
Declarations under Rule 4.17:
— as to applicant’s entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.
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EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

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A PROCESS FOR PREPARING TOMATO POWDER AND PRODUCTS THEREOF

FILED OF THE INVENTION

The present invention relates to a process for preparing dry sliced/dry diced/dry tomato powder and products thereof having improved organoleptic properties.

PRIOR ART AND BACKGROUND OF THE INVENTION

Reference may be made to Gupta, R.G. and Nath, N. 1984. Drying of tomatoes. J. Food Sci. and Tech. 21(6) 373-376, wherein ripe tomatoes of Pusa Ruby var. were blanched in boiling brine for 10 seconds and cooling in water. The blanched tomatoes were made into slices 1, 2 and 3 cm thick and spread on wire mesh trays at the rate of 6.28kg/m2. The slices were dried in the sun and tray dryers. Sun dried tomatoes contained higher moisture than tray dried tomatoes. Dehydration ratio was higher in sun dried product compared to tray dried product. Blanching whole tomatoes, slicing into 1 cm pieces and sun drying gave a good dried product than from tray drying. The main draw back of this process is it advocates sun drying during which the product may be contaminated with dust and other extraneous matter, also the process does not involve the preparation of tomato powder.

Reference may be made to Icera, M. 1988. Dried tomatoes, French patent application FR 861024, wherein tomatoes are halved, the seeds are removed and the halves are sun dried and then packaged in jars, optionally with added anchovies, red pepper, herbs, etc., and the jars are filled with olive oil and sealed. The main draw back of this process is it involves sun drying and does not involve the preparation of tomato powder.

Reference may be made to Olorunda, A.O., Aworh, O.C. and Onuoha, C.N. 1990. Upgrading quality of dried tomato: effects of drying methods, conditions and pre-drying treatments. J of Sci. Fd. & Ag. 52(4) 447-454, wherein tomato pieces dried using through flow and cross flow air patterns. Moisture removal was faster for through flow than for cross flow drying. Lower moisture content and improved appearance were achieved by dipping tomato slice in 30% NaCl or in a solution containing 0.9% potassium metabisulfite and 10% NaCl for 3 min or by adding NaCl 33 gram per kg tomato slurry prior to sun or oven drying. The main draw back of this process is it involves using very high concentrations of NaCl and also the process does not involve the preparation of tomato powder.

Reference may be made to Aminov, M.S. and Kaziakhmedov, M.N. 1981. Manufacture
of tomato powder by foam mat drying. Konservnaya-I-Ovoshchesushil'naya-Promyshlennost'; No.1, 38-39, wherein concentrated tomato juice is foamed and dried in special equipment; the juice being foamed by adding distilled monostearate of glycerine as a 5% water suspension. The drying is intensified and reduced to half time compared to traditional methods. There are only slight changes in the main chemico-technological indices, except for vitamin C, carotene and lycopene contents. Amino N rises gradually, as well as reducing sugars, which may be due to the partial hydrolysis of sugars and proteins during drying. The main drawback of this process is that it is very cumbersome and energy requirement is very high since it involves evaporation and drying using special equipment.

Reference may be made to Dall 'Aglio,G., Carpi,G and Porretta, A. 1980. Importance of granulation of drum dried tomato powder, Industria Conserve, 55 (1)3-8, wherein optimum conditions for dehydration of tomato paste on a double drum drier were reported. The degree of fineness of grinding was evaluated in relation to the color and reconstitution of the powder and particle size of 0.8 mm was better than 100μm. The main draw back of this process is it advocates use of drum drying which is highly energy intensive and the product may be highly hygroscopic.

Reference may be made to Sukhanova, L.I. and Korneva-L.Y.A. 1977. Method of obtaining rapidly soluble dry tomato powder, USSR patent 581919, wherein tomatoes are washed, crushed and comminuted, the water is evaporated off, starch is added and the product is spray dried. For agglomeration of powder particles and to improve reconstitution, starch is added at 2-3% of the finished product dry weight and is added as a mixture with tomato powder during spraying. The main drawback of this process is it involves evaporation of tomato juice, addition of starch and spray drying which are highly energy intensive and high capital cost.

Reference may be made to Henig, Y. and Mannheim, C.H. 1971. Drum drying of tomato concentrate, Food Technology, 25(2) 157-160, wherein tomato powder was prepared from concentrates of the Roma and VF-145 varieties using a modified atmospheric double drum drier. The best product was obtained at 134-143°C for 10-11 sec retention time. Moisture content and browning were lower in the powder made from VF-145 powder compared with the Roma variety. The main draw back of this process is it involves high capital intensive equipment with high energy consumption.

Reference may be made to Baloch, W.A., Saifulla Khan, and Baloch, A.K. 1997.
Influence of chemical additives on the stability of dried tomato powder, Int. J. of Fd. Sci & Tech., 32(2) 117-120, wherein effect of tomato slices dipped in 1% calcium chloride, 2% potassium metabisulfite or 2% sodium chloride solutions before oven drying. CaCl₂ greatly increased carotenoid loss after 30 days and the loss was complete at 90 days, whereas metabisulfite decreased losses over most of the storage period. CaCl₂ had no effect on browning whereas metabisulfite and NaCl had little or no effect on the rate of browning, but reduced initial browning during drying. The untreated powder exceeded the shelf life criteria by the end of drying to about 12% moisture content. The main drawback of this process is the carotenoids of tomato were completely lost during storage.

Reference may be made to Melz, F.E. 1969. Process for production of a dry tomato concentrate. West German Patent Application, 1924490, wherein tomato powder is obtained by concentrating tomato juice until it has a solids content of 12-13%, adding an emulsifier, such as flour, starch etc., and heating until the substance thickens. The mixture is roller dried and ground to powder form. The main drawback of this process is it requires concentration of tomato juice, use of emulsifier which are not permitted in most of the countries and also roller drying which is highly energy intensive.

Reference may be made to Lomelin, Juan, M. and Vaquerio, Mario, C, 1991, Process for dehydrating tomatoes, US patent 5035909 wherein tomatoes are dehydrated by selecting red, ripe tomatoes and washing the selected tomatoes with a biocide and then rinsing with fresh water. The rinsed fruit is cut into approximately cubical chunks and blanched by heating the chunks to a temperature at or below the boiling point of water for a period of less than 10 minutes to inactivate the enzymes contained in the tomato. The blanched tomatoes are cooled to room temperature and then pulped. After removing skin and seeds to form a tomato juice from the pulp chunks, the juice is evaporated under vacuum to form a paste like concentrate having a solid content from about 20% to about 35%. Air trapped in the concentrate is removed, the concentrate is then formed into pieces and dried until the moisture content of the pieces is between about 3% and about 4%. The main drawback of this process is it involves blanching, cutting into chunks, pulping and evaporation which is a laborious process and energy consuming.

Reference may be made to Durance, T.D., Wang, J, H. and Meyer, R.S. 1999. Process for drying mango and pineapples, US patent 5962057, wherein a vacuum microwave dehydration process for drying fresh mango and pineapple fruit pieces at low temperatures was described. The product has fresh uncooked flavor and a unique crunchy
texture with little or no shrinkage. The main drawback of this process it involves coating of sugar to fruit pieces and drying which is not desirable for the preparation of tomato powder.

Reference may be made to Jacobellis, M. 1990. Method for making dried powdered fruit or vegetable salad, US4970089, wherein a method for making a fruit and vegetable salad is disclosed which consists of masticated produce which is freeze dried to produce a powder and combining said powders to create an easily swallowed, digested and assimilated salad. The main drawback of this process is it involves freeze drying which is highly energy intensive operation.

Tomato powder prepared from the process developed by the present invention can be used in various food preparations such as soup formulations, curries, instant mixes etc., The tomato powder developed in this invention had deep red color with a characteristic tomato flavor. The tomato powder is also a rich source of lycopene with antioxidant activity. The tomato powder packed in flexible packaging material is stable at ambient temperature. The instant mixes formulated with the tomato powder were highly acceptable.

OBJECTS OF THE INVENTION

The main object of the present invention is to provide a process for the preparation of dry sliced/dry diced/dry tomato powder and products thereof which obviates the drawbacks as detailed above.

Another object of the present invention is to develop a process for preparing dehydrated tomato slices, dehydrated diced tomato with better retention of color.

Still another object of the present invention is to provide a process for the preparation of tomato powder with improved functional properties.

Yet another object of the present invention is to provide a process for preparing the tomato powder with less non enzymatic browning.

SUMMARY OF THE INVENTION

Accordingly, the present invention provides a process for the preparation of dry sliced tomato/dry diced tomato/dry tomato powder and products thereof which comprises washing of deep red color tomatoes, slicing them into 2 mm to 5 mm thickness or dicing into 10 mm × 10 mm, treating the slices or dices by immersing in calcium chloride solution or calcium gluconate solution or calcium lactate solution or potassium metabisulfite solution or a combination thereof for a period of 60 seconds to 600 seconds
to effect antibrowning quality; loading the treated material on trays at the rate of 7 to 7.5 kg per square meter, drying the material at 50-75°C for a period of 2-4 hours followed by drying at 40-55°C to bring down the moisture content to less than 7%, allowing the dried material to equilibrate at ambient temperature for 6-24 hours, milling the equilibrated dried material to a mesh size ranging from 20-100 mesh, adding anti caking agent such as tricalcium phosphate or silicon dioxide at the rate of 0.1 to 1% to the powder, packing the powder in flexible packaging material such as 400 gauge low density polyethylene or metallized polyester or aluminium laminated pouches.

**DETAILED DESCRIPTION OF THE INVENTION**

According to the present invention, there is provided a process for preparing dry sliced tomato/dry diced tomato/ dry tomato powder having improved organoleptic properties, said process comprising the steps of:

(a) slicing or dicing the tomato;
(b) treating the slices or dices obtained in step (a) by immersing in calcium chloride solution or calcium gluconate solution or calcium lactate solution or potassium metabisulfite solution or a combination thereof for a period of 60 seconds to 600 seconds;
(c) loading the treated tomato slices or dices obtained in step (b) on trays;
(d) drying the loaded tomato at a temperature in the range of 50-75°C for a time period in the range of 2 - 4 hours followed by drying at 40-55°C to bring down the moisture content to less than about 10% and allowing the same to equilibrate at ambient temperature for 6-24 hours to obtain dry sliced tomato or dry diced tomato, and
(e) optionally, milling the equilibrated dried tomatoes and adding anti caking agents at the rate of 0.1 to 1% by weight to obtain dry tomato powder.

In an embodiment of the present invention, the tomatoes of bright red color and firm texture are washed and cut into slices of 2.5 mm to 5 mm or diced into cubes of about 10 mm × 10 mm size.

In a further embodiment of the present invention, the cut tomatoes are treated with calcium chloride solution or calcium lactate solution or calcium gluconate solution, or potassium metabisulfite solution or a combination thereof to effect the antibrowning quality in the dried material.

In another embodiment of the present invention, the cut tomatoes are immersed in
aqueous calcium chloride solution having 0.1 g to 4.0 gm of calcium chloride per 100 ml of water.

In yet another embodiment of the present invention, the cut tomatoes are immersed in aqueous calcium gluconate solution having 0.1 g to 4.0 gm of calcium gluconate per 100 ml of water.

In still further embodiment of the present invention, the cut tomatoes are immersed in calcium lactate solution having 0.1 g to 4.0 gm of calcium lactate per 100 ml of water.

In another embodiment of the present invention, the cut tomatoes are immersed in potassium metabisulfite having 0.5 g to 2.0 gm of potassium metabisulfite per 1000 ml of water.

In yet another embodiment of the present invention, the treated tomatoes are dried initially at 50-75°C in a hot air drier to reduce the moisture content to about 40-50% and later at 40-55°C to reduce the moisture content to less than 7%.

In a further embodiment of the present invention, the dried tomatoes are ground to a mesh size in the range of 25 – 100 mesh.

In yet another embodiment of the present invention, the anticaking agents used are selected from tricalcium phosphate or silicon dioxide.

In still further embodiment of the present invention, the dry sliced tomato/dry diced tomato/ dry tomato powder is packed in flexible packing material such as low density polyethylene or aluminium laminated pouches.

In yet another embodiment of the present invention the treated tomatoes are dried initially at 50-75°C in a hot air drier to reduce the moisture content to about 40-50% and later at 40-55°C to reduce the moisture content to less than 10%.

In still another embodiment of the present invention the dried tomato slices are ground to 25 mesh to 100 mesh, and optionally adding the anticaking agents such as tricalcium phosphate or silicon dioxide.

These and other objects are achieved, according to the invention where the present invention provides a process for the preparation of dry sliced tomato/dry diced tomato/dry tomato powder and products thereof, which comprises selection of deep red color tomatoes, washing, slicing into 2 mm to 5 mm or diced to 10 mm × 10 mm, treating the slices or dices by immersing in a solution comprising 0.1 g to 2.0 g of calcium chloride or 0.1 g to 2.0 g of calcium gluconate or 0.1 g to 2.0 g of calcium lactate or 0.5 g to 2.0 g of potassium metabisulfite or a combination of any two or more of these salts
to effect the desired quality, for a period of 60 seconds to 600 seconds, loading the treated material on trays at the rate of 7 to 7.5 kg per square meter, drying the material at 60-75°C for a period of 2-4 hours followed by drying at 40-55°C to bring down the moisture content to less than 7%, allowing the dried material to equilibrate at ambient temperature for 6-24 hours, packing the material as such or milling the equilibrated dried material to a mesh size ranging from 20-100 mesh to transform into tomato powder, adding anticaking agent such as tricalcium phosphate or silicon dioxide at the rate of 0.1 to 1% to the tomato powder, packing the powder in flexible packaging material such as 400 gauge low density polyethylene or metallized polyester or aluminium laminated pouches.

The novelty and innovative steps of the process developed in the present invention includes treating the sliced/diced tomatoes with calcium chloride solution or calcium gluconate solution or calcium lactate solution or potassium metabisulfite solution or a combination thereof for a period of 60 seconds to 600 seconds and drying the treated tomatoes in two stages wherein the treated tomatoes are first dried at 60-75°C for a period of 2 – 4 hours to reduce moisture content to 40-50% and then the same is dried at 40-55°C to bring down the moisture content to less than 7%. Also, the step of equilibrating the dry sliced/diced tomato plays a vital role on the characteristics of the final product obtained. The inventors have surprisingly found that by following the process of the present invention, the carotenoid content in the dried product obtained is preserved to a very large extent. In addition, no substantial loss in the carotenoid content is observed over a period of six months. Thus, the present invention provides a process for the preparation of dried tomato slices, diced tomato, tomato powder with better color retention and organoleptic properties. These products are stable at room temperature when packed in flexible packaging materials.

The following examples are given by way of illustration of the present invention and therefore should not be construed to limit the scope of the present invention.

**EXAMPLE-1**

Tomatoes of deep red variety were selected. The tomatoes were washed, and sliced through a slicer to obtain slices of 2.5 mm thickness. The tomato slices (10kg) were dipped in 10 liter solution containing 50 grams of calcium chloride and 5 grams of ascorbic acid for 5 minutes and drained. The treated tomato slices were loaded on a 60 mesh tray at the rate of 7 kg per square meter. The material was dried at 70°C for four
hours followed by drying at 55°C to reduce the moisture content to 4%. The dried tomato slices were allowed to cool to ambient temperature. The tomato slices were ground to 60 mesh in a mill. The tomato powder (0.45kg) thus obtained was packed in LDPE pouches of 400 gauge with a secondary packing of corrugated fiber board box.

EXAMPLE-2

Tomatoes of deep red variety with firm texture were selected. The tomatoes were washed, and passed through a dicing machine to obtain dices of 10 mm x 10 mm dimension. The tomato dices (10kg) were dipped in 10 liter solution containing 100 grams of calcium chloride and 5 grams of ascorbic acid for 2 minutes and drained. The treated tomato dices were loaded on a mesh tray at the rate of 7 kg per square meter. The material was dried at 65°C for three hours followed by drying at 50°C to reduce the moisture content to 4%. The dried diced tomato were allowed to cool to ambient temperature. The diced tomato dices were ground to 70 mesh in a mill. The tomato powder (0.45kg) thus obtained was packed in LDPE pouches of 400 gauge with a secondary packing of corrugated fiber board box.

EXAMPLE-3

Tomatoes of deep red variety with firm texture were selected. The tomatoes were washed, and passed through a slicing machine to obtain slices of 5 mm thickness. The tomato slices (10kg) were dipped in 10 liter solution containing 50 grams of calcium chloride and 50 grams of calcium gluconate for 4 minutes and drained. The treated tomato slices were loaded on a tray at the rate of 7 kg per square meter. The material was dried at 60°C for four hours followed by drying at 50°C to reduce the moisture content to 4%. The dried tomatoes were allowed to cool to ambient temperature. The dried tomato slices were ground in a mill. The tomato powder (0.5kg) thus obtained was packed in LDPE pouches of 400 gauge with a secondary packing of corrugated fiber board box.

EXAMPLE-4

Tomatoes of deep red variety with firm texture were selected. The tomatoes were washed, and passed through a slicing machine to obtain slices of 5 mm thickness. The tomato slices (5kg) were dipped in 5 liter solution containing 20 grams of calcium lactate, 30 grams of calcium chloride and 20 grams of calcium gluconate for 4 minutes and drained. The treated tomato slices were loaded on a tray at the rate of 7.5 kg per square meter. The material is dried at 65°C for four hours followed by drying at 50°C to
reduce the moisture content to 4%. The dried tomato slices are allowed to cool to ambient temperature and were ground in a mill. The tomato powder (0.1kg) thus obtained was packed in LDPE pouches of 400 gauge with a secondary packing of corrugated fiber board box.

**EXAMPLE-5**

Tomatoes of deep red variety with firm texture were selected. The tomatoes were washed, and passed through a slicing machine to obtain slices of 5 mm thickness. The tomato slices (5kg) were dipped in 5 liter solution containing 50 grams of calcium gluconate and 5 grams of potassium metabisulfite for 3 minutes and drained. The treated tomato slices were loaded on a tray at the rate of 7.5 kg per square meter. The material is dried at 65°C for four hours followed by drying at 50°C to reduce the moisture content to 4%. The dried tomato slices are allowed to cool to ambient temperature and were ground to in a mill. The tomato powder (0.1kg) thus obtained was packed in LDPE pouches of 400 gauge with a secondary packing of corrugated fiber board box.

**Sensory Profile Score**

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The main advantages of the present invention are:

1. The process developed in the present invention is useful for the preparation of dried tomato slices, diced tomato and tomato powder.
2. Tomato powder prepared by the present process has better color, consistency, flavor, taste and overall quality retention.
3. Tomato powder packed in suitable flexible packaging material is stable at ambient temperature for a period of not less than 6 months.
4. Tomato powder prepared from the process developed in the present invention can be used to prepare various products where tomatoes are used.
5. Tomato powder prepared by the process developed in the present invention did not show substantial reduction in carotenoid content over a period of six months.
We claim

1. A process for preparing dry sliced tomato/dry diced tomato/dry tomato powder having improved organoleptic properties, said process comprising the steps of:
   (a) slicing or dicing the tomato;
   (b) treating the slices or dices obtained in step (a) by immersing in CaCl₂ solution or calcium gluconate solution or calcium lactate solution or potassium metabisulfite solution or a combination thereof for a period of 60 seconds to 600 seconds;
   (c) loading the treated tomato slices or dices obtained in step (b) on trays;
   (d) drying the loaded tomato at a temperature in the range of 50-75°C for a time period in the range of 2 - 4 hours followed by drying at 40-55°C to bring down the moisture content to less than about 10% and allowing the same to equilibrate at ambient temperature for 6-24 hours to obtain dry sliced tomato or dry diced tomato, and
   (e) optionally milling the equilibrated dried tomatoes and adding anti caking agents at the rate of 0.1 to 1% by weight to obtain dry tomato powder.

2. A process as claimed in claim 1 wherein, the tomatoes of bright red color and firm texture are washed and cut into slices of 2.5 mm to 5 mm or diced into cubes of about 10 mm x 10 mm size.

3. A process as claimed in claim 1 or 2 wherein the cut tomatoes are treated with aqueous calcium chloride solution or aqueous calcium lactate solution or aqueous calcium gluconate solution or aqueous potassium metabisulfite solution or combination thereof to effect the antibrowning quality to the dried material.

4. A process as claimed in claim 3 wherein the cut tomatoes are immersed in aqueous CaCl₂ solution having 0.1 g to 4.0 gm of calcium chloride per 100 ml of water.

5. A process as claimed in claim 3 wherein the cut tomatoes are immersed in aqueous calcium gluconate solution having 0.1 g to 4.0 gm of calcium gluconate per 100 ml of water.

6. A process as claimed in claim 3 wherein the cut tomatoes are immersed in aqueous calcium lactate solution having 0.1 g to 4.0 gm of calcium lactate per 100 ml of water.
7. A process as claimed in claim 3 wherein the cut tomatoes are immersed in aqueous potassium metabisulfite solution having 0.5 g to 2.0 gm of potassium metabisulfite per 1000 ml of water.

8. A process as claimed in any one of claims 1 to 3 wherein the treated tomatoes are dried initially at 50-75°C in a hot air drier to reduce the moisture content to about 40-50% and later at 40-55°C to reduce the moisture content to less than 7%.

9. A process as claimed in any one of claims 1 to 4 wherein the dried tomatoes are ground to a mesh size in the range of 25 – 100 mesh.

10. A process as claimed in any one of claim 1 wherein the anticaking agents used are selected from tricalcium phosphate or silicon dioxide.
### INTERNATIONAL SEARCH REPORT

**Category A**

**IPC 7**

**A23L1/212**

**A23B7/022**

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

**IPC 7**

**A23L**

**A23B**

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

**EPO-Internal, WPI Data, PAJ**

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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<td>A</td>
<td>US 5 389 389 A (BECK RODERICK G) 14 February 1995 (1995-02-14) claims 1,2,4,8-11,32-41,49-51,55,56</td>
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<td>US 5 645 876 A (SUBRAMANIAM PERSIS JEBAKUMARI ET AL) 8 July 1997 (1997-07-08) claims example 3</td>
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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

* Special categories of cited documents:

  *A* document defining the general state of the art which is not considered to be of particular relevance
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Date of the actual completion of the international search: 31 August 2004

Date of mailing of the international search report: 10/09/2004

Name and mailing address of the ISA:

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Neyes, P
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