**Title:** METHOD OF MANUFACTURING DIET CHIPS OF VEGETABLES AND FRUITS

**Abstract:** The invention concerns a process of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples. The process is characterised in that the vegetables and fruits are cut into slices, and then blanched (carrots), undergo an enzymatic treatment (carrots and apples) and an enzymatic-chemical modification (bananas) and then are saturated in a solution of primary composition: saccharose amounting for 15.35% of mass, acid mixture: citric and ascorbic amounting for 0.11-0.14% of mass. Saturation parameters: room temperature, time /1-5 min/. Depending on the example of method, and the invention includes twelve examples, the composition of saturating solution alters. After the saturation of sliced vegetables and fruits, the drying is taking place: for bananas, carrots and celeries in a single layer. Drying parameters: temperature of 70-110 °C, time /240-250 min/. air stream speed of /3.5-5.0 m/s/. Drying of carrots includes two stages: drying during /1 h/ and drying out during /1 h+. Aromaflavour additions can be included in a saturating solution, as well as they can be used to sprinkle the product with them.
METHOD OF MANUFACTURING DIET CHIPS OF VEGETABLES AND FRUITS

The invention concerns a method of manufacturing diet chips of vegetables and fruits, applied in food processing, especially of carrots, celeries, bananas and apples, which provides a low-calorie product of delicate, porous structure, crispy and of very good flavour properties and pleasant colour.

Products of that art are known in many countries throughout Europe and America and are manufactured in many different methods.

A method of manufacturing chips of apples according to the US patent description No 4514428 is known. In the method, fruits are cut into slices 1,3-2,2 thick and then saturated in a saturating solution comprising: saccharose and corn syrup solution and a mixture of: saccharose, dextrose and starch hydrolys. Saturation parameters are: temperature 37-60°C and time of 3-10 min. Saturated slices are dried at high temperature of 121-143°C and during 24 min, which provides a final humidity of 3%.

Another method of manufacturing chips of fruits (apples and pears) according to the US patent description No 4547376 is known. Instead of saturating in a solution, one side of slices, spread on a single layer on the
floor at a room temperature, is sprayed with carbohydrate solution, which lasts 15-30 seconds. The slices are then dried at rather high temperature of 115-176°C.

A method of manufacturing chips of fruits and vegetables is also known from the US patent description No 4889730, in which shredded fruits and vegetables are saturated in a solution that is a mixture of organic acids, sodium chloride, alternatively with addition of sulphur dioxide and carbohydrates, which occur on form of glucose, fructose as well as maltose, saccharose and fruit sugars; fruit juice concentrates and corn syrup are also added. Saturated fruits and vegetables are dried.

A method of manufacturing chips of fruits and vegetables is also known from the US patent description No 5000972, in which shredded fruits and vegetables undergo a pre-treatment using reducing and non-reducing organic acids with parallel use of chelate-forming factors and factors that disable microbiological changes. During saturation of raw material in a carbohydrate solution the reducing sugars, that occur in fruits and vegetables, are substituted with non-reducing sugars. The saturating solution plays a structure-forming role, and natural components in form of organic acids and sodium chloride allow the end-product to maintain a light colour, and simultaneously maintain the right flavour of a product.

A method employing osmosis and ventilation drying of fruits and vegetables is known from the Polish patent description No 150040. In this process shredded fruits and vegetables and thermally processed in 10-15% osmotic solution with addition of 0,5% ascorbic acid at a temperature of 70-90°C during 3-5 min, the product is then cooled down through immersion in 10-15% osmotic solution at a temperature of 10-15°C. Following steps are: the semi-finished product is dehydrated in an osmotic solution of water activity $a_w=0.85-0.90$ and comprising: glucose, saccharose, starch syrup, fruit juice concentrate, ascorbic acid, at a temperature of 30-70°C, the semi-finished product is then washed with water at a temperature of 30°C in a water bath and subjected to surface drying in an air stream at a temperature
of 20-40°C during 3-5 min. Finally, the semi-finished product is dried in a ventilation drier at a temperature of 70-80°C in the time of 3-5 h.

A method of manufacturing diet chips of fruits is also known from the Polish patent description No 176824. It consists in saturating sliced fruits in a saturating solution comprising saccharose solution amounting for 10-40% of mass, concentrated fruit juice amounting for 5-10% of mass, a mixture of citric acid amounting for 0,5-1,5% of mass and ascorbic acid amounting for 0,5-1,5% of mass or acid sodium sulphite amounting for 0,1-0,2% of mass instead of the acid mixture, or pro-long mixture amounting for 0,5-1,0% of mass comprising mono- and biglicerides of fatty acids, CM-cellulose sodium salt and saccharose esters of fatty acids. Saturation parameters: room temperature, time 2-5 min. After the saturation, the sliced fruits are filtered off and dried at a temperature of 70-110°C and in the time of 30-120 min, until the water content in a dry mass reaches 3,0-4,5%.

In another variant of this method, after saturating slices in a saturating solution without a Pro-long mixture, the slices are sprayed or immersed (in next stages) for 10-20 sec in a Pro-long mixture of a mass concentration of 0,5-1,0%, comprising mono- and biglicerides of fatty acids, CM-cellulose sodium salt and saccharose esters of fatty acids, and then dried to a humidity of 3,0-4,5%.

The invention relates to a method of manufacturing diet chips of vegetables and fruits, characterised in that, the initial raw material is cut, preferably into slices, then the sliced raw material is blanched, in case of carrot, in the first operation in a hot water at a temperature 70-95°C during 12-16 sec. or immediately undergoes an enzymatic treatment in the way, that the slices are immersed in an enzyme water solution with cellulase activity and enzyme concentration of 18-22g/litre water at a room temperature in the time of 45-80 sec., then the slices are saturated in a saturating solution comprising, by mass, 15-35% saccharose solution with addition of 0,11-0,14% sulphur dioxide and a mixture 0,28-0,35% citric acid and 0,28-0,35%
ascorbic acid during 1-2 min in a room temperature, then the slices are dried on a single layer spread on the floor, preferably on a dense metal sieve, at a temperature of 70-110°C during 1 h at the air stream speed of 3,5-5,0 m/s, after which dried slices are slid from a number of sieves on one and the drying is completed at a temperature of 70-110°C during 1 h at the air stream speed of 3,5-5,0 m/s or the slices are dried from the beginning during 1,8-2,2 h at foregoing parameters to the final humidity of 1-3%. Moreover, suitable aroma-flavour additions are used, depending on the kind of desired flavour. Those additions are added to the saturating solution in a concentration of 1-5%, and for intensifying the aroma and flavour qualities, direct before the packaging into individuals packages, the still warm chips are additionally sprinkled with aroma-flavour additions or those additions' quantities are left, that were added into the saturating solution, while at the packaging into individual packages, inert gases are used, preferably the nitrogen.

In the first example of the method, employed to the manufacturing of chips of carrot, the aroma-flavour additions are added only in the way that the single layer of slices spread over a sieve is sprinkled with those additions only direct before drying, while the other operations, substances and parameters are not altered.

In the second example of the method, employed to the manufacturing of chips of carrot, the aroma-flavour additions are added only in the way that the dried slices are initially dusted with 30-40% water solution of sorbitol, then are sprinkled with suitable aroma-flavour additions and the drying is completed at a temperature of 90-150 °C during 10-15 min at the air stream speed of 1,0-2,0 m/s, while the other operations, substances and parameters are not altered.

In the third example of the method, employed to the manufacturing of chips of carrot, the aroma-flavour additions are added only in the way that they are introduced to the final product employing no solution but in a mixture with modified starch and then thermally fixed at a temperature of 120-150 °C during 4-6 min at the air stream speed of 0,5-2,0 m/s, while the other operations, substances and parameters are not altered.
In the fourth example of the method, employed to the manufacturing of chips of carrot, an addition of 0.5-2.5 g of alpha-tocopherol (vitamin E) is introduced to the saturating solution in a water soluble form or in a fat-soluble form, in which case the addition is distributed in 2.5 g of glycerol at a concentration of 89% - as a total dose for 1000 g of a solution, while the other operations, substances and parameters are not altered.

In the fifth example of the method, employed to the manufacturing of chips of carrot, an addition of 0.5-2.5 g of alpha-tocopherol (vitamin E) is introduced to the saturating solution in a water soluble form or in a fat-soluble form, in which case the addition is then distributed in 2.5 g of glycerol at a concentration of 89% - as a total dose for 1000 g of a solution, and the aroma-flavour additions are added only in the way that the single layer of slices spread over a sieve is sprinkled with those additions only direct before drying, while the other operations, substances and parameters are not altered.

In the sixth example of the method, employed to the manufacturing of chips of carrot, an addition of 0.5-2.5 g of alpha-tocopherol (vitamin E) is introduced to the saturating solution in a water soluble form or in a fat-soluble form, in which case the addition is then distributed in 2.5 g of glycerol at a concentration of 89% - as a total dose for 1000 g of a solution, and the aroma-flavour additions are added only in the way that the dried slices are initially dusted with 30-40% water solution of sorbitol, then are sprinkled with suitable aroma-flavour additions and the drying is completed at a temperature of 90-150°C during 10-15 min at the air stream speed of 1.0-2.0 m/s, while the other operations, substances and parameters are not altered.

In the seventh example of the method, employed to the manufacturing of chips of carrot, an addition of 0.5-2.5 g of alpha-tocopherol (vitamin E) is introduced to the saturating solution in a water soluble form or in a fat-soluble form, in which case the addition is then distributed in 2.5 g of glycerol at a concentration of 89% - as a total dose for 1000 g of a solution, and the aroma-flavour additions are added only in the way that they are introduced to the final product employing no solution but in a mixture with modified starch
and then thermally fixed at a temperature of 120-150 °C during 4-6 min at the air stream speed of 0,5-2,0 m/s, while the other operations, substances and parameters are not altered.

In the eighth example of the method, employed to the manufacturing of chips of haulm celery, the sliced raw material is immediately saturated in a saturating solution, comprising, by mass, 15-35% saccharose solution with addition of 0,11-0,14% sulphur dioxide and 0,28-0,35% citric acid, and during a single stage drying an air stream speed of 2,0-2,5 m/s is applied during 60-120 min. Moreover, only flavour additions are used, preferably ground hazelnuts or walnuts or their mixture, and they are added only to the saturating solution, while the other operations, substances and parameters are not altered.

In the ninth example of the method, employed to the manufacturing of chips of celery, the sliced raw material is immediately saturated in a saturating solution, comprising, by mass, 15-35% saccharose solution with addition of 0,11-0,14% sulphur dioxide and 0,28-0,35% citric acid, and during a single stage drying an air stream speed of 2,0-2,5 m/s is applied during 60-120 min. Moreover, only flavour additions are used, preferably ground hazelnuts or walnuts or their mixture and they are added only in the way that the slices are sprinkled with those additions just before drying, while the other operations, substances and parameters are not altered.

In the tenth example of the method, employed to the manufacturing of chips of banana, in the first operation sliced bananas undergo an enzymatic and chemical modification in the way that banana slices are put into a water bath of enzyme solution at a 2-10% concentration, with pectinesterase activity at a temperature of 40-50°C during 10-15 min, after which the bath is changed to 0,4-0,6% calcium chloride solution and is kept during 0,8-1,2 min, whereas in a saturating solution the citric and ascorbic acids' mixture is substituted for citric acid amounting for 0,22-0,30% of mass and the saturation time is 1-5 min. However, during a single stage drying a time of 3,5-4 h and the air stream speed of 3,5-5,0 m/s are applied, whereas no
aroma-flavour additions are introduced, while the other operations, substances and parameters are not altered.

In the eleventh example of the method, employed to the manufacturing of chips of apples, seed chambers and leaf stalks are removed or not, and as a first operation, enzymatic treatment of slices in a enzyme water solution is employed or not, while in a mixture of citric and ascorbic acids, added to the saturating solution, an amount of both acids is increased to 0.5-2.0% of mass, and acid sodium sulphite, alternatively substituting the acid mixture, amounts for 0.08-0.22% of mass; and moreover, the vitamin C, in an amount up to 1.5%, preferably up to 1.0%, is added to the saturating solution. A well known Pro-long mixture, that comprises mono- and biglicerides of fatty acids, CM-cellulose sodium salt and saccharose ester of fatty acids amounting for 0.5-1.0% of mass, can be added or not, whereas other emulsifiers can be substituted for the Pro-long mixture. Dye or natural dyes are also included in a saturating solution, depending on a need, in order to change chips colour to a desired colour, while saturation time is 2-5 min, and after the saturation, slices are filtered off and dried in a single stage during 240-250 min, at the air stream speed of 3.5-5.0 m/s, while the other operations, substances and parameters are not altered.

In the twelfth example of the method, employed to the manufacturing of chips of apples, seed chambers and leaf stalks are removed or not, and as a first operation, enzymatic treatment of slices in a enzyme water solution is employed or not, and in saturating solution, the saccharose solution is substituted by a mixture of apple juice concentrate with sorbitol or interchangeably with one of the following syrups: starch, corn or glucose, adding acesulfam K or aspartam, while in a mixture of citric and ascorbic acids, added to the saturating solution, an amount of both acids is increased to 0.5-2.0% of mass, and acid sodium sulphite, alternatively substituting the acid mixture, amounts for 0.08-0.22% of mass, and moreover, the vitamin C, in an amount up to 1.5%, preferably up to 1.0%, is added to the saturating solution. A well known Pro-long mixture, that comprises mono- and biglicerides of fatty acids, CM-cellulose sodium salt and saccharose ester of
fatty acids amounting for 0.5-1.0% of mass, can be added or not, whereas other emulsifiers can be substituted for the Pro-long mixture. Dye or natural dyes are also included in a saturating solution, depending on a need, in order to change chips colour to a desired colour, while saturation time is 2-5 min, and after the saturation, slices are filtered off and dried in a single stage during 240-250 min, at the air stream speed of 3.5-5.0 m/s, while the other operations, substances and parameters are not altered.

The method according to the invention provides a product of very good flavour properties, aromatic, highly nutritious, crispy, low-calorie and of delicate, porous structure. Enzymatic treatment decreases hardness of the product and improves the colour, while an application of sorbitol facilitates covering slices with aroma-flavour additions, and an employed enzyme-chemical modification of banana slices reduces the susceptibility of the product to stick to the floor.

Short saturation times are enough to superficial saturation of raw material tissues with sugars, protects product's colour and also reduces excessive osmotic dehydration and eliminates leaching of useful nutrients from the product, as well as reduces a loss of material's aroma.

Drying temperature is lower than the temperature known from the state of the art, which prevents carmelisation of sugars, and a slightly higher temperature at final drying is associated with a short time of this process, which produces the same effect as above. With temperature values in the method according to the invention, more even vaporisation is achieved than at higher temperatures, which facilitates keeping the right proportion between surface and material's interior dehydration grades. Relatively high value of drying speed accelerates the abstraction of evaporated moisture. Removal of fructose solution in one of the method's examples from the saturating liquid and its substitution with a mixture of apple juice concentrate with sorbitol or alternatively with one of the juices: starch, corn or glucose, with addition of acesulfam K or aspartam, makes it possible to obtain a high quality product for diabetics.
The method of manufacturing chips of fruits and vegetables is explained in detail in the embodiments of the invention:

Example I
After cleaning and washing a carrot is cut into slices 1,2 mm thick and undergoes a treatment
1. Pre-treatment
   1.1. Blanching through slices’ immersion in:
         • A hot water at a temperature of 80 °C and
         • Immersion time of 15 sec
   1.2. Enzymatic treatment through immersion in:
         • enzyme water solution of a concentration of 20g/litre water in
         • room temperature (20 °C) and
         • immersion time of 60 sec

2. Primary process
   2.1. Saturation of slices in a solution comprising:
         • saccharose solution amounting for 25% of mass
         • an addition of sulphur dioxide amounting for 0,12% of mass
         • citric acid amounting for 0,3% of mass
         • ascorbic acid amounting for 0,3% of mass
         • aroma-flavour addition in “Taco” powder (Dutch production)
   2.2. Saturation parameters
         • temperature 20 °C
         • time 2 min

2.3. Drying
   2.3.1. First stage
         • single layer of slices
         • temperature 88 °C
         • time 1 h
         • air stream speed 4,8 m/s
   2.3.2. Second stage
         • dried slices are slid from a number of sieves on one
- temperature 88 °C
- time 1 h
- air stream speed 4.8 m/s
- final humidity of about 3%

Example II
After cleaning and washing, a celery is cut into slices 2.2 mm thick and undergoes a treatment

1. Saturation of slices in a solution comprising:
   - saccharose solution amounting for 25% of mass
   - an addition of sulphur dioxide amounting for 0.12% of mass
   - citric acid amounting for 0.25% of mass
   - an aroma-flavour addition in form of a mixture of ground hazel-nuts and walnuts

2. Saturation parameters
   - Temperature of about 20 °C
   - Time 2 min

3. Drying
   - Single layer of slices
   - Temperature 85 °C
   - Time 2 h
   - Air stream speed 2.5 m/s
   - Final humidity of about 3%

Example III
After cleaning and washing, bananas are cut into slices 2.2 mm thick and undergoes a treatment.

1. Enzymatic and chemical modification before saturation:
   - Sliced bananas are immersed in an enzyme water solution
   - Enzyme concentration of 8%
· Pectinoesterase activity
· Temperature 45 °C
· Time 14 min

And then the bath is changed to:
· Calcium chloride 0.5% solution
· Time 1 min

2. Slice saturation in a solution comprising:
   · saccharose solution amounting for 25% of mass
   · an addition of sulphur dioxide amounting for 0.12% of mass
   · citric acid amounting for 0.25% of mass

3. Saturation parameters:
   · Temperature 20 °C
   · Time 4 min

4. Drying
   · Single layer of slices
   · Temperature 88 °C
   · Time 3.5 h
   · Air stream speed 4.8 m/s
   · Final humidity of about 3%

Example IV
Elstar apples are cut after washing transverse to the seed chamber into slices 2.5 mm thick and the seed chamber is removed. Sliced material undergoes a treatment.

1. Enzymatic treatment
   · Sliced apples are immersed in an enzyme water solution
   · Enzyme concentration 18g/ litre water
   · Room temperature
   · Time 1 min
2. Slice saturation in a solution comprising:
   - saccharose solution amounting for 22% of mass
   - an addition of vitamin C amounting for 1,0% of mass
   - citric acid amounting for 0,8% of mass
   - ascorbic acid amounting for 1,0% of mass
   - Pro-long mixture (mono- and biglicerides of fatty acids, CM-cellulose sodium salt and saccharose ester of fatty acids) amounting for 0,65% of mass
   - addition of vanilla powder

3. Saturation parameters
   - Room temperature
   - Time 4 min

4. Drying
   - Slices' filtering after saturation
   - Spreading slices over sieves
   - Temperature 95 °C
   - Time 240 min
   - Air stream speed 5 m/s
   - Final humidity of about 3%

Example V
Jonagold apples are cut after washing transverse to the seed chamber into slices 2,5 mm thick. Sliced material undergoes a treatment.

1. Enzymatic treatment
   - Sliced apples are immersed in an enzyme water solution
   - Enzyme concentration 18g/ litre water
   - Room temperature
   - Time 1,5 min

2. Slice saturation in a solution comprising:
   - A mixture of apple juice concentrate with sorbitol amounting for 10% of mass
• Citric acid amounting for 0,8% of mass
• Ascorbic acid amounting for 1,0% of mass
• Pro-long mixture (mono- and biglicerides of fatty acids, CM-cellulose sodium salt and saccharose ester of fatty acids) amounting for 0,65% of mass
• Addition of vanilla powder
• Addition of acesulfan K

3. Saturation parameters
• Room temperature
• Time 4 min

4. Drying
• Slices’ filtering after saturation
• Spreading slices over sieves
• Temperature 95 °C
• Time 240 min
• Air stream speed 5 m/s
• Final humidity of about 3%
PATENT CLAIMS

1. Method of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples, consisting in a saturation of sliced vegetables and fruits in an sugars solution, and then drying them, characterised in that, the initial raw material is cut, preferably into slices, then the sliced raw material is blanched, in case of carrot, in the first operation in a hot water at a temperature /70-95°C/ during /12-16 sec/ and undergoes an enzymatic treatment, or immediately undergoes an enzymatic treatment in the way, that the slices are immersed in a enzyme water solution with cellulase activity and enzyme concentration of /18-22g/litre water/ at a room temperature in the time of /45-80 sec/, then the slices are saturated in a saturating solution comprising /15-35% of mass/ saccharose solution with addition of /0,11-0,14% of mass/ sulphur dioxide and mixture of /0,28-0,35% of mass/ citric acid and /0,28-0,35% of mass/ ascorbic acid during /1-2 min/ at a room temperature, then the slices are dried on a single layer spread on the floor, preferably on a dense metal sieve, at a temperature of /70-110°C/ during /1 h/ at the air stream speed of /3,5-5,0 m/s/, after which dried slices are slid from a number of sieves on one and the drying is completed at a temperature of /70-110°C/ during /1 h/ at the air
stream speed of /3,5-5,0 m/s/ or the slices are dried from the beginning during /1,8-2,2 h/ at foregoing parameters to the final humidity of /1-3%/.

Moreover, suitable aroma-flavour additions are used, depending on the kind of desired flavour. Those additions are added to the saturating solution in a concentration of /1-5%/ and for intensifying the aroma and flavour qualities, direct before the packaging into individuals packages, the still warm chips are additionally sprinkled with aroma-flavour additions or those additions' quantities are left, that were added into the saturating solution, while at the packaging into individual packages, inert gases are used, preferably the nitrogen.

2. The process of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples, consisting in a saturation of sliced vegetables and fruits in an sugars solution, and then drying them, characterised in, that the initial raw material is cut, preferably into slices, then the sliced raw material is blanched, in case of carrot, in the first operation in a hot water at a temperature /70-95°C/ during /12-16 sec/ and undergoes an enzymatic treatment or immediately undergoes an enzymatic treatment in the way, that the slices are immersed in a enzyme water solution with cellulase activity and enzyme concentration of /18-22g/litre water/ at a room temperature in the time of /45-80 sec/, then the slices are saturated in a saturating solution comprising /15-35% of mass/ saccharose solution with addition of /0,11-0,14% of mass/ sulphur dioxide and mixture of /0,28-0,35% of mass/ citric acid and /0,28-0,35% of mass/ ascorbic acid during /1-2 min/ at a room temperature, then the slices are dried in a single layer spread on the floor, preferably on a dense metal sieve, at a temperature of /70-110°C/ during /1 h/ at the air stream speed of /3,5-5,0 m/s/, after which dried slices are slid from a number of sieves on one and the drying is completed at a temperature of /70-110°C/ during /1 h/ at the air stream speed of /3,5-5,0 m/s/ or the slices are dried from the beginning during /1,8-2,2 h/ at foregoing parameters to the final humidity of /1-3%/.

Moreover suitable aroma-flavour additions are used, depending on the kind of desired flavour, which are added only in the way that the single layer of
slices spread over a sieve is sprinkled with those additions only direct before
drying while at the packaging into individual packages, inert gases are used,
preferably the nitrogen.
3. The process of manufacturing chips of vegetables and fruits, applied in a
food industry, especially of carrots, celeries, bananas and apples, consisting
in a saturation of sliced vegetables and fruits in an sugars solution, and then
drying them, characterised in, that the initial raw material is cut, preferably
into slices, then the sliced raw material is blanched, in case of carrot, in the
first operation in a hot water at a temperature /70-95°C/ during /12-16 sec/
and undergoes an enzymatic treatment or immediately undergoes an
enzymatic treatment in the way, that the slices are immersed in a enzyme
water solution with cellulase activity and enzyme concentration of /18-
22g/litre water/ at a room temperature in the time of /45-80 sec/, then the
slices are saturated in a saturating solution comprising /15-35% of mass/
saccharose solution with addition of /0,11-0,14% of mass/ sulphur dioxide
and mixture of /0,28-0,35% of mass/ citric acid and /0,28-0,35% of mass/
ascorbic acid during /1-2 min/ at a room temperature, then the slices are
dried on a single layer spread on the floor (flat surface), preferably on a
dense metal sieve, at a temperature of /70-110°C / during /1 h/ at the air
stream speed of /3,5-5,0 m/s/, after which dried slices are slid from a number
of sieves on one and the drying is completed at a temperature of /70-110°C/
during /1 h/ at the air stream speed of /3,5-5,0 m/s/ or the slices are dried
from the beginning during /1,8-2,2 h/ at foregoing parameters to the final
humidity of /1-3%/.
Moreover suitable aroma-flavour additions are used,
depending on the kind of desired flavour, which are added only in the way
that the dried slices are initially dusted with /30-40%/ water solution of
sorbitol, then are sprinkled with suitable aroma-flavour additions and the
drying is completed at a temperature of /90-150°C/ during /10-15 min/ at the
air stream speed of /1,0-2,0 m/s/ while at the packaging into individual
packages, inert gases are used, preferably the nitrogen.
4. The process of manufacturing chips of vegetables and fruits, applied in a
food industry, especially of carrots, celeries, bananas and apples, consisting
in a saturation of sliced vegetables and fruits in an sugars solution, and then drying them, characterised in, that the initial raw material is cut, preferably into slices, then the sliced raw material is blanched, in case of carrot, in the first operation in a hot water at a temperature /70-95°C/ during /12-16 sec/ and undergoes an enzymatic treatment or immediately undergoes an enzymatic treatment in the way, that the slices are immersed in a enzyme water solution with cellulase activity and enzyme concentration of /18-22g/litre water/ at a room temperature in the time of /45-80 sec/, then the slices are saturated in a saturating solution comprising /15-35% of mass/ saccharose solution with addition of /0,11-0,14% of mass/ sulphur dioxide and mixture of /0,28-0,35% of mass/ citric acid and /0,28-0,35% of mass/ ascorbic acid during /1-2 min/ at a room temperature, then the slices are dried on a single layer spread on the floor (flat surface), preferably on a dense metal sieve, at a temperature of /70-110°C/ during /1 h/ at the air stream speed of /3,5-5,0 m/s/, after which dried slices are slid from a number of sieves on one and the drying is completed at a temperature of /70-110°C/ during /1 h/ at the air stream speed of /3,5-5,0 m/s/ or the slices are dried from the beginning during /1,8-2,2 h/ at foregoing parameters to the final humidity of /1-3%/.

Moreover suitable aroma-flavour additions are used, depending on the kind of desired flavour, which are added only in the way that they are introduced to the final product employing no solution but in a mixture with modified starch and then thermally fixed at a temperature of /120-150°C/ during /4-6 min/ at the air stream speed of /0,5-2,0 m/s/, while at the packaging into individual packages, inert gases are used, preferably the nitrogen.

5. The process of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples, consisting in a saturation sliced vegetables and fruits in an sugars solution, and then drying them, characterised in, that the initial raw material is cut, preferably into slices, then the sliced raw material is blanched, in case of carrot, in the first operation in a hot water at a temperature /70-95°C/ during /12-16 sec/ and undergoes an enzymatic treatment or immediately undergoes an enzymatic treatment in the way, that the slices are immersed in a enzyme
water solution with cellulase activity and enzyme concentration of /18-
22g/litre water/ at a room temperature in the time of /45-80 sec/, then the
slices are saturated in a saturating solution comprising /15-35% of mass/
saccharose solution with addition of /0,11-0,14% of mass/ sulphur dioxide
and mixture of /0,28-0,35% of mass/ citric acid and /0,28-0,35% of mass/
ascorbic acid, and to that solution an addition of /0,5-2,5 g/ of alphatocopherol (vitamin E) is introduced in a water soluble form or in a fat-soluble
form, in which case the addition is distributed in /2,5 g/ of glycerol at a
concentration of /89%/ - as a total dose for /1000 g/ of a solution, whereas
the saturation lasts /1-2 min/ at a room temperature, then the slices are dried
on a single layer spread on the floor (flat surface), preferably on a dense
metal sieve, at a temperature of /70-110°C/ during /1 h/ at the air stream
speed of /3,5-5,0 m/s/, after which dried slices are slid from a number of
sieves on one and the drying is completed at a temperature of /70-110°C/
during /1 h/ at the air stream speed of /3,5-5,0 m/s/ or the slices are dried
from the beginning during /1,8-2,2 h/ at foregoing parameters to the final
humidity of /1-3%/ . Moreover, suitable aroma-flavour additions are used,
depending on the kind of desired flavour. Those additions are added to the
saturating solution in a concentration of /1-5%/ , and for intensifying the
aroma and flavour qualities, direct before the packaging into individuals
packages, the still warm chips are additionally sprinkled with aroma-flavour
additions or those additions' quantities are left, that were added into the
saturating solution, while at the packaging into individual packages, inert
gases are used, preferably the nitrogen.

6. The process of manufacturing chips of vegetables and fruits, applied in a
food industry, especially of carrots, celeries, bananas and apples, consisting
in a saturation of sliced vegetables and fruits in an sugars solution, and then
drying them, characterised in, that the initial raw material is cut, preferably
into slices, then the sliced raw material is blanched, in case of carrot, in the
first operation in a hot water at a temperature /70-95°C/ during /12-16 sec/
and undergoes an enzymatic treatment or immediately undergoes an
enzymatic treatment in the way, that the slices are immersed in an enzyme
water solution with cellulase activity and enzyme concentration of /18-
22g/litre water/ at a room temperature in the time of /45-80 sec/, then the slices are saturated in a saturating solution comprising /15-35% of mass/ saccharose solution with addition of /0,11-0,14% of mass/ sulphur dioxide and mixture of /0,28-0,35% of mass/ citric acid and /0,28-0,35% of mass/ ascorbic acid, and to that solution an addition of /0,5-2,5 g/ of alphatocopherol (vitamin E) is introduced in a water soluble form or in a fat-soluble form, in which case the addition is distributed in /2,5 g/ of glycerol at a concentration of /89%/ - as a total dose for /1000 g/ of a solution, whereas the saturation lasts /1-2 min/ in a room temperature, then the slices are dried onin a single layer spread on the floor (flat surface), preferably on a dense metal sieve, at a temperature of /70-110°C/ during /1 h/ at the air stream speed of /3,5-5,0 m/s/, after which dried slices are slid from a number of sieves on one and the drying is completed at a temperature of /70-110°C/ during /1 h/ at the air stream speed of /3,5-5,0 m/s/ or the slices are dried from the beginning during /1,8-2,2 h/ at foregoing parameters to the final humidity of /1-3%/ . Moreover suitable aroma-flavour additions are used, depending on the kind of desired flavour, which are added only in the way that the single layer of slices spread over a sieve is sprinkled with those additions only direct before drying, while at the packaging into individual packages, inert gases are used, preferably the nitrogen.

7. The process of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples, consisting in a saturation of sliced vegetables and fruits in a sugars solution, and then drying them, characterised in, that the initial raw material is cut, preferably into slices, then the sliced raw material is blanched, in case of carrot, in the first operation in a hot water at a temperature /70-95°C/ during /12-16 sec/ and undergoes an enzymatic treatment or immediately undergoes an enzymatic treatment in the way, that the slices are immersed in an enzyme water solution with cellulase activity and enzyme concentration of /18-22g/litre water/ at a room temperature in the time of /45-80 sec/, then the slices are saturated in a saturating solution comprising /15-35% of mass/ saccharose solution with addition of /0,11-0,14% of mass/ sulphur dioxide and mixture of /0,28-0,35% of mass/ citric acid and /0,28-0,35% of mass/
ascorbid acid, and to that solution an addition of /0,5-2,5 g/l of alphatoctopherol (vitamin E) is introduced in a water soluble form or in a fat-soluble form, in which case the addition is distributed in /2,5 g/l of glycerol at a concentration of /89%/ - as a total dose for /1000 g/l of a solution, whereas the saturation lasts /1-2 min/l at a room temperature, then the slices are dried on a single layer spread on the floor (flat surface), preferably on a dense metal sieve, at a temperature of /70-110°C/l during /1 h/l at the air stream speed of /3,5-5,0 m/s/l, after which dried slices are slid from a number of sieves on one and the drying is completed at a temperature of /70-110°C/l during /1 h/l at the air stream speed of /3,5-5,0 m/s/l or the slices are dried from the beginning during /1,8-2,2 h/l at foregoing parameters to the final humidity of /1-3%/l. Moreover suitable aroma-flavour additions are used, depending on the kind of desired flavour, which are added only in the way that the dried slices are initially dusted with /30-40%/ water solution of sorbitol, then are sprinkled with suitable aroma-flavour additions and the drying is completed at a temperature of /90-150°C/l during /10-15 min/l at the air stream speed of /1,0-2,0 m/s/l while at the packaging into individual packages, inert gases are used, preferably the nitrogen.

8. The process of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples, consisting in a saturation of sliced vegetables and fruits in an sugars solution, and then drying them, characterised in, that the initial raw material is cut, preferably into slices, then the sliced raw material is blanched, in case of carrot, in the first operation in a hot water at a temperature /70-95°C/l during /12-16 sec/l and undergoes an enzymatic treatment or immediately undergoes an enzymatic treatment in the way, that the slices are immersed in an enzyme water solution with cellulase activity and enzyme concentration of /18-22g/litre water/ at a room temperature in the time of /45-80 sec/l, then the slices are saturated in a saturating solution comprising /15-35% of mass/saccharose solution with addition of /0,11-0,14% of mass/sulphur dioxide and mixture of /0,28-0,35% of mass/citric acid and /0,28-0,35% of mass/ascorbic acid, and to that solution an addition of /0,5-2,5 g/l of alphatoctopherol (vitamin E) is introduced in a water soluble form or in a fat-soluble
form, in which case the addition is distributed in /2,5 g/ of glycerol at a concentration of /89%/ - as a total dose for /1000 g/ of a solution, whereas the saturation lasts /1-2 min/ at a room temperature, then the slices are dried on a single layer spread on the floor (flat surface), preferably on a dense metal sieve, at a temperature of /70-110°C/ during /1 h/ at the air stream speed of /3,5-5,0 m/s/, after which dried slices are slid from a number of sieves on one and the drying is completed at a temperature of /70-110°C/ during /1 h/ at the air stream speed of /3,5-5,0 m/s/ or the slices are dried from the beginning during /1,8-2,2 h/ at foregoing parameters to the final humidity of /1-3%/.

Moreover, suitable aroma-flavour additions are used, depending on the kind of desired flavour, which are added only in the way that they are introduced to the final product employing no solution but in a mixture with modified starch and then thermally fixed at a temperature of /120-150 °C/ during /4-6 min/ at the air stream speed of /0,5-2,0 m/s/, while at the packaging into individual packages, inert gases are used, preferably the nitrogen.

9. The process of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples, consisting in a saturation of sliced vegetables and fruits in an sugars solution, and then drying them, characterised in, that the initial raw material is cut, preferably into slices, then the sliced raw material is, in case of celery, immediately saturated in a saturating solution, comprising, by mass, /15-35%/ saccharose solution with addition of /0,11-0,14%/ sulphur dioxide and /0,28-0,35%/ citric acid, and during a single stage drying an air stream speed of /2,0-2,5 m/s/ is applied during /60-120 min/. Moreover, flavour additions are used, preferably ground hazel-nuts or walnuts or their mixture, and they are added only to the saturating solution, while at the packaging into individual packages, inert gases are used, preferably the nitrogen.

10. The process of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples, consisting in a saturation sliced vegetables and fruits in a sugars solution, and then drying them, characterised in, that the initial raw material is cut, preferably into slices, then the sliced raw material is, in case of celery, immediately
saturated in a saturating solution, comprising, by mass, /15-35%/ saccharose solution with addition of /0,11-0,14%/ sulphur dioxide and /0,28-0,35%/ citric acid, and during a single stage drying an air stream speed of /2,0-2,5 m/s/ is applied during /60-120 min/. Moreover, flavour additions are used, preferably ground hazel-nuts or walnuts or their mixture and they are added only in the way that the slices are sprinkled with those additions just before drying, while at the packaging into individual packages, inert gases are used, preferably the nitrogen.

11. The process of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples, consisting in a saturation of sliced vegetables and fruits in an sugars solution, and then drying them, characterised in that, the initial raw material is cut, preferably into slices, then the sliced raw material, in case of bananas, undergoes in the first operation an enzymatic and chemical modification in the way that banana slices are put into a water bath of enzyme solution at a /2-10%/ concentration, with pectinesterase activity at a temperature of /40-50 °C/ during /10-15 min/, after which the bath is changed to /0,4-0,6%/ calcium chloride solution and is kept during /0,8-1,2 min/, then the banana slices are saturated in a saturating solution comprising /15-35%/ of mass/ saccharose solution with addition of /0,11-0,14% of mass/ sulphur dioxide and citric acid amounting for /0,22-0,30% of mass/ in a time of /1-5 min/ in room temperature, and then the slices are dried on a single layer, spread over a floor (flat surface), preferably over a dense teflon sieve, at a temperature of /70-110°C/ during /3,5-4 h/ at the air stream speed of /3,5-5,0 m/s/ to the final humidity of /1-3%/ while at the packaging into individual packages, inert gases are used, preferably the nitrogen.

12. The process of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples, consisting in a saturation of sliced vegetables and fruits in a sugars solution, and then drying them, characterised in, that the initial raw material is cut, preferably into slices, and then, in case of apples, the seed chambers and leaf stalks are removed or not and as the first operation enzymatic treatment of slices in a enzyme water solution is employed or not, then the slices are saturated in a
saturating solution, comprising /15-35% of mass/ saccharose solution, vitamin /C/ addition amounting for /1,5%/i, preferably up to /1,0%/i, a mixture of citric /0,5-2,0% of mass/ and ascorbic /0,5-2,0% of mass/ acids or acid sodium sulphite /0,08-0,22% of mass/ or of added or not added known Pro- long mixture, comprising mono- and biglicerides of fatty acids, CM-cellulose sodium salt and saccharose ester of fatty acids amounting for /0,5-1,0% of mass/ at a room temperature in the time of /2-5 min/, whereas other emulsifiers can be substituted for the Pro-long mixture, after which the slices are filtered off and dried at a temperature of /70-110 °C/ during /240-250 min/, at the air stream speed of /3,5-5,0 m/s/ to the final humidity of /1-3%/i, and further aroma-flavour additions are applied, depending on the type of desired flavour, that are added only in the way that they are introduced to the saturating solution at a concentration of /1-5%/i, and also dye or natural dyes are added to the saturating solution, depending on a need, in order to change chips colour to a desired colour, while at the packaging into individual packages, inert gases are used, preferably the nitrogen.

13. The process of manufacturing chips of vegetables and fruits, applied in a food industry, especially of carrots, celeries, bananas and apples, consisting in a saturation of sliced vegetables and fruits in an sugars solution, and then drying them, characterised in that the initial raw material is cut, preferably into slices, and then, in case of apples, the seed chambers and leaf stalks are removed or not and as the first operation enzymatic treatment of slices in a enzyme water solution is employed or not, then the slices are saturated in a saturating solution, comprising a mixture of concentrated apple juice with sorbitol amounting for /5-10% of mass/ or alternatively with one of three syrups: starch, corn or glucose with an addition of acelosulfam /K/ or aspartam, a mixture of citric /0,5-2,0% of mass/ and ascorbic 0,5-2,0% of mass/ acids or acid sodium sulphite /0,08-0,22% of mass/ or added or not added known Pro-long mixture, comprising mono- and biglicerides of fatty acids, CM-cellulose sodium salt and saccharose ester of fatty acids amounting for /0,5-1,0% of mass/ at a room temperature in the time of /2-5 min/, whereas other emulsifiers can be substituted for the Pro-long mixture, after which the slices are filtered off and dried at a temperature of /70-110 °C/
during /240-250 min/, at the air stream speed of /3,5-5,0 m/s/ to the final humidity of /1-3%/ and further aroma-flavour additions are applied, depending on the type of desired flavour, that are added only in the way that those additions are introduced to the saturating solution at a concentration of /1-5%/ and also dye or natural dyes are added to the saturating solution, depending on a need, in order to change chips colour to a desired colour, while at the packaging into individual packages, inert gases are used, preferably the nitrogen.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

**IPC 7** A23L1/212 A23B7/022 A23B7/08

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)

WPI Data, PAJ, EPO-Internal, FSTA

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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*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**

19 June 2002

**Date of mailing of the international search report**

01/07/2002

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