.

For small-scale production (up to 100kg/day) manual grinders are adequate. Small Chinese or Indian models designed for domestic spice grinding are suitable. A treadle or bicycle could be attached to make the work easier.

For larger scale production a small, powered grinding mill is needed and models are available that can grind 25kg/hour. A grinding mill needs to be placed in a separate and well ventilated room because of the dust. Great care is needed to ensure uniform sized pieces/powders after grinding and also to prevent heating of spices during grinding.

Packaging and storage

After drying, the material should be packed quickly into clean heavy gauge polypropylene sacks to avoid any moisture pick up. The spices must be cool before they are packed into the sacks and they must be stored out of direct sunlight to prevent condensation forming on the inside of the sack. Workers should not directly handle the spices, but should use clean gloves and scoops. Sacks should be labelled and dated.

The packaging requirements depend on: 1) the type of spice, 2) whether it is ground or intact and 3) the humidity of storage. Most intact spices will store adequately in sacks/boxes if the humidity of the air is not too high. Ground spices can also be stored without special packaging if humidity is low but over long periods there is a loss of flavour and risk of contamination and spoilage.

It is therefore better to store spices in a barrier film such as polypropylene (essential in areas of high humidity) to provide an attractive package, retain spice quality and prevent contamination and losses. If polypropylene is not available, cellulose film is adequate if it is heat sealable. Polythene is a poor substitute and should only be used for short term storage as it allows the flavour/aroma of the spices to escape.

Equipment suppliers

Note: This is a selective list of suppliers and does not imply endorsement by Practical Action.

This website includes lists of companies in India who supply food processing equipment.

www.niir.org/directory/tag/z..1b_0_32/fruit+processing/index.html

Dryers

Acufil Machines

S. F. No. 120/2, Kalapatty Post Office
Coimbatore - 641 035

Tamil Nadu, India

Tel: +91 422 2666108/2669909

Fax: +91 422 2666255

E-mail: acufilmachines@yahoo.co.in

acufilmachines@hotmail.com

Website:

www.indiamart.com/acufilmachines/#products

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

E-mail: bomeng@vsnl.com

Website:

www.bombayengg.com/contact.html

Bry-Air (Asia) Pvt Ltd

21C Sector 18

Gurgaon – 122015

India

Tel: +91 124 4091111

Fax: +91 124 4091100

E-mail: enquire@pahwa.com

Website: www.bryair.com/index.htm

Premium Engineers Pvt Ltd

Plot No 2009, Phase IV, GIDC

Vatva, Ahmedabad 382445

India

Tel: +91 79 25830836

Fax: +91 79 25830965

Website: www.premiumengineers.com/

Rank and Company

A-p6/3, Wazirpur Industrial Estate

Delhi – 110 052

India

Tel: +91 11 7456101/ 27456102

Fax: +91 11 7234126/7433905

E-mail: rank@poboxes.com

Tata Energy Research Institute (TERI)

Darbari Seth Block

IHC Complex, Lodhi Road

New Delhi, India

Tel: +91 11 2468 2100/ 4150 4900

Fax: +91 11 2468 2144/ 2468 2145

E-mail: mailbox@teri.res.in

Website:

www.teriin.org/tech_cardamom.php

Bry-Air China

No 951-F Jian Chuan Road

Minhang District

Shanghai 200240

China

Tel: +86 21 51591555

Fax: +86 21 51591559

E-mail: bryairc@online.sh.cn;

bryair@vip.sina.com

Website: www.bryair.com.cn

Bry-Air (Korea)

202 2F DH Building, 174-2 Songpa-dong

Songpa-gu

Seoul, Korea

Tel: +82 2 414 0629

Fax: +82 2 417 2622

E-mail: drikorea@hanmail.net

Website: www.drikorea.co.kr

Bry-Air (Malaysia)

Sdn Bhd (197712-W)

Lot 11, Jalan P/7, Bangi Industrial Estate

43650 Bandar Baru Bangi

Selangor, Malaysia

Tel: 603 89256622

Fax: 603 89259957

E-mail: bryair@bryair.com.my

Website: www.bryair.com.my

Bry-Air (Thailand)

448 Richie Tower, 2nd Floor

Ratchadaphisek Road

Samsennai Huayekhwang

Bangkok 10320

Thailand

Tel: +66 2 5415479, 9389304

Fax: +66 2 9389314

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E-mail: info@bryair.co.th
 Website: www.bryair.co.th

Industrias Technologicas Dinamicas SA

Av. Los Platinos 228
 URB industrial Infantas
 Los Olivios
 Lima
 Peru
 Tel: +51 14 528 9731
 Fax: +51 14 528 1579

Bry-Air (Africa)

Lower Ground Floor
 Lakeside Place
 1 Ernest oppenheimer Drive
 Bruma-2198, Bedfordview
 Johannesburg, South Africa
 Tel: +27 11 6150458
 Fax: +27 11 6166485
 E-mail: bryairafrika@telkomsa.net;
 E-mail: bryairafrika@pahwa.com

Ashoka Industries

Kirama
 Walgammulla
 Sri Lanka
 Tel: +94 71 764725

Grinders and mills

Kaps Engineers 831, G.I.D.C.

Makarpura
 Vadodara - 390 010
 India
 Tel: +91 265 644692/ 640785/ 644407
 Fax: +91 265 643178/ 642185
 E-mail: sales@kapsengineers.com
 Website: www.kapsengineers.com

Lehman Hardware and Appliances Inc.

P.O. Box 41
 Kidron
 Ohio 44636
 USA
 Tel orders: +1 877 438 5346
 Tel enquiries: +1 888 438 5346
 E-mail: info@lehmans.com
 Website: www.lehmans.com

Alvan Blanch

UK (See above)

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
 E-mail: enquiries@alvanblanch.co.uk
 Website: www.alvanblanch.co.uk

Mitchell Dryers Ltd

Denton Holme, Carlisle
 Cumbria
 CA2 5DU
 UK
 Tel: +44 1228 534433
 Fax: +44 1228 633555
 E-mail: webinfo@mitchell-dryers.co.uk
 Website: www.mitchell-dryers.co.uk/

Premium Engineers PVT Ltd

India (see above)

CS Bell Co

170 West Davis Street
 PO Box 291
 Tiffin
 Ohio
 USA
 Tel: +1 419 448 0791
 Fax: +1 419 448 1203
 E-mail: sales@csbell.co.com
 Website: www.csbellco.com/

Miracle Mills Ltd

Knightsdale Road
 Ipswich
 IP1 4LE
 United Kingdom
 Tel: (01473) 742325
 Fax: (01473) 462773
 E-mail: sales@miracle-mills.co.uk
 Website: www.miracle-mills.co.uk/

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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 Buxabhoj & Co

140 Sarang Street
1st Floor, Near Crawford Market
Mumbai, India
Tel: +91 22 2344 2902
Fax: +91 22 2345 2532
E-mail: yusufs@vsnl.com;
mmmb@vsnl.com; yusuf@mmmb.in

Narangs Corporation

P - 25, Connaught Place,
New Delhi 600 08
Delhi
India
Tel: +91 11 2336 3547
Fax: +91 11 2374 6705

[Alvan Blanch](#)

UK (see above)

Orbit Equipments Pvt Ltd

175 - B, Plassy Lane
Bowenpally
Secunderabad - 500011, Andhra Pradesh
India
Tel: +91 40 32504222
Fax: +91 40 27742638
E-mail: info@orbitequipments.com
Website: www.orbitequipments.com

Pharmaco Machines

B-2/17, 'Anubandh', Near Ramkrishna
Math, Dandekar Bridge,
Sinhgad Road, Pune - 411030,
Maharashtra, India
Tel: +91 20 65706009
Fax: +91 20 24391953
E-mail: response@pharmacomachines.com
Website: www.pharmacomachines.com/

[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

Technology Consultancy Center

University of Science and Technology
Kumasi
Ghana
Tel: +233 51 60296/7
Fax: +233 51 60137
E-mail: tcc@knut.edu.gh
Website: www.knut.edu.gh/tcc/

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Contacts

The following contacts should be able to provide further information:

Tata Energy Research Institute (TERI)
Darbari Seth Block
IHC Complex, Lodhi Road
New Delhi, India
Tel: +91 11 2468 2100/ 4150 4900
Fax: +91 11 2468 2144/ 2468 2145
E-mail: mailbox@teri.res.in
Website: www.teriin.org/tech_cardamom.php

Indian Institute of Spices Research (IISR)
Marikunnu PO, Calicut
Kerala
India 673012
Tel: +91 495 2731346
+91 495 2730294
E-mail: parthasarathy@iisr.org; rdinesh@iisr.org
Website: www.iisr.org/package/index.php?spice=Cardamom&body=Overview

Indian Institute of Technology (IIT) Bombay
Powai
Mumbai 400076
India
Tel: +91 22 2572 2545
Fax: +91 22 2572 3480
Website: www.ircc.iitb.ac.in/webnew/

References and further reading

Practical Action Technical Briefs:

[Drying of Foods](#) Practical Action Technical Brief

[Food Labelling](#) Practical Action Technical Brief

[Drying](#) selection of Practical Action Technical Briefs

[Herbs and Spices](#) selection of Practical Action Technical Briefs

[Drying](#) UNIFEM Practical Action Publishing 1995

Processing of Black Pepper, Practical Action Food Chain No. 3

Spice Plants, M. Borget, 1993, CTA/MacMillan

Ground and Packaged Spices: Options and Difficulties in Processing at Origin. Marketing Series 7, NRI, 1993

[Quality assurance for small-scale rural food industries](#). Chapter 2.4 Herb and spice products.

FAO agricultural services bulletin 117, 1995.

[Try Drying It! Case Studies in the Dissemination of Tray Drying Technology](#), B Axtell, Practical Action Publishing 1991

Producing Solar Dried Fruit and Vegetables for Micro and Small scale Rural Enterprise Development, A Series of Practical Guides' written by the [Natural Resources Institute](#).

[Setting up a food drying business](#) P Thuillier, Practical Action Publishing, 2002

[Drying Food for Profit](#) B Axtell, Practical Action Publishing, 2002

This document was produced by Dr. S Azam Ali for Practical Action in January 2008. 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

Practical Action
The Schumacher Centre
Bourton-on-Dunsmore
Rugby, Warwickshire, CV23 9QZ
United Kingdom
Tel: +44 (0)1926 634400
Fax: +44 (0)1926 634401
E-mail: infoserv@practicalaction.org.uk
Website: <http://practicalaction.org/practicalanswers/>

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