

COMMONWEALTH OF AUSTRALIA

60 4379

Patents Act 1952

Form 1

Regulation 9

Case: 43-21(6918)A AS

APPLICATION FOR A STANDARD PATENT OR
A STANDARD PATENT OF ADDITION

We, MONSANTO COMPANY, a Corporation organised and existing under the laws of the State of Delaware, United States of America, having its principal place of business at 800 North Lindbergh Boulevard, St. Louis, State of Missouri, United States of America, hereby apply for the grant of a Standard Patent for an invention entitled:

"FOOD PRESERVATIVE COMPOSITIONS"

which is described in the accompanying complete specification.

This application is a Convention application and is based on an application numbered 118,132 for a patent or similar protection made in United States of America on 9th November 1987.

Our address for service is care of E.F. WELLINGTON & CO., Patent and Trade Mark Attorneys, 457 St. Kilda Road, Melbourne, in the State of Victoria, Commonwealth of Australia.

DATED this 8th day of November, A.D. 1988

For and on behalf of
MONSANTO COMPANY,

Bruce S. Wellington

BRUCE S. WELLINGTON
Patent Attorney for Applicant Company

To: The Commissioner of Patents,
Commonwealth of Australia.



MOO4186

08/11/88

APPLICATION ACCEPTED AND AMENDMENTS

ALLOWED 14-9-90

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

FORM 8

REGULATION 12(2)

DECLARATION IN SUPPORT OF A CONVENTION APPLICATION
~~XXXXXX~~ FOR A PATENT OR PATENT OF ADDITION.

In support of the Convention Application made ~~XXXXXXXXXXXXXXXXXXXX~~
~~XXXX~~ by MONSANTO COMPANY for a patent for an invention entitled:

FOOD PRESERVATIVE COMPOSITIONS

I, William Harry Duffey, General Patent Counsel, Monsanto Company, of 800 North Lindbergh Boulevard, St. Louis, 63167, in the State of Missouri, United States of America, do solemnly and sincerely declare as follows:

1. I am authorized by MONSANTO COMPANY, the applicant for the Patent to make this declaration on its behalf.

2. The basic application as defined by Section 141 of the Act was made at the Patent Office, Washington, District of Columbia, in the United States of America on the 9th of November 1987, by Beth Zartman Warren.

3. Beth Zartman Warren, 2072 Running Ridge Court,
Maryland Heights, Missouri 63043, United States of
America,

is ~~the~~ the actual inventor~~s~~ of the invention, and the facts upon which the MONSANTO COMPANY is entitled to make the application are as follows:
The Company is the assignee of the actual inventor~~s~~.

4. The basic application referred to in paragraph 2 of this declaration was the first application made in a Convention country in respect of the invention, the subject of the application.

DECLARED at St. Louis, Missouri, aforesaid this 5th day of
October, 1988.

William Harry Duffey
WILLIAM HARRY DUFFEY

To Commissioner of Patents
COMMONWEALTH OF AUSTRALIA

(12) PATENT ABRIDGMENT (11) Document No. AU-B-24792/88
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 604379

(54) Title
FOOD PRESERVATIVE COMPOSITIONS

International Patent Classification(s)
(51)⁴ **A01N 003/00**

(21) Application No. : **24792/88**

(22) Application Date : **08.11.88**

(30) Priority Data

(31) Number	(32) Date	(33) Country
118132	09.11.87	US UNITED STATES OF AMERICA

(43) Publication Date : **11.05.89**

(44) Publication Date of Accepted Application : **13.12.90**

(71) Applicant(s)
MONSANTO COMPANY

(72) Inventor(s)
BETH ZARTMAN WARREN

(74) Attorney or Agent
E F WELLINGTON & CO, 312 St Kilda Road, MELBOURNE VIC 3004

(57) Claim

1. A process for treatment of freshly cut plant parts whereby the storage life of the parts is extended, which comprises dipping the plant parts into, or otherwise contacting the plant parts with, an aqueous solution at ambient temperature, said solution comprising:

(a) from .2% to 1% of an antioxidant;

(b) from .3% to 2% of a metal sequestrant comprising an alkali metal acid polyphosphate salt;

(c) from .2% to 1% of an acidulant; and

(d) from .3% to 2% of an inorganic chloride enzyme inhibitor.

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

FORM 10

Application Number
Lodged: 60 4379

Case: 43-21(6918)A AS

Class: Int. Class

Complete specification: Lodged:
Accepted:
Published:

Priority:

Related Art:

This document contains the
amendments made under
Section 49 and is correct for
printing

Name of Applicant: MONSANTO COMPANY

Address of Applicant: 800 North Lindbergh Boulevard,
St. Louis Missouri, 63167,
United States of America

Actual Inventor/s: BETH ZARTMAN WARREN

Address for Service: E.F. WELLINGTON & CO.,
Patent and Trade Mark Attorneys,
457 St. Kilda Road,
Melbourne, 3004, Victoria.

Complete Specification for the invention entitled:

"FOOD PRESERVATIVE COMPOSITIONS"

The following statement is a full description of this invention
including the best method of performing it known to us.

Background of the Invention

This invention relates to novel compositions which are adapted as food preservatives. More particularly, this invention relates to compositions
5 and a process for preserving freshly cut plant parts for long periods of time without appreciable degradation, loss of flavor and without fear of discoloration.

It has long been known that sulfiting agents including sulfur dioxide, sodium sulfite, sodium and
10 potassium bisulfite and sodium and potassium metabisulfite possess the ability to preserve vegetable food products, particularly in the restaurant industry. Sulfites have also been employed as preservatives in prepared foods such as flavored beverages, syrup
15 concentrates, wine and vinegar as well as in the processing of sugar, corn starch and shrimp. Because of the recent increase in reported allergic reactions to these compounds, their use has fallen into disfavor. Regulatory actions involving the use of sulfites have
20 been initiated and the former status of "generally recognized as safe" GRAS use of sulfites on raw foods and vegetables has been withdrawn by the U. S. Government Food and Drug Administration. Further labeling requirements have been imposed by the Food and
25 Drug Administration on packaged food containing direct or indirect additions of sulfites.

There has not been known previously any single GRAS approved chemical that can replace sulfites in any given application, much less across the range
30 of all applications. Food degradation from various sources are recognized in the literature and individual chemicals are known which will inhibit one aspect or another of degradation derived from a single source. Degradation, loss of color or flavor of freshly cut
35 plant parts are known to be caused by oxidation,

enzymes, microbes, and metal ions. For example, acidulants are known to prevent microbial degradation by maintaining a relatively low pH environment but their effectiveness has been only temporary.

5 There is currently a great need for a composition which would replace sulfite treatment yet obtain the multiple preservative and antioxidant actions that sulfites provide. While no single agent has been found, numerous attempts at combinations of agents have failed to provide storage stable
10 freshly cut plant parts, safe from degradation by the several different sources of degradation to which cut plant parts are so vulnerable.

SUMMARY OF THE INVENTION

15 The present invention provides compositions useful in the treatment of raw, cut plant parts to improve their quality and storage stability against the effects of oxidation, thermo-oxidation, enzymatic, microbial and metal
20 ion attack. Such compositions have been found to be an effective replacement for sulfite treatment. The present compositions provide in a single, simple dipping process, preservative action against the above-mentioned elements which result in degradation thereby extending the time during which the cut plant parts are capable of being stored without degradation or discoloration.

25 Compositions of this invention include an antioxidant, an enzyme inhibitor, an acidulant and a unique metal ion sequestrant which is compatible with the acidulant.

30 Thus, the present invention provides a process for treatment of freshly cut plant parts whereby the storage life of the parts is extended, which comprises dipping the plant parts into, or otherwise contacting the plant parts with, an aqueous solution at ambient temperature, said solution comprising:

- 35 (a) from about .2% to about 1% of an antioxidant;
 (b) from about .3% to about 2% of a metal sequestrant comprising an alkali metal acid polyphosphate salt;
 (c) from about .2% to about 1% of an acidulant; and
40 (d) from about .3% to about 2% of an inorganic chloride enzyme inhibitor.



The present invention also provides a process for the treatment of freshly cut potatoes whereby the storage life of the potato is extended, which comprises dipping the freshly cut potato into, or otherwise contacting the freshly cut potato with, an aqueous solution at ambient temperature, said solution comprising:

- (a) from about .5% to about .7% of ascorbic acid;
- (b) from about .5% to about .7% of citric acid;
- (c) from about 1% to about 1.5% of sodium acid pyrophosphate; and
- (d) from about 1% to about 1.5% of calcium chloride.

The present invention further provides a process for the treatment of freshly cut apples whereby the storage life of the apples is extended, which comprises dipping the freshly cut apples into, or otherwise contacting the freshly cut apples with, an aqueous solution at ambient temperature, said solution comprising:

- (a) from about .2% to about .5% of ascorbic acid;
- (b) from about .2% to about .5% of citric acid;
- (c) from about .3% to about 1% of sodium acid pyrophosphate; and
- (d) from about .3% to about 1% of calcium chloride.

The present invention still further provides a dry particulate composition suitable for use in the preparation of an aqueous dipping solution for the treatment of freshly cut plant parts whereby the storage life of the plant parts is extended, said composition comprising:

- (a) from about 15% to about 20% of an antioxidant;
- (b) from about 30% to about 35% of a metal sequestrant comprising an alkali metal acid polyphosphate salt;
- (c) from about 15% to about 20% of an acidulant; and
- (d) from about 30% to about 35% of an inorganic chloride enzyme inhibitor,

said treatment comprising a single or multiple dipping in the aqueous solution of said composition at ambient temperature.

DETAILED DESCRIPTION OF THE INVENTION

There has been found unique combinations of agents each compatible with the other and soluble in water which provides a simple, effective dipping process whereby cut plant parts can be treated by contacting the plant parts with the aqueous solution



containing the below-described components. Further,
there has been found particular blends of these
components which are effective to provide freshly
cut plant parts with a pleasing and fresh appearance
as well as favorable storage stable properties.

In the following description of the present
invention all percentages given are understood to be
percent by weight unless otherwise stated. Further,
the components of the food preservative of this
invention are usually prepared by mixing the various
components such as by blending them in the dry state
mechanically. Of course, other means for blending
the various components may be employed and the
components may be blended together by adding them
independently to an aqueous medium thereby providing
the inventive blend of ingredients in aqueous solution.

The antioxidant component of the composi-
tions of this invention comprises, preferably,
ascorbic acid. In many instances such as when the
freshly cut plant parts are to be consumed within
about 24 hours of cutting, the food preservative
composition of this invention comprises only from
about 8 to about 12 percent ascorbic acid or any
antioxidant equivalent thereof. However, when
longer storage times are desired larger amounts such
as up to about 20% of the composition comprises
ascorbic acid. The larger amount of antioxidant
in the composition of this invention protects the
plant parts against temperature accelerated oxidative
processes. Ascorbic acid has been found to be the
most effective and convenient antioxidant in the
compositions of this invention because it is most
compatible with the other ingredients. However,
the stereoisomer of ascorbic acid, erythorbic acid
may also be employed.

Some plant parts are rapidly decomposed after cutting through enzymatic action, particularly potatoes, apples, pears, green peppers, and mushrooms. It has been found that a chloride ion source in the preservative compositions of this invention greatly inhibits such enzymatic action and the incorporation of an inorganic chloride ion source results in surprising storage stability of the cut plant parts. The chloride ion source is typically a non-toxic alkali metal or alkaline earth metal chloride such as calcium chloride. As with other components of the inventive preservative compositions now claimed the chloride ion source is preferably highly water soluble at room temperature, in the amounts employed in the compositions and process herein disclosed. Thus, calcium chloride is preferred but other salts such as sodium chloride, potassium chloride, magnesium chloride may also be employed to provide the chloride ion in solutions into which the plant parts are dipped in accordance with this invention. The chloride ion source usually comprises about 25% to about 40% of the preservative composition and is typically in the range of about 25% to about 35%. As with other components of the compositions of this invention, adjustments in the amount of each ingredient may occur depending upon the plant part treated and the amount of storage time of the cut plant parts expected.

The third component of the preservative compositions of this invention comprises an antimicrobial agent in the form of an acidulant. The acidulant desirably maintains the treating solutions into which the cut plant parts are immersed at a relatively low pH so that microbial growth is inhibited. In general, the acidulant will maintain the treating solution pH of between about 2 and 3. More particularly, the usual pH of the treating

5 solutions of this invention are in the range of about 2.5 to about 3. Typical acidulants include edible acids such as fumaric acid, citric acid, and erythorbic acid. Such acids are particulate materials at ordinary temperatures and are therefore preferred. Other acids may be employed at lower pH of the treating solution. In compositions of this invention citric acid is preferred because of its water solubility.

10 Another important ingredient of the preservative compositions of this invention is a metal ion sequestrant. While it has been known to be important to sequester metal ions in fruit and vegetable preservation schemes, the compositions of this invention provide cut plant parts with particularly effective
15 preservation because of the incorporation therein of an acidic polyphosphate metal ion chelant or sequestrant. In particular, it is desirable to incorporate an alkali metal acid polyphosphate and more particularly a sodium acid polyphosphate.
20 Because they are strongly active at the required low pH levels for microbial growth inhibition and is safe at relatively high levels of concentration, such polyphosphates are uniquely suited in compositions of this invention to provide cut plant parts extraordi-
25 narily long storage ability. While any alkali metal acid polyphosphate may be employed it has been found preferable to employ sodium acid pyrophosphate (SAPP). Potassium pyrophosphate may also be employed but is not as generally available as SAPP.

30 Acidic polyphosphates useful in compositions of this invention are those which in aqueous solution provide a pH of about 4.5 or less. Those acid polyphosphates providing such relatively low pH levels in aqueous solutions also exhibit high
35 binding power for metal ions at said low pH. It is pointed out that binding power and pH level are a

required combination in compositions of this invention since low pH levels are required for antimicrobial properties to remain. Should polyphosphates providing higher pH levels in aqueous solution be employed and larger amounts of acidulant be required, the sequestering ability of such higher pH polyphosphate is reduced.

There has been described novel combinations of ingredients which, in a single dip process, provide surprising by storage stable cut plant parts including the difficultly stored cut potato and apple. However, any number of cut plant parts may be treated by the process of this invention. Another advantage of the process of this invention is the fact that the single dipping operation may be carried out at room temperature. The above-noted advantage not only provides economy with respect to the amount of equipment required but also provides economy in the reduced amount of handling and cleaning of such equipment. Because the single dip process of this invention is carried out at room temperature, i.e., from about 20°C. to about 25°C., it is abundantly clear that the process now described is extremely simple and cost effective.

The above-described dry, particulate preservative compositions of this invention are summarized as follows wherein function and preferred choice of agent are provided along with a general range of concentrations.

TABLE 1

Function	Agent	Concentration Range-%
antioxidant	ascorbic acid	8-20
enzyme inhibitor	calcium chloride	20-40
acidulant	citric acid	8-20
metal ion chelant	SAPP	20-40

The compositions of this invention are conveniently formed in dry particulate form combined with dry blending to assure that the mixture is uniform. Dipped solutions of this invention are formed by combining suitable water for such a dip operation with the desired amount of the dry blended composition of this invention. Depending upon the cut plant parts to be treated, the dip solution contains up to about 5% of the dry blended composition. Higher amounts may be employed but benefits of extended storage life of the cut plant parts are not proportional. Usually satisfactory results are obtained when the dipping solution contains about 3% of a composition of this invention.

The following listed plants have been found to be satisfactorily treated in accordance with this invention with decreasing concentrations of preservative solutions: Potatoes -->pears-->green peppers-->apples-->lettuce.

It is preferred that the various agents chosen to be combined to make compositions of this invention provide completely soluble mixtures at the temperature and concentration employed. However, to obtain complete solution the dipping solution may be warmed slightly to aid in the dissolution of the components of the compositions of this invention.

To obtain maximum storage time before cut plant parts begin to exhibit deterioration they are immersed in a dipping solution of this invention as soon after cutting as is practical. The dipping solution may be allowed to cool before actual dipping operations begin in those instances wherein the water is warmed to reduce the required time for complete dissolution to occur. While adequate results are achieved with as little as 3% concentration of the inventive compositions of this invention it has been

found to be more important to extend the time of contact of the cut plant parts with the dipping solution. Usually the contact time employed is from about 10 to about 30 minutes depending upon the plant variety and storage objective. For example, the contact time or dipping time for potatoes is in the range of from about 15 to about 25 minutes to obtain maximum storage stability. Effective long storage stability for apples, green peppers or lettuce is achieved at much shorter dipping times which may be as short as 2 minutes. Simple testing with particular varieties of plants enables the determination of optimum dipping or contact time.

The amount of each component of the preservative composition of this invention to contact the cut plant part varies within certain boundary limitations. By dry blending a composition as described above the amount of each ingredient to contact the cut plant part is controlled by the concentration of blend in the dipping solution. Optimally the dipping solution contains the following amount of each preferred ingredient by weight.

	<u>Function</u>	<u>Agent</u>	<u>Concentration Range - %</u>
	antioxidant	ascorbic acid	.2 - 1
	enzyme inhibitor	calcium chloride	.3 - 2
	acidulant	citric acid	.2 - 1
	metal ion chelant	SAPP	.3 - 2

The agents may also be added directly to the dipping solution independently thereby providing an opportunity to achieve dissolution on an independent basis as each ingredient is added.

The following examples are included herein to illustrate preferred embodiments of this invention. All blends or dipping solutions are described as weight percent of each component.



EXAMPLES 1-4

Whole potatoes were mechanically peeled and the eyes removed in the usual commercial process. The whole potatoes were then dipped in the solutions described below and stored at 0°C. - 2°C. in polyethylene bags, each bag containing about 20 potatoes. No attempt was made to exclude air but each bag was tightly tied off with wire immediately above the top of the contents. The peeled potatoes were dipped in the solutions described below for 10 minutes, drained and immediately bagged and stored. In some instances the water was warmed to achieve maximum solution then cooled to ambient room temperature for use in the dipping operation. Upon cooling a small amount of insoluble material was observed at the bottom of the mixing tank. Dry blends of ingredients were made and then added to water as indicated below. Failure is noted upon the appearance of decay to the extent of brown spotting or color on the surface of the potatoes.

<u>EXAMPLE</u>	<u>1</u>	<u>2</u>	<u>3</u>	<u>4</u>
SAPP	33.3	33.3	33.3	33.3
fumaric acid	16.7	16.7	16.7	16.7
NaCl	16.7	16.7		
CaCl ₂ •2H ₂ O	16.7	16.7	33.3	33.3
erythorbic acid	16.7	16.7	16.7	
ascorbic acid				16.7
% conc. in dip	3	2	3	3
days to failure	5	3	5	5

EXAMPLES 5-10

The procedure of Example 1 was repeated with the exception that the dip time was 20 minutes. The composition, concentrations and results are listed below. Some compositions, for purpose of comparison, do not include agents to perform all functions included in the compositions of this invention.

<u>EXAMPLE</u>		<u>5</u>	<u>6</u>	<u>7</u>	<u>8</u>	<u>9</u>	<u>10</u>
5	SAPP	33.3	33.3	33.3	33.3	29.2	29.2
	fumaric acid	16.7	16.7	16.7	16.7		
	CaCl ₂ •2H ₂ O	33.3	33.3	33.3			
	NaCl				33.3	33.3	33.3
	ascorbic acid	16.7		16.7	16.7	37.5	37.5
	erythorbic acid		16.7				
	% conc. in dip	3	4	3	4	3	4
	days to failure	5	5	5	5	3	3

10

EXAMPLES 11-13

15

20

25

30

Apples (one each of Red Delicious, Golden Delicious, and Granny Smith) were quartered and placed in a pan at room temperature. Oxidation began at 10 minutes and in about 30 minutes the sliced areas turned uniformly brown. Another set of apples of the same varieties was quartered and submerged in aqueous solutions described below for a period of 2 minutes. After removal from the solution the sliced apples were placed in polyethylene bags (1 apple per bag). As much air as possible was pressed out of the bags and each bag tied tightly above the contents. In this example each component of the dipping solution was added individually to water to form the solution. No insoluble material was observed in the dipping solution.

Bananas were also tested in this example and a small amount of brown flecks appeared on the outside portion (adjacent peel) after 1 day on bananas treated with compositions of Examples 11 and 12. The bananas treated with the compositions of Example 13 were nearly completely covered on the outside portion (adjacent peel) with brown flecks after 1 day and considered unusable.

	<u>11</u>	<u>12</u>	<u>13</u>
SAPP	1	1	
CaCl ₂ •2H ₂ O	1	1	
erythorbic acid	.5	.5	
5 citric acid	1	.5	
ascorbic acid			3

10 The Red Delicious variety dipped in the composition of Example 13 showed brown color along the peel line and at the seeds after 1 day and all varieties dipped in this composition showed mold formation after 5 days. The apples treated by dipping in compositions of Examples 11 and 12 dried out (8 days) without any color or mold deterioration observed.

15 EXAMPLES 14-15

20 Potatoes which were harvested the previous Fall and held in cold storage for about 6 months were mechanically peeled and the eyes removed in the usual commercial process. The whole potatoes were then dipped into the solutions described below for 20 minutes and placed in plastic bags for storage as described for Examples 1-4. The dipping solutions were prepared by first making a blend of materials and adding the specified amount of the blend to warm water to provide a 3 percent solution. The solutions were cooled to room temperature before the dipping operation began. The blend of Example 14 was completely soluble at the dipping temperature while the blend of Example 25 15 had a small amount of insoluble material at the dipping temperature. 30

	<u>14</u>	<u>15</u>
SAPP	33.3	33.3
CaCl ₂ •2H ₂ O	33.3	33.3
ascorbic acid	16.7	
5 erythorbic acid		16.7
citric acid	16.7	16.7

After 5 days the potatoes dipped in the composition of Example 14 were superior to the potatoes dipped in composition Example 15. The first indication of color in the potatoes treated with the composition of Example 14 occurred on the 9th day and was attributed to a bruise on one corner of one potato. Also, a darkening at a bruised spot inherent in one potato was observed. This indicates that, contrary to sulfite treatment, damaged portions are not bleached to remove discoloration by compositions of this invention.

The above examples illustrate the importance of the combination of ingredients in the compositions of this invention. Although some alternative agents can be employed, the four functions of the dipping operation must be accomplished to provide the maximum storage time for the fruits and vegetables.

The results shown in the above examples demonstrate the importance of completely soluble preservative compositions in accordance with this invention. Compositions of this invention provide a combination or weight ratio of ingredients which provide the critical properties required to achieve extended storage life of freshly cut plant parts. The compositions of this invention are in completely soluble form in aqueous solution at ambient or room temperature. Such superior storage life of freshly cut plant parts has been demonstrated by the above examples over preservative compositions containing the same ingredients at different weight ratios which results

in the insolubility of some components even to only
a small degree. It has been found that the insolu-
bility demonstrated in the above examples results
from undesired interaction between the components of
5 the preservative composition in aqueous solution.
Such interaction results in one of the acids forming
an insoluble salt at the concentrations and pH required
for effective maximum storage life. Compositions of
this invention have been designed to avoid conditions
10 which result in undesired precipitation of any
component in aqueous solution at acceptable dipping
temperature.

Although the invention has been described
by the above examples, such examples have been chosen
15 to illustrate rather than limit the scope of the
invention as defined by the following claims.



The claims defining the invention are as follows:

1. A process for treatment of freshly cut plant parts whereby the storage life of the parts is extended, which comprises dipping the plant parts into, or otherwise contacting the plant parts with, an aqueous solution at ambient temperature, said solution comprising:

- (a) from .2% to 1% of an antioxidant;
- (b) from .3% to 2% of a metal sequestrant comprising an alkali metal acid polyphosphate salt;
- (c) from .2% to 1% of an acidulant; and
- (d) from .3% to 2% of an inorganic chloride enzyme inhibitor.

2. A process of Claim 1 wherein the antioxidant is selected from the group consisting of ascorbic acid and erythorbic acid.

3. A process of any Claim 1 or 2 wherein the metal sequestrant is sodium acid pyrophosphate.

4. A process of any one of Claims 1 to 3 wherein the acidulant is selected from the group consisting of fumaric acid and citric acid.

5. A process of any one of Claims 1 to 4 wherein the enzyme inhibitor is selected from the group consisting of alkali metal and alkaline earth metal chlorides.



6. A process of any one of Claims 1 to 5 wherein the plant part is selected from potatoes, apples, pears, green peppers and lettuce.

7. A process for the treatment of freshly cut potatoes whereby the storage life of the potato is extended, which comprises dipping the freshly cut potato into, or otherwise contacting the freshly cut potato with, an aqueous solution at ambient temperature, said solution comprising:

(a) from .5% to .7% of ascorbic acid;

(b) from .5% to .7 of citric acid;

(c) from 1% to 1.5% of sodium acid pyrophosphate; and

(d) from 1% to 1.5% of calcium chloride.

8. A process of Claim 7 wherein the potatoes are peeled.

9. A process for the treatment of freshly cut apples whereby the storage life of the apples is extended, which comprises dipping the freshly cut apples into, or otherwise contacting the freshly cut apples with, an aqueous solution at ambient temperature, said solution comprising:

(a) from .2% to .5% of ascorbic acid;

(b) from .2% to .5% of citric acid;

(c) from .3% to 1% of sodium acid pyrophosphate; and



(d) from .3% to 1% of calcium chloride.

10. A process of Claim 9 wherein the apples are sliced.

11. A dry particulate composition suitable for use in the preparation of an aqueous dipping solution for the treatment of freshly cut plant parts whereby the storage life of the plant parts is extended, said composition comprising:

(a) from 15% to 20% of an antioxidant;

(b) from 30% to 35% of a metal sequestrant comprising an alkali metal acid polyphosphate salt;

(c) from 15% to 20% of an acidulant; and

(d) from 30% to 35% of an inorganic chloride enzyme inhibitor,

15. said treatment comprising a single or multiple dipping in the aqueous solution of said composition at ambient temperature.

12. A composition of Claim 11 wherein the antioxidant is selected from the group consisting of ascorbic acid and erythorbic acid.

13. A composition of Claim 11 or 12 wherein the acidulant is selected from the group consisting of fumaric acid and citric acid.



14. A composition of any one of Claims 11 to 13 wherein the metal sequestrant is an alkali metal acid pyrophosphate.

15. A composition of any one of Claims 11 to 14 wherein the enzyme inhibitor is selected from the group consisting of alkali metal and alkaline earth metal chlorides.

16. An aqueous solution of a composition of any one of Claims 11 to 15 wherein the solution is suitable for the treatment of plant parts selected from potatoes, apples, pears, green peppers and lettuce.

DATED this 8th day of November, A.D. 1988

MONSANTO COMPANY,
By its Patent Attorneys,
E. F. WELLINGTON & CO.,
By:

Bruce Wellington

BRUCE S. WELLINGTON