FORM 1

COMMONWEALTH OF AUSTRALIA 600361

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

I\We,

UNILEVER PLC

of UNILEVER HOUSE
BLACKFRIARS
LONDON EC4
ENGLAND

hereby apply for the grant of a standard patent for an invention entitled:
A Method of Stripping Aromas and Flavours From Plant Materials ~~FOOD PRODUCT~~

which is described in the accompanying complete specification

Details of basic application(s):

Number of basic application	Name of Convention country in which basic application was filed	Date of basic application
057283	US	02 JUN 87

My/our address for service is care of CLEMENT HACK & CO., Patent Attorneys, 601 St. Kilda Road, Melbourne 3004, Victoria, Australia.

DATED this 31st day of May 1988

UNILEVER PLC

~~FEE STAMP TO VALUE OF~~ $ 210 ATTACHED
MAIL OFFICER BS

CLEMENT HACK & CO.

APPLICATION ACCEPTED AND AMENDMENTS ALLOWED 31.5.90

TO: The Commissioner of Patents.

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Forms 7 and 8

AUSTRALIA

Patents Act 1952

DECLARATION IN SUPPORT OF A CONVENTION OR NON-CONVENTION APPLICATION FOR A PATENT OR PATENT OF ADDITION

Name(s) of Applicant(s): In support of the application made by UNILEVER PLC

Title: for a patent for an invention entitled FOOD PRODUCT

Name(s) and address(es) of person(s) making declaration: I/~~We~~, DILSHAD RAJAN of Unilever House, Blackfriars, London EC4, England,

do solemnly and sincerely declare as follows:-

1. I am/~~We are the applicant(s) for the patent, or~~ ~~am/are~~ authorised by the abovementioned applicant to make this declaration on its behalf.

2. The basic application(s) as defined by Section 141 of the Act was/were made in the following country or countries on the following date(s) by the following applicant(s) namely:-

Country, filing date and name of Applicant(s) for the or each basic application:

in United States of America on 2nd June 1987
by Jimbin MAI, Steven A GOBBO, Dennis Jay BREITBART and Craig Daniel FISCHER
in ______ on ______ 19__
by ______

3. The said basic application(s) was/were the first application(s) made in a Convention country in respect of the invention the subject of the application.

Name(s) and address(es) of the or each actual inventor:

4. The actual inventor(s) of the said invention is/are as attached

See reverse side of this form for guidance in completing this part:

5. The facts upon which the applicant(~~s~~) is/~~are~~ entitled to make this application are as follows:-
The Applicant is the assignee of Thomas J. LIPTON INC. of 800 Sylvan Avenue, Englewood Cliffs, New Jersey 07632, USA. which latter company is the assignee of the actual inventors.

DECLARED at London, England, this 26th day of May 1988.

[signature] Rajan

Inventor(s): JIMBIN MAI a citizen of TAIWAN of
5 Foxburn Street
New City
New York 10956
United States of America

STEVEN A. GOBBO a citizen of the United States
of America of
278 Grace Avenue
Secaucus
New Jersey 07094
United States of America

DENIS JAY BREITBART a citizen of the United States
of America of
Q012 Quincy Circle
Dayton
New Jersey 08810
United States of America

CRAIG DANIEL FISCHER a citizen of the United States
of America of
19 Apache Drive
Manalapan
New Jersey 07726
United States of America

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(71) Applicant(s)
UNILEVER PLC

(72) Inventor(s)
JIMBIN MAI; CRAIG DANIEL FISCHER; DENNIS JAY BREITBART; STEVEN A. GOBBO

(74) Attorney or Agent
GRIFFITH HACK & CO. MELBOURNE

(56) Prior Art Documents
US 3870053
EP 79242

(57) Claim

1. A method of stripping aroma and flavour compounds from a plant material which comprises the steps of subjecting the plant material to microwave radiation in the presence of adsorbed and/or absorbed moisture to release a substantial portion of said moisture, said aroma and flavour compounds as a vapour, and collecting the vapour as a condensate.

5. A method for processing a plant material comprising the steps

(a) stripping aroma and flavour compounds from the material in accordance with the process of claim 1 to provide a stripped plant material and a condensate containing aroma and flavour compounds;

(b) subjecting the stripped plant material to further processing; and

.../2

(c) adding the condensate obtained in step (a) above back to the said further processed plant material.

6. A method for processing tea leaf comprising the steps of

(a) providing a tea leaf preparation having a moisture content of from ~~about~~ 25 to ~~about~~ 90% by weight;

(b) subjecting said tea leaf preparation to microwave radiation to release a substantial portion of aroma and flavour compounds, together with moisture, therefrom;

(c) drawing off the said aroma and flavour compounds and vapourised moisture from the tea leaf; and

(d) condensing said aroma and flavour compounds and vapourised moisture to form a condensate.

AUSTRALIA

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Form 10

COMPLETE SPECIFICATION

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TO BE COMPLETED BY APPLICANT

Name of Applicant: UNILEVER PLC

Address of Applicant: UNILEVER HOUSE
BLACKFRIARS
LONDON EC4
ENGLAND

Actual Inventor:

Address for Service: CLEMENT HACK & CO.,
601 St. Kilda Road,
Melbourne, Victoria 3004,
Australia.

Complete Specification for the invention entitled:

~~FOOD PRODUCT~~

A Method of Stripping aromas and Flavours from Plant Materials

The following statement is a full description of this invention including the best method of performing it known to me:-

AUSTRALIAN PATENT OFFICE

A Method of Stripping aromas and Flavours from Plant Materials

~~FOOD PRODUCT~~

The present invention relates to a method for treating plant materials to recover aroma and flavour compounds therefrom while ensuring that the residual plant material undergoes little or no deterioration.

A number of processes are known in the prior art for recovering flavour and aroma constituents from plant materials. In the processing of coffee, for example, processes are known whereby the coffee aroma and flavour is recovered from ground roasted coffee by techniques using distillation and condensation. The condensate is reserved, while the ground coffee undergoes additional processing such as aqueous extraction to recover water soluble coffee solids to be used in an instant coffee product. The aroma and flavour condensate is thereafter recombined with soluble coffee solids to form an aromatised instant coffee product. Other uses for the aroma/flavour condensate include its use as flavouring material in other foodstuffs such as candy, and the placing of it in the head space of a jar of soluble coffee to provide a pleasant aroma on opening thereof for the first time.

Similarly, in the tea processing art, tea aroma/flavour is often removed from tea leaf, and the tea leaf then extracted to remove water soluble tea solids. The flavour and aroma constituents are then returned to the tea solids to provide an instant tea, in liquid or dry form, of improved flavour and aroma.

These prior art processes have one or more disadvantages, either causing high losses of the natural aroma and flavour compounds, causing undesirable changes to occur in the recovered flavour and aroma product, or causing deterioration of the natural plant product so as to make it less suitable for further processing. Most of these prior art processes use externally applied heat, such as steam, to drive off the flavour and aroma materials.

We have now found an improved method of stripping aroma and flavour compounds from plant materials.

Thus, according to the invention, there is provided a method of stripping aroma and flavour compounds from a plant material which comprises the steps of subjecting the plant material to microwave radiation in the presence of moisture to release a substantial portion of said moisture, said aroma and flavour compounds as a vapour, and collecting the vapour as a condensate.

Preferably, the vapour is then collected as a water-containing condensate and either used by itself as a flavouring material or added back to the plant material or an extract thereof at a later stage in its processing.

The method of the present invention will be described with reference to a method for removing valuable aroma and flavour compounds from tea. It should be recognised, however, that the method is also applicable to the production of good quality flavour and aroma preparation from fruits, herbs, spices, vegetables, coffee and other plant materials where the realisation of a high quality aroma and flavour product from the natural product, without at the same time causing substantial deterioration of the raw material, is a desirable end.

In accordance with one embodiment of the present invention, microwave stripping of aroma and flavouring materials from tea leaf is accomplished by wetting the tea leaf with water, thereafter sealing it in a heating vessel and subjecting the moistened tea, uniformly, to microwave radiation. The microwave stripping releases in, vapour form, a portion of the water added to the tea during the wetting step. At the same time, a substantial portion of the aroma and flavour consitutuents are removed. The combination of the moisture given off by the wetted tea together with the aroma and flavouring constituents are recovered by subjecting the effluent vapour to condensation at low temperatures.

The important variables to regulate in accordance with the method of the present invention include the moisture level to be added to the plant material, the power levels used during the microwave treatment, the degree of vacuum and/or pressure applied to the plant material, and the presence or absence of auxiliary convection or conductive heating. Each of these parameters can be varied depending upon the nature of the plant material and the results desired.

In the case of tea leaf, good results have been obtained where the tea leaf is wetted with water, to provide a tea leaf preparation having a moisture content of from about 25 to about 90%, by weight. In processes where the end product is intended to be a dry tea leaf product, such as a decaffeinated leaf tea, good results have been obtained by using a moistened tea leaf preparation having from about 40% to 60%, by weight, of moisture. The higher moisture levels result in more complete removal of aroma and flavour compounds from the tea, but also provide an aroma and flavour condensate more dilute with respect to the aroma and flavour compounds.

These interrelationships are more fully shown in the drawings attached hereto in which:

Fig. 1 shows the relationship between stripping efficiency and draw-off ratio under vacuum (0-10 mm Hg) microwave stripping conditions; and

Fig. 2 shows the relationship between draw-off ratio and concentration of condensate obtained under vacuum microwave stripping.

As shown by the studies summarised in Fig. 1, within the range studied, a fairly linear relationship exists between draw-off ratio and stripping efficiency. Thus, following the considerations established in Fig. 1, it is possible to regulate stripping conditions to obtain maximum yield consistent with the realisation of a condensate having a desired concentration of aroma/flavour.

Further, as shown in Fig. 2, at higher draw-off ratio, the recovered condensate will be more dilute. A compromise between draw-off ratio and efficiency may be made to avoid the need for additional downstream processing, ie. further concentration of the aroma/flavour condensate.

Microwave heating in accordance with the method of this invention may vary over a wide range of energy levels, depending on the product loading, the dimensions of the container, and upon whether the plant material is agitated uniformly during heating to avoid localised overheating. Good results have been obtained where the tea leaf is wetted with an equal weight of water, eg. 75 grams of leaf wetted with 75 grams of water, and the sample exposed to microwave energy at a level of 0.6 Kw, the source having a frequency of 2450 MHZ. Energy levels of 0.1 Kw-200 Kw and frequencies of 715 MHZ-2450MHZ are suitable operational parameters.

The microwave stripping operation is extremely efficient. It can take as little as five minutes to complete and can remove from 25-80% of the aroma and flavour compounds found in the starting tea leaf. In addition, the aroma/flavour condensate obtained is of superior quality and can be incorporated into finished tea products without further processing. Furthermore, the stripped tea leaf remains largely unaffected by the processing and can be used as the raw material for the preparation of regular tea leaf products, decaffeinated tea leaf products and instant tea products by subjecting it to conventional processes.

In the microwave stripping operation of the present invention, care must be taken to avoid hot spots which may be formed in the bed of prewetted tea. This problem can be avoided by the proper control of the microwave power level and by ensuring that the radiation is uniformly applied to the leaf. A rotating heating vessel may be used or the tea may be treated in a continuous production fluidised bed. Conventional pulsing of the power source is also beneficial.

The invention will be further described by the following non-limiting examples.

EXAMPLE 1

Prior art atmospheric steam stripping methods were carried out using 30 grams of black tea leaf that was pre-wetted with 30 grams of water and packed into a column with 10g of stainless steel boiling chips. Stripping of aroma and flavour was conducted at 95°C for 30 minutes. Condensate was condensed at 4°C, using circulating propylene glycol to cool the condensing surface.

Vacuum steam stripping was conducted in the same equipment, using 30g of black tea leaf packed into a column with 10g of stainless steel boiling chips, at 10-25 mm Hg vacuum with a steam temperature of 60±5°C, and a bed temperature maintained at 65±5°C to prevent condensation. Liquid nitrogen traps were used to collect the condensate in this instance.

In the procedures using microwave heating, a CEM Model MDS-81 microwave drying/digestion system sold by CEM Corporation, Indian Trail, NC 28079 was used. The system provides 0-100% of full power (600 watts) in 1% increments. In this case, 30 grams of tea leaf, prewetted with 30 grams of water, was transferred in equal parts to two 120 ml Teflon heating vessels and sealed tightly. The outlets of these two vessels were connected to a propylene glycol cooled condenser (4°C) and/or two liquid nitrogen traps connected in series. Both atmospheric pressure and vacuum stripping were performed, as indicated below.

The condensate was collected in each case, and aliquots were taken for gas chromatographic analysis and sensory evaluation. The stripped leaf was weighed to calculate the water retained. The leaf was then air dried overnight and stored for further analysis and tasting. For aroma/flavour mass balance studies, the treated leaf was analysed immediately.

For aroma/flavour balance studies, using capillary gas chromatographic analysis, the samples were prepared by Likens-Nickerson distillation. For the quantification of condensates, 5 ml of condensate was partitioned with 1 ml of 1:1 (V/V) methylene chloride:hexane mixture and the organic phase was used for GC analysis. The samples were chromatographed on a DB-5 60m x 0.32mm fused silica column with 1 millimicron film thickness. The initial column temperature wa 40°C. After two minutes holding at 40°C, the temperature was programmed to rise at 4°C per minute to 250°C. To maximise the sensitivity, the splitless injection mode was used. The data is reported as GC area counts per aliquot analysed.

Sensory evaluation was conducted using informal taste panels of experienced tea tasters. Black tea leaf which had been treated by conventional prior art steam stripping techniques, and then dried was used as a control. Two grams of the stripped black tea leaf were packed into a tea bag with and without the add-back of the aroma/flavour condensate undergoing evaluation. The tea bag was then brewed for three minutes and tasted against an infusion prepared from the starting unstripped black tea leaf. For instant tea tasting, the aroma condensate was added to an instant tea product at a 5% level based on weight of tea solids. A black tea aroma condensate recovered by standard commercial techniques was used for comparison.

EXAMPLE 2

Comparison of Microwave Stripping of the Present Invention with Steam Stripping of Prior Art

A comparison of stripping efficiencies was made between the two aroma stripping methods, under both atmospheric and vacuum conditions, using the conditions given in Example 1. The results of these tests are given in Table 1 below. The draw off ratio (DOR) is defined as the volume of condensate collected divided by the dry weight of the tea leaf used. Therefore, the small the DOR the higher the condensate concentration.

In order to compare the efficiencies among several stripping methods, a more general term called total efficiency index (TEI) was used. The TEI is defined as the percent of the aroma/flavour stripped divided by the DOR times 100. Higher TEI indicate better efficiencies for the whole process as well as more concentrated condensates.

As shown in Table 1, microwave stripping was more effective than steam stripping under both atmospheric and vacuum conditions. In terms of the aroma/flavour recovered, atmospheric stripping appeared to be more efficient than vacuum stripping, whether microwave or prior art steam stripping was used.

TABLE 1

Comparison of Various Stripping Methods on the Stripping Efficiency of Tea Aroma/Flavour

Method of Stripping	% of Aroma/Flavour Stripped (I)	Draw-Off Ratio[a] (II)	Total Efficiency Index[b] (I/II x 100)
Atmospheric Steam Stripping	42	2.7	16
Vacuum Steam Stripping at 15 mm Hg	25	3.7	7
Atmospheric Microwave Stripping	52	1.3	40
Vacuum Microwave Stripping at 0-1[illegible] mm Hg	--	1.2	26

[a] - Draw-off ratio is defined as the volume of condensate collected divided by the dry weight of tea leaf used

[b] - Total efficiency index is defined as the percent of the aroma/flavour stripped divided by draw-off ratio times 100.

EXAMPLE 3

Comparison of Aroma/Flavour Stripped Under Atmospheric Pressure and Vacuum Conditions

A comparison of the aroma stripped under atmospheric pressure and two sets of vacuum conditions, 0-10 mm Hg and 65-120 mm Hg., as outlined in Example 1, is presented in Table 2. The condensates analysed were obtained under otherwise identical conditions, using 30g dry weight of black tea leaf, prewetted with 30f of water, and a microwave power level of 0.6 Kw for three minutes using the CEM system described in Example 1. Based on the total aroma/flavour present in the starting leaf, atmospheric microwave stripping stripped 65% of the aroma/flavour and recovered 52% thereof, while both vacuum microwave strippings stripped 40-52% and recovered 31%. Under the two vacuum conditions studied, the amount of aroma stripped appeared to be independent of the vacuum applied. Atmospheric microwave stripping recovered 20% more of the aroma/flavour originally present in the leaf than either of the samples prepared under vacuum.

TABLE 2

Comparison of Microwave Stripping Under Atmospheric & Two Sets of Vacuum Conditions, based on Gas Chromatographic Analysis

Compound, Counts/ 2.5g Leaf	Starting Leaf	Condensate Atmos. 760mm Hg	% Stripped	Condensate Vacuum 65-120mm Hg	% Stripped	Condensate Vacuum 0-10mm Hg	% Stripped
t-2-Hexenal+c-3-hexanol	1144	632	55	282	25	221	19
Phenylacetaldehyde	545	414	76	126	23	104	19
Linalool oxide I	43	27	63	24	56	32	74
Linalool oxide II	115	87	76	77	67	98	85
Linalool	176	109	62	98	56	111	63
Methylsalicylate	82	51	62	51	62	66	80
Geraniol	3	0	0	0	0	1	3[illegible]
beta-Ionone	121	42	35	27	22	41	3[illegible]
Peaks identified	3300	1903	58	1055	32	1104	3[illegible]
Total Peaks	6910	3540	51	2172	31	2124	31

EXAMPLE 4

Study of Aroma/Flavour Mass Balance by Microwave Stripping

In an attempt to understand if vacuum and insufficient cooling of the effluent vapours was the cause for observed lowered recoveries, an aroma/flavour mass balance study was conducted. The aroma/flavour mass balance across the microwave heated stripping unit operation under both atmospheric and vacuum conditions was investigated. Conditions of operation were those given in Example 1 above. The results are set forth in Table 3. Based on the total available aroma/flavour quantitied by gas chromatography, both atmospheric and vacuum stripping studies show the same level of aroma/flavour accountability, ie. 86-88%. Between 12 to 14% of the aroma/flavour present in the leaf was lost to the process despite the use of an efficient trapping system. This loss was observed under both atmospheric and vacuum conditions, and to the same extent.

In general, a fairly good mass balance was observed for most of the compounds identified. However, aroma/flavour recoveries over 100% for hexanol and phenylacetaldehyde, especially under the atmospheric stripping condition, is not understood. It is possible that some of the aroma/flavour may exist in precursor forms through glycosidic and/or cyanoglycosidic linkages. The stripping process may cause the cleavage of these covalent linkages resulting in the formation of these components (J.Chrom. 331:83-90, 1985). Other mechanism(s) of generation of these compounds are also possible.

TABLE 3

Comparison of Aroma/Flavour Mass Balance by Microwave Stripping Under Atmospheric & Vacuum Conditions

Compound, Count/2.5g	Starting	Condensate Atmospheric	Spent	Ratio*	Starting	Condensate Vacuum	Spent	Ratio*
t-2-Hexenal+ c-3-hexenol	1108	632	157	0.71	1144	282	725	0.88
Phenylacetal- dehyde	530	414	433	1.60	545	126	476	1.10
Linalool oxide I	41	27	6	0.80	43	24	17	0.95
Linalool oxide II	113	87	8	0.84	115	77	27	0.90
Linalool	171	109	37	0.85	176	98	68	0.94
Geraniol	1	0	0	0.00	3	0	1	0.33
beta-Ionone	122	42	55	0.80	121	27	93	0.99

TABLE 3

Comparison of Aroma/Flavour Mass Balance by Microwave Stripping Under Atmospheric & Vacuum Conditions

Compound, Count/2.5g	Starting	Condensate Atmospheric	Spent	Ratio*	Starting	Condensate Vacuum	Spent	Ratio*
Nerolidol	22	5	13	0.82	22	4	18	1.00
Peaks Identified	3274	1403	999	0.89	3320	1055	2016	0.93
Total Peaks	6757	3540	2378	0.88	6910	2172	2759	0.86

* (Condensate + Spent)/Starting

EXAMPLE 5

Since stripping of aroma/flavour compounds from tea leaf was demonstrated to be more efficient at atmospheric pressure than vacuum stripping, optimisation of the stripping conditions at atmospheric pressure to maximise the yield was investigated. Under constant microwave power, higher moisture content of leaf and long microwaving time result in an increased stripping efficiency, as shown in Table 4. However, this was accomplished at the cost of a more dilute aroma/flavour condensate. Therefore, a poor TEI resulted.

A lower degree of wetting of the leaf and a shorter microwaving time resulted in a higher TEI indicating a more economic process.

EXAMPLE 6

Effect of Microwave Power on Stripping Efficiency

The effect of microwave power on the aroma stripping efficiency under atmospheric stripping conditions was also investigated using the materials and procedures given in Example 1 above. It was found that an inverse relationship exists between the microwave power and stripping efficiency. The results of these tests are summarised in Table 5. However, when total efficiency was considered, stripping at 50% of the full microwave power is still a more economical process.

TABLE 4

Comparison of the Efficiency of Atmospheric Pressure Microwave Stripping of Tea Aroma/Flavour from Black Tea Leaf Under Three Different Conditions*

	Test No.		
	1	2	3
Aroma/Flavour Stripping efficiency (% aroma/flavour of starting leaf)	46	56	71
Aroma/Flavour conc. GC counts/ml	17684	14357	7529
Draw-off ratio[b]	0.76	1.13	2.73
Total efficiency index[a]	61	50	26

*1 = 30g tea leaf wetted by 30ml of H_2O and microwaved as in Example 1 at 100% 600w. power for 3 mins.

*2 = 30g tea leaf wetted by 45ml of H_2O and microwaved as in Example 1 at 100% 600w. power for 4 mins.

*3 = 30g tea leaf wetted by 90ml of H_2O and microwaved as in Example 1 at 100% 600w. power for 9 mins.

[a] - Aroma/Flavour Stripping Efficiency/Draw-Off Ratio x 100

[b] - Draw-Off Ratio - Condensate Volume/Dry Leaf Weight

TABLE 5

Effect of Microwave Power on the Efficiency of Stripping Tea Aroma/Flavour under Atmospheric Conditions*

	% of Microwave Power (600 watts)		
	100	75	50
Stripping efficiency (1% aroma of starting leaf)	52	44	23
Draw-Off ratio[a] (DOR)	1.13	0.67	0.24
Total efficiency index [b]	6	66	96
Aroma concentation (μg/ml)	69	111	164

a - DOR = Volume of condensate collected/dry weight of tea leaf used

b - Total efficiency index = stripping efficiency/DOR x 100

* - 30g of tea leaf was prewetted with 45ml of H_2O and stripped at atmospheric pressure and at the specified microwave power for 4 minutes.

EXAMPLE 7

Sensory Evaluation of Aroma/Flavour Condensate Obtained Using Microwave Heating

Aroma/flavour condensates obtained from tea leaf in accordance with the process of this invention were evaluated as add-back materials, both to tea leaf and to instant tea solids. At a draw-off ratio of 0.76, 22.8 grams of microwave aroma/flavour condensate was produced from 30 grams of dry black tea leaf, following the process described in Test No. 1, Example 5 above. The stripped tea leaf was then air dried at room temperature to a stable moisture content.

Leaf Tea

The stripped, dried tea leaf obtained above was divided into two portions. The first, portion A, was packed into tea bags at a level of two grams of tea leaf per bag. The second, portion B, was combined with the microwave aroma/flavour condensate obtained above, at a level of 1.52 grams condensate for each two grams of dry leaf. The mixture was then allowed to dry at room temperature to a stable moisture content, and packed into tea bags at a level of two grams per bag. Tea bags from each portions A and B, as well as tea bags containing two grams each of the original black leaf tea, portion C, used as the starting material in preparing portions A and B, were brewed for three minutes in boiling water poured into tea cups, and then evaluated by experienced tasters.

It was found that the microwaved leaf of portions A and B brewed slightly more slowly than the starting leaf, portion C. However, at the end of the 3 minute brewing period, the infusions prepared from all three portions of leaves looked the same. Without aroma add-back, the infusion produced from the microwaved leaf (portion A) tasted more bitter, brisk, harsh and astringent and was not acceptable. With aroma add-back (portion B), the brew was well rounded and was very close in flavour and aroma to the infusion prepared from the starting leaf, portion C.

Decaffeinated Leaf

An additional 30 grams of dry black tea leaf was treated at a draw-off ratio of 0.76, as described above, to obtain 22.8 grams of microwave aroma/flavour condensate. The stripped leaf, without substantial drying, was then decaffeinated with supercritical CO_2, following the steps and conditions given in the second phase of Example 1 of U.S. Patent No. 4,167,589. In addition, 30 grams of the original dry black tea leaf was moistened by addition thereto of 30 grams of water, and then subjected to the same decaffeination process. On completion of the decaffeination step, both batches of tea leaf were dried at room temperature to stable moisture content and packaged into tea bags containing 2 grams each.

The tea bags were brewed into tea by adding boiling water to the bag in a tea cup and allowing the infusion to stand for three minutes. Evaluation by experienced tasters established that the decaffeinated microwave stripped leaf produced a brew that was superior in taste and aroma to brewed decaffeinated original tea leaf, decaffeinated by the same method.

Instant Tea

Dry black tea leaf, as used above, was subject to aqueous extraction to recover an aqueous extract containing 35% of the solids of the starting tea leaf. The aqueous extract was obtained using a multi-stage extraction technique, whereby the fresh leaf is subjected to four counter-current stages of aqueous extraction, the first three at atmospheric pressure and at temperatures approaching the boiling point. The fourth stage was at higher temperature and pressure conditions of 155°C, with 100-110 p.s.i.g. steam and residence time of 4 minutes. At the conclusion of stage 4, the aqueous extract was stripped of the aroma and flavour by conventional means, including condensation of vapours at liquid nitrogen temperature, and the extract was decreamed and dehazed by conventional techniques, whereafter it was dried to produce an instant tea powder.

A comparison was made of the quality of the microwave aroma/flavour condensate of the present invention with that obtained during the conventional manufacture of instant tea. Both aroma/flavour concentrates were added to a solution of instant tea solids. 0.7 grams of the instant tea powder described above was dissolved in 200 ml of water to provide, based on process yield values, a tea calculated to be correct for drinking as a typical brew. To this solution, 1.52 grams of microwave aroma/flavour condensate obtained as described above, was added, to provide instant tea product A. Similarly, an amount of aroma/flavour concentrate obtained from the conventional extraction process, equivalent to the 1.52 grams of microwave aroma/flavour condensate, as determined by an expert tea taster, was added back to another 200 ml of water containing 0.7 grams of the instant tea powder to provide a control sample, product B.

Products A and B were evaluated as iced tea products by experienced tea tasters. Product A, containing the microwave aroma/flavour condensate was considered to be more tea-like than product B. This observation was consistent with the analytical observation that the microwave aroma/flavour condensate contained a higher proportion of the tea-like components (57% vs. 43%) and 50 times less of thermally derived aldehydic components than the conventional tea aroma/flavour condensate.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:

1. A method of stripping aroma and flavour compounds from a plant material which comprises the steps of subjecting the plant material to microwave radiation in the presence of adsorbed and/or absorbed moisture to release a substantial portion of said moisture, said aroma and flavour compounds as a vapour, and collecting the vapour as a condensate.

2. The method of claim 1, wherein the plant material is moistened tea leaf.

3. A method of stripping aroma and flavour compounds from a plant material containing said compounds which comprises the steps of subjecting the plant material to microwave radiation in the presence of adsorbed and/or absorbed moisture to release a substantial portion of said aroma and flavour compounds and to vapourise a substantial portion of said moisture, drawing off said aroma and flavour compounds and water vapour, as formed, from the stripped plant material, and collecting said aroma and flavour compounds and water vapour as a condensate.

4. A method according to claim 3, wherein the microwave radiation is of sufficient intensity to release from 25 to 80% of the flavour and aroma compounds in the plant material, together with a substantial portion of the moisture present, and wherein the conditions under which the plant material is subjected to the microwave radiation ensures uniform radiation exposure and is insufficient in intensity to cause substantial damage to the plant material.

5. A method for processing a plant material comprising the steps

(a) stripping aroma and flavour compounds from the material in accordance with the process of claim 1 to provide a stripped plant material and a condensate containing aroma and flavour compounds;

(b) subjecting the stripped plant material to further processing; and

(c) adding the condensate obtained in step (a) above back to the said further processed plant material.

A method for processing tea leaf comprising the steps of

(a) providing a tea leaf preparation having a moisture content of from ~~about~~ 25 to ~~about~~ 90% by weight;

(b) subjecting said tea leaf preparation to microwave radiation to release a substantial portion of aroma and flavour compounds, together with moisture, therefrom;

(c) drawing off the said aroma and flavour compounds and vapourised moisture from the tea leaf; and

(d) condensing said aroma and flavour compounds and vapourised moisture to form a condensate.

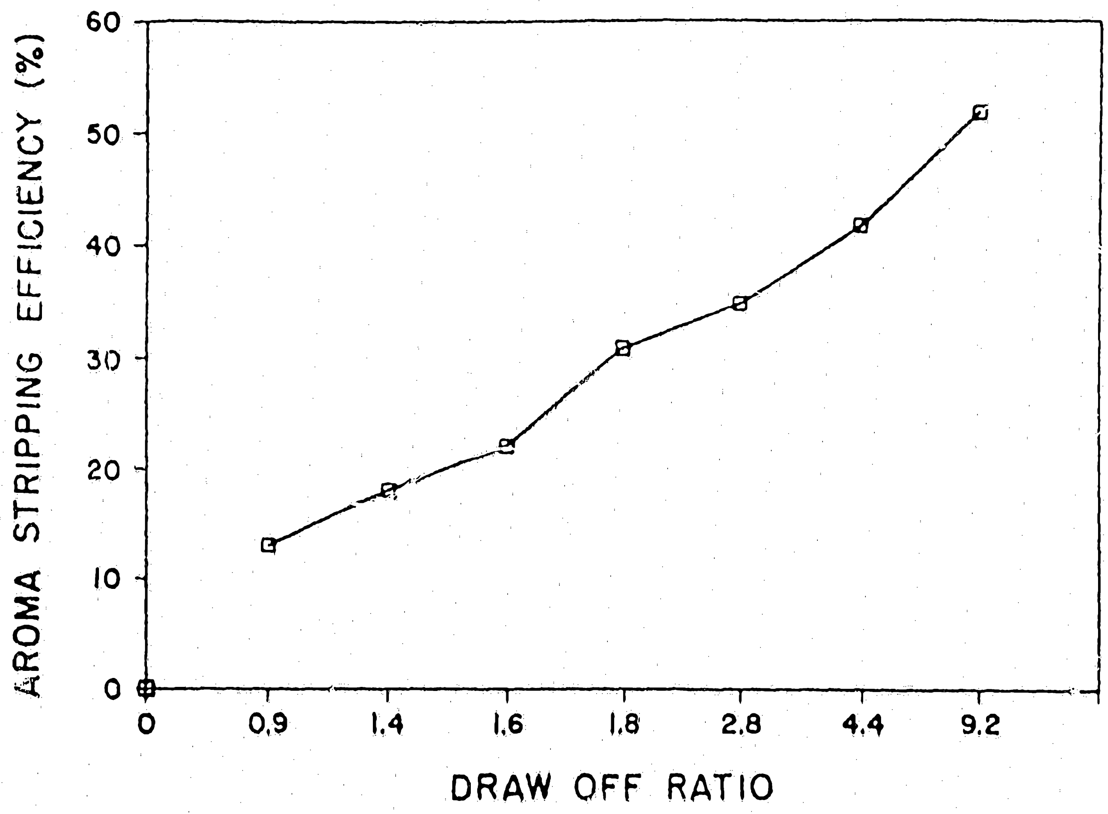
7. A method for processing tea leaf according to claim 6 comprising the further steps of

(a) subjecting the moist tea leaf to a further processing step selected from the group consisting of decaffeination, drying and aqueous extraction to form a tea product; and

(b) adding the condensate to the tea to form a tea product of improved aroma and flavour.

AUSTRALIAN PATENT OFFICE

DATED THIS 31ST DAY OF MAY 1988
UNILEVER PLC
By its Patent Attorneys:
CLEMENT HACK & CO.
Fellows Institute of Patent Attorneys of Australia



AROMA STRIPPING EFFICIENCY (%)
60
50
40
30
20
10
0
0
0,9
1,4
1,6
1,8
2,8
4,4
9,2
DRAW OFF RATIO

FIG. 1

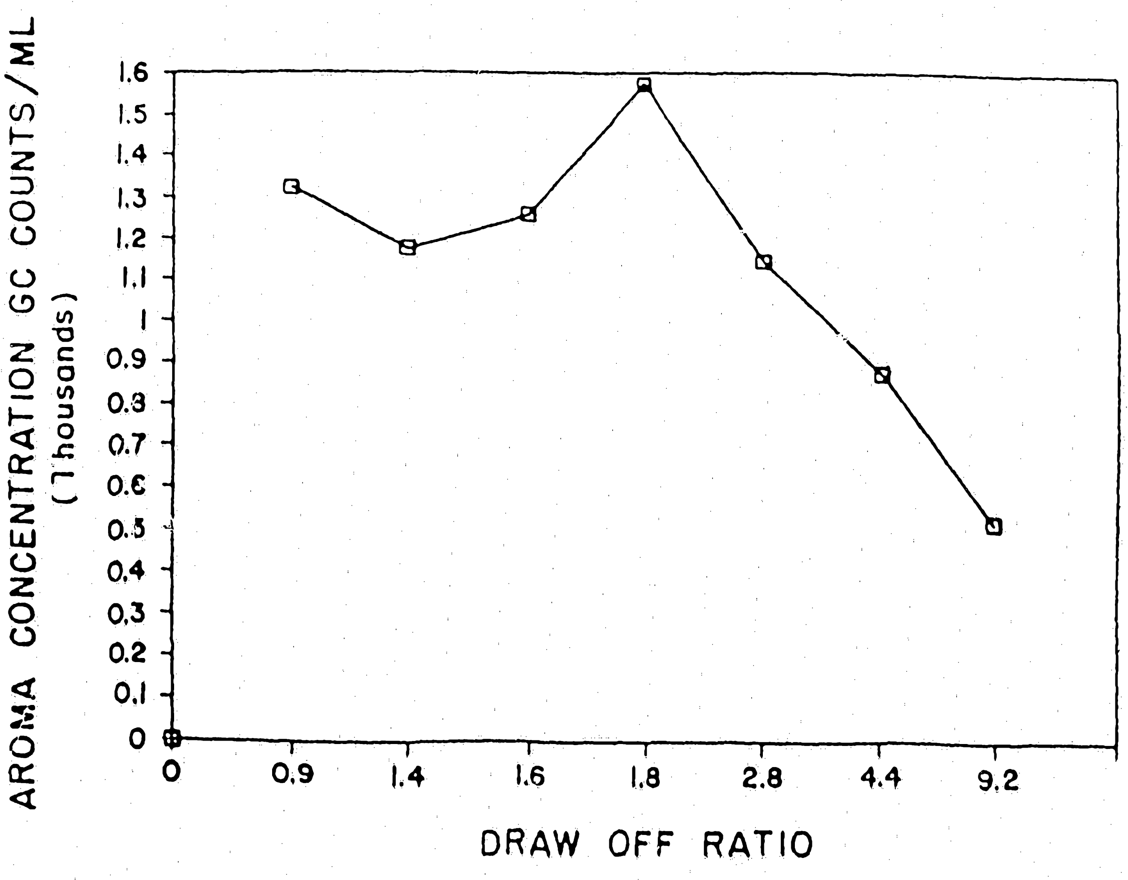

AROMA CONCENTRATION GC COUNTS/ML
(Thousands)
1.6
1.5
1.4
1.3
1.2
1.1
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
0
0.9
1.4
1.6
1.8
2.8
4.4
9.2
DRAW OFF RATIO

FIG. 2