

LIME MARMALADE

Introduction

As the name suggests, lime marmalade is a preserve made from limes and sugar. Marmalades can also be made from other citrus fruits - notably oranges, lemons, grapefruit or a mixture of any of these. This recipe is based on practical experiences of making lime marmalade in the West Indies. When using other citrus fruits or limes that are grown in a different region, it is likely that minor modifications to the formulation will be needed to account for the different levels of acidity.

Production

The production of traditional lime marmalade by the small-scale processor is perfectly feasible provided the equipment is available and the general principles for jam making are understood and followed.

Lime marmalade is made according to the basic principles of jam and marmalade production. However, there are two potential problem areas which the processor should be aware of:

1. Lime is unusual in that it has a very high acidity (and low pH). Jams and jellies need to have a pH between 3.0 and 3.3 to enable the pectin to set the gel. Most fruits lie in this pH range but if they have a pH higher than 3.3, citric acid can be added to the fruit to bring the pH down to the required range. Lime juice however has a pH of 2.7 to 2.9 and therefore the pH has to be increased. It is possible to do this quite easily by adding sodium bicarbonate (baking powder) to the fruit pulp.

In the experience in the West Indies, it was found that the addition of 20g of sodium bicarbonate per litre of lime juice was sufficient to give the required pH adjustment. In each situation, it is important to get the correct pH, which should be done by adding sodium bicarbonate to the lime juice and measuring the acidity with a pH meter.

If a pH meter is not available, it may be necessary to seek outside advice. Alternatively, the amount to add can be determined by trial and error. Carry out a series of small trial batches using different levels of bicarbonate and find out the best level by checking the set of the marmalade.

2. The second problem in marmalade production is getting an even distribution of shredded peel throughout the product. If the correct technique is not used the peel tends to float to the surface of the jar during setting. It is important to soak the peel slices in a sugar solution before they are added to the marmalade to increase their density. This means that the marmalade making process is somewhat longer than for jam making and planning for production should take this into account.

At first glance the production of jams and marmalade may seem like the best option for utilising a glut of fruit. In fact, this is not the case. To make a consistently good quality product requires a certain level of skill and technical input and some specialist equipment – stainless steel boiling pans, refractometer, glass jars and lids for packaging. Preserve making also requires large quantities of sugar and in some cases the addition of pectin, both of which can be expensive ingredients. Therefore, as with all food products, it is essential that the processor carries out a full technical, economic and marketing feasibility study prior to starting the enterprise. Not only will this exercise determine the potential market for the products, it will be a useful tool for planning production and day-to-day running of the business and can be used to approach a bank for a loan if one is required. See the Practical action technical brief on how to carry out a market and technical feasibility study for further information.

Recipe

1 litre lime juice
 20g sodium bicarbonate
 3kg sugar
 1200g 5 SAG pectin (made up from 40g pectin, 200g sugar, 960ml water)
 Few drops of green food colour (optional)
 200g prepared sugared lime peel

Lime juice

The extraction of lime juice is the most time consuming step for the small-scale manufacturer. It is strongly recommended that if a local commercial lime processor exists, racked juice should be purchased in bulk.

If no such supplier exists then there is no alternative but to extract the juice oneself using small manual or electric squeezers (see Figure 1). It must be remembered at all times that lime juice is very acidic and therefore attacks metals. It is essential to use only good quality food-grade plastic, stainless steel and wooden utensils to collect the juice. The extracted juice must be strained to remove pulp prior to use. If required, lime juice can be extracted and stored in bulk preserved with 1000ppm sulphur dioxide (using 3g of sodium metabisulphite per litre of juice).

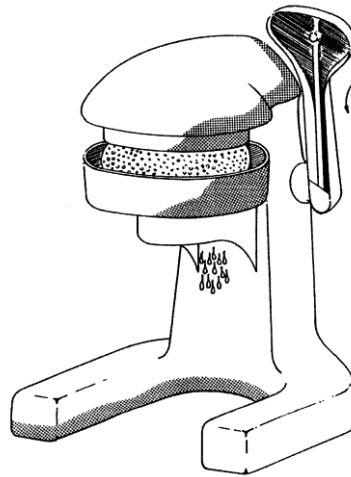


Figure 1: Small manual squeezer

Lime peel

The lime peel needs to be cut into very thin strips about 12 to 25mm long and as thin as possible. This is another slow and tedious job which can also be a potential hazard point for contamination by flies and other insects. The cut slices should be kept covered until they are used. A very sharp stainless steel knife should be used to cut the peel into slices. The process can be speeded up by using a small peeler to remove the peel from the limes (see Figure 2) before they are squeezed.

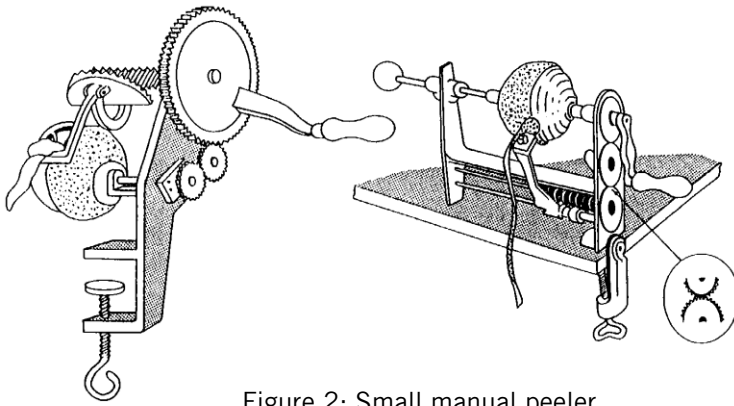


Figure 2: Small manual peeler

Treatment of the peel

If fresh peel is incorporated directly into the marmalade it will float to the surface during setting and produce a very unsatisfactory product. The shredded peel needs to be saturated with sugar before use so that it has the same density as the marmalade and stays suspended in the gel and evenly distributed through the jar.

The shredded peel should be well mixed with dry sugar (1kg peel + 1kg sugar) and left in a sealed container for at least a week, mixing occasionally. During this time a sugar solution will form as the moisture from the peel mixes with the dry sugar. The pieces of peel will float in the heavy sugar syrup. Sodium metabisulphate can be added to the sugar (1g per 1kg of peel) to prevent the growth of moulds and yeasts.

This sweet mixture of peel and sugar will be highly attractive to ants and insects. Make sure that the container is covered with a lid or netting and stand it in a trough of water to prevent ants.

Pectin

The ideal situation is to use commercially available pectin as it has a standard setting power and produces the same product time after time. If it is impossible (or too costly) to buy pectin, it can be extracted from citrus peels or passion fruit rinds, but you will have to experiment on how much to add to the juice to get a good set (see the technical brief on fruit waste utilisation for more information on pectin production).

The best pectin for marmalade is a fast-set pectin. Fast set pectin is preferable because it forms a gel quickly and so holds the pieces of peel in place throughout the marmalade. The usual strength of commercial pectin is 150 SAG. To make marmalade you need a pectin with a setting power of about 5SAG. Therefore the commercial pectin needs to be diluted (30 times in this case) prior to use.

Preparation of 5 SAG pectin working solution

30g of 150 SAG pectin
150g sugar
720ml water

- Dry mix the pectin and sugar thoroughly.
- Heat the water to 70-75°C and slowly add the sugar/pectin, mix with constant stirring. If a small electric stirrer is available there will be less chance of lumps forming.
- Heat to boiling and boil for 1 minute, again with constant stirring.
- Hold at 50-60°C (a double saucepan is useful here).

Batch preparation

The technical brief on jams and marmalade production outlines the principles of jam boiling. Ideally a heavy based stainless steel pan or double bottomed jam pan will be available for boiling the mixture. The other desirable pieces of equipment are a wooden stirrer, jam thermometer and possibly a refractometer (figure 3) for testing the total soluble solids and determining the end point of the boiling process.

Method

1. Place the lime juice, bicarbonate and half the sugar in the pan, heat slowly to dissolve the sugar and then bring to the boil. Boil for 3 - 5 minutes with steady stirring (it is impossible to state boiling times exactly, as this depends on the heat source etc).
2. Add the remaining half of the sugar, peel, pectin and green colour and continue boiling until the required sugar level (68%) is reached (as measured either by refractometer, jam boiling thermometer or skill of the producer).

3. Filling and capping

Hot fill the finished preserve into clean, dry jars and cap immediately. Care is needed not to fill too hot or too cold, the ideal range being 82-85°C. Filling whilst too hot can result in drops of steam condensing on the inside of the lid, falling back onto the surface of the product and diluting it to below 68% sugar solids (so that moulds and yeasts can grow). Too cold filling carries the danger of microbiological contamination from the jar etc.

Cap the jars quickly using either screw type or 'Omnia' type push-on lids. When the jars have cooled and a vacuum has formed (about 50°C) rinse them in a bath of clean chlorinated water - one tablespoon of bleach per 4.5 litres of water.

Dry the jars and label (see the technical brief on labelling for more details of the legal requirements for food labels).

4. Storage

If properly preserved and packaged in glass, marmalade can be stored for up to one year away from direct sunlight. If it is packaged in plastic bottles, it can only be stored for about 4-6 months.

Equipment required

- pH meter (optional)
- Juice extractor
- Peeler
- Knives
- Plastic buckets
- Stainless steel pan
- Wooden spoons
- Gas ring or other heat source

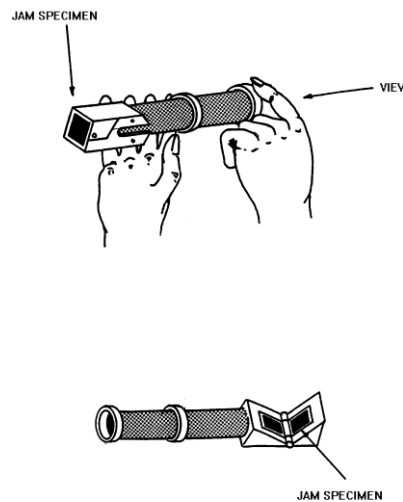


Figure 3: Refractometer

Jam thermometer or refractometer
Capping machine
Jar cooler (optional)

Equipment suppliers

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

Cutting and slicing equipment

A range of manual and powered cutting and slicing machinery is available.

Eastend Engineering Company

173/1 Gopal Lal Thakur Road
Calcutta 700 035
India
Tel: +91 33 2553 6397

Narangs Corporation

P-25 Connaught Place
New Delhi 110001
India
Tel: +91 11 2336 3547
Fax: +91 11 2374 6705

Gardners Corporation

158 Golf Links
New Delhi 110003
India
Tel: +91 11 2334 4287/2336 3640
Fax: +91 11 2371 7179

Juice filters, strainers and sieves

A range of filtering and straining equipment can be used. The simplest is the filter bag (or jelly bag) made of terylene or muslin cloth. More sophisticated are the filter presses and strainers which may be mechanised.

Gauthier

Parc Scientifique Agropolis
34397 Montpellier
Cedex 5
France
Tel: +33 4 67 61 11 56
Fax: +33 4 67 54 73 90

Alvan Blanch

Chelworth
Malmesbury
Wiltshire
SN16 9SG
United Kingdom
Tel: +44 (0) 666 577333
Fax: +44 (0) 666 577339
E-mail: info@alvanblanch.co.uk
Website: <http://www.alvanblanch.co.uk>

Lakeland Mail order kitchenware

38 Alexandra Buildings
Windermere
LA23 1BQ
United Kingdom
Tel: +44 (0)15394 88100
Website: www.lakeland.co.uk

[Gardners Corporation](#)

India (see above)

Weighing machines

It is important to have accurate weighing machines. Quite often more than one machine is required - a large one to weigh the fruit and a small one for weighing out the dry ingredients such as pectin and spices.

Fisher Scientific

Bishop Meadow Road
Loughborough
LE11 5RG
UK
Tel: +44 1509 231166
Fax: +44 1509 231893
Email: fisher@fisher.co.uk
Web: www.fisher.co.uk

Alvan Blanch

UK (see above)

Gardners Corporation

India (see above)

Juice extractors and pulpers

A variety of juice extractors and pulpers is available from a wide range of suppliers. They are available in different capacities and either manual or powered (either electric or diesel).

Kenwood Limited

New Lane
Havant
Hampshire
PO9 2NH
United Kingdom
Tel: +44 (0) 23 9247 6000
Fax: +44 (0) 23 9239 2400
Website: <http://www.kenwood.co.uk>

Alvan Blanch

UK (see above)

Robot Coupe

12 Avenue Cal Leclerc
BP 134
71303 Montceau-les-Mines
France
Tel: +33 3 85 58 80 80

DISEG (Diseno Industrial y Servicios Generales)

Av Jose Carlos Mariategui 1256
Villa Maria del Triunfo
Lima
Peru
Tel: +51 14 283 1417

Servifabri SA

JR Alberto Aberd
No. 400 Urb Miguel Grau (ex Pinote)
San Martin de Porres
Lima
Peru
Tel: +51 14 481 1967

Essae-Teraoka Ltd

377/22 6th Cross Wilson Garden
Bangalore 560027
India
Tel: +91 80 2216185/2241165

Narangs Corporation

India (see above)

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: <http://www.lehmans.com>

Eastend Engineering Company

India (see above)+

Florachem

Flat No. 1119, Hemkunt Chambers, 89,
Nehru Place
New Delhi 110019
India
Tel: +91 11 25589502

Gardners Corporation

India (see above)

Food Packs Indiana

Thrikkariyoor, Kothamangalam, Ernakulam
Kerala 686692
India
Tel: +91 485-2522134, 2523610

technical brief

Bajaj Machine Private Limited

7/20, 7/27, Jai Lakshmi Industrial Estate,
Side-IV
Sahibabad Industrial Area
Ghaziabad-201301
U.P
India
Tel: +91 120 22775119/22775137
Fax: +91 120 22775137
Website: www.indiamart.com/

Buhler (India) Pvt Ltd

13-D, K A I D B Industrial Area, Attibele
Bangalore
Karnataka 562107
India
Tel: +91 80- 27820000
Fax: +91 80-7820001
Website: www.buhlergroup.com

Delhi Industries

4 Paharganj Lane,
New Delhi 110055
India
Tel: +91 11 2529720, 27525200,
27536888
Fax: +91 11 25791291

Do-All-Engineering Industries

87/12, Industrial Suburb, Yeshawanthpur
Bangalore
Karnataka 560022
India
Tel: +91 80 23345754, 23372298
Fax: +91 80 23346138

Udaya Industries

Uda Aludeniya, Welligalla
Gampola
Sri Lanka
Tel: +94 8 388586
Fax: +94 8 388909

Mark Industries (Pvt) Ltd

348/1 Dilu Road
Mokbazar
Dhaka 1000
Bangladesh
Tel: +880 2 9331778/835629/835578
Fax: +880 2 842048
Email: markind@citechco.net

Geeta Food Engineering

Plot No C-7/1 TTC Area
Pawana MIDC Thane Belapur Road
Behind Davita Chemicals Ltd
Navi Mumbai 400 705
India
Tel: +91 22 2782 6626/2766 2098
Fax: +91 22 2782 6337

Narangs Corporation

India (see above)

Praj Industries Ltd

Praj House Bavdhan
Pune, Maharashtra 411021
India
Tel: +91 20-22951511, 22952214
Fax: +91 20-22951511 / 22952214
Website: www.praj.net

Techno Equipments

Saraswati Sadan
1st Floor, 31 Parekh Street
Mumbai 400004
India
Tel: +91 22 2385 1258

Kundasala Engineers

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

technical brief

For boiling

Boiling pans should be made of aluminium, enamelled metal or stainless steel. For larger quantities it is necessary to buy equipment which does not cause burning or sticking of the product to the bottom of the pan. Stainless steel steam jacketed kettles, which are double walled pans are suitable for boiling large quantities of jam and are available in a range of sizes (from 5 to 500litres).

Gardners Corporation

India (See above)

HRS Process Systems Pvt Ltd

Asia Division, Praj House,
Bavdhan, Pune
Maharashtra 411021
India
Tel: +91 20- 22951511
Fax: +91 20- 22951718
Website: www.hrsasia.co.in

Raylons Metal Works

Kondivita Lane
J. B. Nagar Post Office
Post Box No. 17426
Andheri (E) Andheri - Kurla Road,
Mumbai - 400 059
India
Tel: +91 22 26323288 / 6325932

Sri Rajalakshmi Commercial Kitchen Equipment

No.57, (old No. 30/1) Silver Jubilee Park
Road
Bangalore - 560 002
India
Tel: +91 (0)812 2222 1054/223 9738
Fax: +91 (0)812 2222 2047

United Engineering (Eastern) Corporation

Shantiniketan Site No.2 & 3
(10th Floor) 8 Camac Street
Kolkata, West Bengal 700017
India
Tel: +91 33-22823914, 22820157
Fax: +91 33-22823742

Bottle filling and packaging equipment**H Erben Limited**

Lady Lane
Hadleigh
Suffolk
IP7 6AS
United Kingdom
Tel: +44 (0)1473 823011
Fax: +44 (0)1473 828252
Website: <http://www.erben.co.uk>

Alvan Blanch

United Kingdom (See above)

Israel Newton Limited

Summerley Works
All Alone Road
Bradford
West Yorkshire BD10 8TT
United Kingdom
Tel: +44 (0)1274 612059
Fax:+44 (0)1274 612059

APV Baker Limited

Manor Drive
Paston Parkway
Peterborough
Cambridgeshire
PE4 7AP
United Kingdom
Tel: +44 (0)1733 283000
Fax: +44 (0)1733 283005

T Giusti and Son Limited

Rixon Road, Finedon Road Industrial Estate
Wellingborough,
Northamptonshire NN8 4BA
United Kingdom
Tel: + 44 (0)1933 229933
Fax: + 44 (0)1933 272363
Website: www.giusti.co.uk

Orbit Equipments Pvt Ltd

175 - B, Plassy Lane
Bowenpally
Secunderabad - 500011, Andhra Pradesh
India
Tel: +91 40 32504222
Fax: +91 40 27742638
Website : <http://www.orbitequipments.com>

Sussex and Berkshire Machinery Company PLC

Blacknest
Alton, Hants GU34 4PX
United Kingdom
Tel: + 44 (0)1420 22669
Fax: + 44 (0)1420 22687
E-mail: technical@sabplc.uk
Website: <http://www.sabplc.co.uk/>

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
Email : acufilmachines@yahoo.co.in,
acufilmachines@hotmail.com
<http://www.indiamart.com>

Autopack Machines Pvt Ltd

101-C Poonam Cambers
A Wing, 1st Floor
Dr Annie Besant Road, Worli
Mumbai 400018
India
Tel: +91 22 2493 4406/2497 4800/2492 4806
Fax: +91 22 2496 4926
E-mail: autopack@bom3.vsml.net.in
www.autopackmachines.com

Bombay Engineering Industry

R NO 6 (Extn) Sevantibai Bhavan
Chimatpada
Marol Naka Andheri (East)
Mumbai 400059
India
Tel: +91 22 2836 9368/2821 5795
Fax: +91 22 2413 5828

MMM Buxabhoj & Co

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

Gardners Corporation

India (see above)

Pharmaco Machines

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

Rank and Company

A-p6/3, Wazirpur Industrial Estate
Delhi – 110 052
India
Tel: +91 11 27376101
Fax: +91 11 7234126
Rank@poboxes.com

Banyong Engineering

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

Alfa Technology Transfer Centre

301 Cach Mang Thang 8
Tan Binh District
Ho Chi Minh City
Vietnam
Tel: +84 8 9700868
Fax: +84 8 8640252

Technology and Equipment Development Centre (LIDUTA)

360 Bis Ben Van Don St
District 4
Ho Chi Minh City
Vietnam
Tel: +84 8 9400906
Fax: +84 8 9400906

Mark Industries (Pvt) Ltd

Bangladesh (See above)

technical brief

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

John Kojo Arthur

University of Science and Technology
Kumasi
Ghana

Eastend Engineering Company

India (See above)

Alvan Blanch

UK (see above)

Narangs Corporation

India (see above)

Refractometers

The refractometer is used to measure the sugar content.

Bellingham + Stanley Ltd.

Longfield Road, North Farm Industrial Estate
Tunbridge Wells, Kent TN2 3EY
United Kingdom
Tel: +44 1892 500400
Fax: +44 1892 543115
E-mail: sales@bs-ltd.com
Website: <http://www.bs-ltd.com>

International Ripening Company

1185 Pnieridge Road
Norfolk
Virginia 23502-2095
USA
Tel: +1 757 855 3094
Fax: +1 757 855 4155
Email: info@QAsupplies.com
Web: www.qasupplies.com

Fisher Scientific UK Ltd

UK (see above)

Gardners Corporation

India (see above)

References and further reading

Practical Action Technical Briefs:

[Passion fruit jam](#)
[Jams, jellies and marmalades](#)
[Pineapple jam](#)
[Strawberry jam](#)
[Watermelon jelly](#)
[Food labelling](#)
[Fruit waste utilisation](#)
[Juices and Drinks](#)
[Snack Foods](#)

[Technical manual on small-scale processing of fruits and vegetables](#), Food and Agriculture Organization of the United Nations (FAO)

[Setting up and Running a Small Fruit or Vegetable Processing Enterprise: Opportunities in Food Processing](#) CTA

[Starting a Small Food Processing Enterprise](#) by Peter Fellows, Ernesto Franco & Walter Rios
Practical Action Publishing/CTA 1996

[Small Scale Food Processing](#) 2nd Ed. P Fellows & S Azam Ali, Practical Action Publishing, 2003

[Fruit and Vegetable Processing](#) UNIFEM Practical Action Publishing, 1993

This document was produced by Dr. S Azam Ali for Practical Action March 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.

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: inforsew@practicalaction.org.uk
Website: <http://practicalaction.org/practicalanswers/>

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.