Title: FERMENTED RED GINSENG COMPRISING METABOLITES OF GINSENG SAPONINS BY THE ACTION OF HUMAN INTESTINAL BACTERIA AND THE PREPARATION METHOD THEREOF

Abstract: The present invention relates to fermented red ginseng comprising metabolites of ginseng saponins by the action of human intestinal bacteria having anti-obesity activity, energy improving activity or blood circulation improving effect and the preparation method thereof. More particularly, the present invention relates to fermented red ginseng products with enhanced pharmacological effects due to specific component of red ginseng such as ginsenoside-Rg3, ginsenoside-Rg2, ginsenoside-Rh2 as well as at least one saponin metabolites selected from 20(S)-protopanaxadiol 20-O-beta-D-glucopyranoside, 20(S)-protopanaxadiol and 20(S)-protopanaxatriol. The fermented red ginseng in the present invention has anti-obesity activity, energy improving activity or blood circulation improving effect and it is useful as a health care food with safe and efficacy.
Description

FERMENTED RED GINSENG COMPRISING METABOLITES OF GINSENG SAPONINS BY THE ACTION OF HUMAN INTESTINAL BACTERIA AND THE PREPARATION METHOD THEREOF

Technical Field

[1] The present invention relates to fermented red ginseng comprising metabolites of ginseng saponins by the action of human intestinal bacteria and the preparation method thereof. Particularly, the present invention relates to fermented red ginseng comprising specific component of red ginseng such as ginsenoside-Rg3, ginsenoside-Rg2, ginsenoside-Rh2 as well as at least one saponin metabolites selected from 20(S)-protopanaxadiol 20-O-beta-D-glucopyranoside, 20(S)-protopanaxadiol and 20(S)-protopanaxatriol.

Background Art

[2] A ginseng has been reported to be a representative nutritive tonic agent in Asian countries as well as other countries in the world and there are many genus of Panax genus plants belonged to Araliaceae, for example, Panax ginseng distributed or cultivated in far-eastern Asia region, Panax quinquefolia in America and Canada, Panax notoginseng in China, Panax trifolia in eastern region of north America, Panax japonica in Japan, China and Nepal, Panax pseudoginseng in Nepal, Panax vietnamensis in Vietnam, Panax elegator, Panax wangianus and Panax bipinratifidus, etc.

[3] In Korea, a ginseng is classified with several types according to the processed methods, i.e., an un-processed natural ginseng cultivated for more than 4 years called as a fresh ginseng, simple processed ginseng such as removing cortex of fresh ginseng called as a white ginseng, complex processed ginseng cultivated for more than 6 years old, i.e., the processing steps consisting of 1st steaming with vapor at about 130 °C for 1 or 2 hours; cooling with the air; 2nd steaming with vapor at about 70 °C for 7 to 10 hours; removing unnecessary parts such as beard root etc; and drying in the drying room in order to the water content of ginseng to be in the range from 12.5 to 13.5%, which is called as red ginseng, the most expensive and pharmacologically active form of ginseng.

[4] It has been known that main component of Panax genus plant is a dammarane
saponin such as ginsenosides Rb₁, Rb₂, Rc, Rd, Rg₁ and Re of which activities are
different from each other in accordance with their chemical structures (Chung B S.

Therefore, there have been several attempts to process or modify Panax genus
plants so as to increase their pharmacological potency, in particular, to modify the
structure of ginsenosides therein or to find effective and specific method to increase
pharmacologically potent ginsenoside.

For example, Korean Patent Registration No. 0164266 issued on Sep. 11, 1998 and
United States Patent Registration No. US5919770 issued on Jul. 06, 1999 discloses a
process for mass production of saponin metabolites such as compound K from ginseng
saponins using intestinal bacteria.

It has been reported that when the glycoside forms of ginsenoside or the
metabolites thereof are administrated into human, most of those are degraded or me-
tabolized to degraded forms of saponin which is further absorbed in human body, for
example, 20(S)-protopanaxadiol 20-O-beta-D-glucopyranoside,
20(S)-protopanaxadiol, 20(S)-protopanaxatriol etc, by the action of human intestinal
bacteria not by human digestive enzyme. However, the major dominant species and the
amount of individual human bacteria are different from each other according to the
personal condition, which can influence the absorbing ability of each person for the
saponin (Hasegawa H, et al., Microbial Ecology in Health and Disease, 12, pp85-91,
Planta Med., 62, pp453-457, 1996). Additionally, present inventors found that the
individual difference in respect to the absorbing activities for ginsenoside saponin took
an effect on the anti-cancer efficacy through cancer metastasis experiments using by
animal test as well as human clinical study (Hasegawa H, et al., Planta Med., 64,
population of human intestinal microbes can be influenced by individual food favor
taste and body condition, which give rise to great difference in absorbing ability for
ginsenoside saponin between each person and each races and to several problems such
as an individual difference of potency and some limitation with the free access to take
ginseng because of the individual difference.

US Patent No. 5,925,537 discloses a process for the preparation of metabolites of
panaxadiol saponins comprising culturing Provitella sp.1 strain in a medium sup-
plemented with Panax ginseng saponin, however, the method has also several
problems such as the formation of unpleasant odor including characteristic smell of
intestinal bacteria which should be eliminated from the culture medium, and the limits to supply human with addable food because of aforementioned disadvantage.

[9] Therefore, there have been needed to develop new processing method to obtain safe and commercially addable ginseng product having potent pharmacological activity and overcoming above described disadvantages till now.

[10] However, there has been not reported or disclosed about a fermented red ginseng with human intestinal bacteria and the preparation method thereof to use as a safe and addable health care food which can be taken regardless of individual difference with high absorbing activity for pharmacologically active ginsenoside metabolites in any of above cited literatures, the disclosures of which are incorporated herein by reference

[11] The inventors of the present invention have been investigated to find a suitable intestinal bacteria to be applied to red ginseng having increased amount of pharmacologically active ginsenoside metabolites such as 20(S)-protopanaxadiol 20-O-beta-D-glucopyranoside, 20(S)-protopanaxadiol and 20(S)-protopanaxatriol as well as to be taken by addable form of product itself without further purification process. As a result of the investigation, the inventors have discovered suitable intestinal bacteria which can provide degrading ability for ginsenoside saponin and addable red ginseng with abundant ginsenoside metabolites, and they have finally completed the present invention.

Disclosure

[12] Accordingly, it is an object of the present invention to provide novel fermented red ginseng comprising specific component of red ginseng such as ginsenoside-Rg3, ginsenoside-Rg2, ginsenoside-Rh2 as well as at least one saponin metabolites selected from 20(S)-protopanaxadiol 20-O-beta-D-glucopyranoside, 20(S)-protopanaxadiol and 20(S)-protopanaxatriol.

[13] And, another object of the present invention is to provide a process for preparing fermented red ginseng described above.

[14] In accordance with the present invention, the present invention provides novel fermented red ginseng comprising ginsenoside-Rg3, ginsenoside-Rg2 and ginsenoside-Rh2 as specific components of red ginseng as well as at least one saponin metabolites selected from 20(S)-protopanaxadiol 20-O-beta-D-glucopyranoside, 20(S)-protopanaxadiol and 20(S)-protopanaxatriol as the metabolites thereof.

[15] The present invention also provides a process for preparing fermented red ginseng comprising the steps consisting of: inoculating a bacteria having saponin degrading ability into fresh ginseng; culturing said ginseng; subjecting the cultured ginseng to
repetitive steaming and drying steps to obtain fermented red ginseng of the present invention.

[16] The present invention also provides novel fermented red ginseng obtained from the above-described process.

[17] The term 'ginseng' disclosed herein comprises all the root of Panax genus plant which may be employed includes, but are limited to, Panax genus plant such as Panax ginseng C. A. Meyer (Korean ginseng), Panax quinquefolia L (American ginseng), Panax notoginseng F. H Chen (Sanch ginseng), Panax japonica C. A. Meyer (Chikusetsu ginseng), Panax pseudo-ginseng Wall. Subsp. Hmalicus Hara (Hmalayan ginseng), and Panax vietnamensis Ha et Grushv. (Vietnamese ginseng), which may be used as sole the combinations thereof.

[18] The term 'a bacteria having saponin degrading ability' disclosed herein comprises all the bacteria which can degrade ginsenoside saponins, however, Lactic acid bacteria, Bifidobacterium genus bacteria or Saccharomyces genus bacteria are preferable, which may be used as a sole or the combinations thereof. The 'bacteria having saponin degrading ability' disclosed herein can be selected by confirming experiment cited in the literature (Hasegawa H et al. Planta Medica 62, pp453-457, 1996), for example, the procedure consisting of inoculating any bacteria to be selected into fresh ginseng, steaming and drying said ginseng and finally determining the amount of isolated saponin metabolites such as 20(S)-protopanaxadiol 20-O-beta-D-glucopyranoside, 20(S)-protopanaxadiol and 20(S)-protopanaxatriol with TLC.

[19] Above described fermented red ginseng of the present invention can be prepared by following steps:

[20] 1. 1st step: fermentation step

[21] Disinfected fresh ginseng for example, disinfected with high pressured heating apparatus at the temperature ranging from 100 to 150 °C, preferably, 120 to 130 °C for the period ranging from 10 to 30 mins, preferably, 15 mins, is subject to following fermentation process with a bacteria having saponin degrading ability;

[22] For example, a bacteria having saponin degrading ability include any one which can be added to food with safe and produce beta-glucosidase, alpha-arabinosidase and alpha-rhamnosidase, preferably, lactic acid bacteria belonged to Lactobacillus genus, Streptococcus genus, Lactococcusgenus, Bifidobacterium genus, Saccharomyces genus, Torulaspora genus and Candida genus, more preferably, at least one or the mixture thereof selected from the group consisting of Lactobacillus gasseri DSM2024 and ATCC393, Lactobacillus plantarum ATCC14947 and ATCC10241, Lactobacillus
*buchneri* ATCC4005, *Lactobacillus mail* ATCC27304, *Lactobacillus johnsonii*, *Lactobacillus gallinarum* JCM2011, *Lactobacillus amylovorus* JCM1126, *Lactobacillus brevis* ATCC14869, *Lactobacillus rhamnosus* ATCC7469 and ATCC53103, *Lactobacillus kefir* NRIC1693, *Lactobacillus paracasei* NCDO151, *Lactobacillus crispatus*, *Streptococcus thermophilus*, *Lactococcus lactis* ATCC15577, *Bifidobacterium bifidum* JCM7002, *Bifidobacterium longum*, *Bifidobacterium adolescentis* ATCC15703, *Bifidobacterium infantis*, *Bifidobacterium breve*, *Bifidobacterium catenulatum*, *Saccharomyces cerevisiae* IFO-0309 and IFO-2018, *Torulaspora delbrueckii* and *Candida kefiri*, which can be used as a sole, however, the fermentation with the combinations of more than 2 species is preferable to shorten the incubation time.

The condition of fermentation may be varied with the species of bacteria, for example, anaerobic condition is preferably adopted such that oxygen is substituted with inert gas such as carbonate gas or nitrogen gas or removed with oxygen reactors for the anaerobic bacteria and aerobic condition is preferably adopted, for example, in the presence of oxygen gas for the aerobic bacteria.

For example, in case of *Bifidobacterium* genus bacteria or *Saccharomyces* genus bacteria, preferably, the incubation is subjected at the temperature ranging from 25 to 37 °C, for a period ranging from 24 to 48 hours in the concentration of fresh ginseng ranging from 1 to 50% at the base of solid parts to maximize the production of saponin metabolites. Besides the fresh ginseng, various sugar component can be added thereto, for example, 10-30% rice husk, corn or starch or 0.5 to 5.0% glucose, fructose, lactose or sucrose.

Through above 1st step, saponins for example, ginsenoside Rg₃, Rg₂, Rh₂, Rh₁ in fresh ginseng may be transformed into metabolites of ginseng saponins such as 20(S) PPD 20-O-beta-D-glucopyranoside, 20(S) PPD, 20(S)-PPT, etc. through the fermentation with above described bacteria.

2. 2nd step: Preparation of Red ginseng

The process for preparing red ginseng is pursuant to the techniques well known in the art.

As an exemplary process for preparing red ginseng, following steps may be repeated after the above fermentation step:

2-1. 1st Steaming and drying process

The fermented fresh ginseng obtained in above step 1 is subjected to 1st steaming treatment with hot vapor steamed in a steamer at below 130 °C preferably, 80 to 90 °C,
for 1 to 2 hours and then to drying process by heating in drying room at 70 °C for 7 to 10 hours.

2-2. 2nd Steaming and drying process

The dried ginseng obtained in above step 2-1 is subjected to 2nd steaming treatment with hot vapor steamed in a steamer at the temperature ranging from 50 to 100 °C preferably, 70 °C, for 7 to 10 hours and then to drying process dried in the sun so as to the water content of ginseng be in the range from 12.5 to 14.0 %.

After the 2nd steps, the fermented red ginseng can be subjected to additional step such as removal of unnecessary beard etc.

Therefore, the present invention also provides the process for preparing above described fermented red ginseng comprising the steps of fermentation step treated with lactic-acid bacteria or intestinal bacteria.

The fermented red ginseng obtained from above described preparation method shows various pharmacological activities such as anti-obesity activity, energy improving activity and blood circulation improving effect through several experiments performed by the present inventors.

Hereinafter, the following formulation methods and excipients are merely exemplary and in no way limit the invention.

The fermented red ginseng of the present invention can be in sale as a form of itself, however, it is preferable that sitologically acceptable additives such as flavoring agent or sweetener is added thereto to elevate the value of good.

As an addable or combinable component, various sugar component such as glucose, sucrose, fructose, honey, etc.; emulsifier such as sugar alcohols of sorbitol, xylitol, erythritol, lactitol, palatinit, etc.; sucrose fatty acid ester, glycerin fatty acid ester, lecithin, etc.; acidulant such as citric acid, acetic acid, lactic acid, etc.; sweetener, fruit juice or flavoring agent etc. can be added to fermented red ginseng of the present invention.

The other addable or combinable components other than aforementioned composition are various vitamin such as vitamin A, vitamin B, vitamin C, vitamin E, etc., plant components, cereal components, vegetable components, milk components, yoghurt components, berry components, orange components, papaya components, apple components, mint components, grape components, custard cream, peach, melon, banana tropical, herb components, black tea, coffee et al.

Above described composition therein can be added to fermented red ginseng inclusive of the combinations of more than 1 or 2 species.
The amount of above described composition therein may generally range from about 0.05 to 0.5 w/w %, preferably 0.1 to 0.3 w/w % of total weight of fermented red ginseng.

The formulation of above described fermented red ginseng may be prepared in any form such as solid type, liquid type or sterilized milk product.

It will be apparent to those skilled in the art that various modifications and variations can be made in the compositions, use and preparations of the present invention without departing from the spirit or scope of the invention.

**Mode for Invention**

The present invention is more specifically explained by the following examples. However, it should be understood that the present invention is not limited to these examples in any manner.

**Example 1. Preparation of red ginseng from fresh ginseng treated by human intestinal bacteria.**

200 g of sliced 4 years old *Panax ginseng* root (produced by Korea) was steamed and 1 % of *Lactobacillus rhamnose* (No. of Subscription: ATCC7469) was added thereto and then incubated at 37 °C for 7 days. The incubated *Panax ginseng* root was repeatedly steamed and dried at 80 - 90 °C to obtain 170 g of red ginseng.

**Example 2. Preparation of steamed red ginseng from fresh ginseng treated by human intestinal bacteria.**

200 g of sliced *Panax quinquefolia* root was steamed and 1 % of *Lactobacillus gasseri* (No. of Subscription: DSM20243) was added thereto and then incubated at 37 °C for 7 days. The incubated *Panax quinquefolia* root was repeatedly steamed and dried at 80 - 90 °C to obtain 170 g of red ginseng.

**Example 3. Preparation of steamed red ginseng from fresh ginseng treated by human intestinal bacteria.**

200 g of sliced 4 years old *Panax notoginseng* root (produced by China) was steamed and 1 % of *Bifidobacterium bifidum* (No. of Subscription: JCM7002) was added thereto and then incubated at 37 °C for 7 days. The incubated *Panax notoginseng* root was repeatedly steamed and dried at 80 - 90 °C to obtain 85 g of red ginseng.

**Example 4. Preparation of steamed red ginseng from fresh ginseng treated by human intestinal bacteria.**

200 g of sliced 4 years old *Panax japonica* root (produced by Japan) was steamed and 1 % of *Saccharomyces cerevisiae* (No. of Subscription: IFO3009) was added
thereto and then incubated at 37 °C for 7 days. The incubated *Panax japonica* root was repeatedly steamed and dried at 80 - 90 °C to obtain 170 g of red ginseng.

**Example 5. Preparation of steamed red ginseng from fresh ginseng treated by human intestinal bacteria.**

100 g of sliced *Panax pseudoginseng* root was steamed and 1 % of *Saccharomyces cerevisiae* (No. of Subscription: IFO0309) was added thereto and then incubated at 37 °C for 7 days. The incubated *Panax pseudoginseng* root was repeatedly steamed and dried at 80 - 90 °C to obtain 88 g of red ginseng.

**Example 6. Preparation of steamed red ginseng from fresh ginseng treated by human intestinal bacteria.**

200 g of sliced *Panax vietnamensis* root was steamed and 1 % of *Lactobacillus gnnali* (No. of Subscription: ATCC27304) and *Bifidobacterium bifidum* (No. of Subscription: JCM7002) were added thereto and then incubated at 37 °C for 7 days. The incubated *Panax vietnamensis* root was repeatedly steamed and dried at 80 - 90 °C to obtain 170 g of red ginseng.

**Reference Example 1: Preparation of food material and experiment animal**

Equivalent amount of fermented red ginsengs obtained from above Example 1 and non-processed red ginseng using as a comparative group were added to mouse feed to the concentration of 1% in the feed.

Male ICR mice weighing 22 g to 23g were divided into 3 groups (n=5), i.e., fermented red ginseng of Example 1 administration group, non-processed red ginseng administration group and control group fed with commercial feed for 7 days.

**Experimental Example 1. Content Analysis Experiment**

To determine the content of saponin metabolites in fermented red ginseng, following experiments were performed according to the procedure disclosed in the literature (Hasegawa H, et al., *Planta Medica*, 62, pp456-457, 1996). Each 1 g of test samples obtained from above Examples 1 to 6 was extracted with 2 ml of distilled water, respectively, and 1 ml of saturated n-BuOH, respectively. The extracts were centrifuged at 3,000 rpm for 10 minute and 2 ul of the supernatant was subjected to thin layer chromatography(developing solvent: CHCl₃-MeOH-distilled water=6:3:5:10) to isolate and detect 20(S)-protopanaxadiol 20-O-beta-D-glucopyranoside, 20(S)-protopanaxadiol and 20(S)-protopanaxatriol spot. A spraying agent containing the mixture of 8% of vanillin MeOH and 72% of H₂SO₄ (the capacity ratio of 1:5) was sprayed upon developed thin layer chromatography
plate and then was heated at 140 °C for 3 minute to detect the spots of aforementioned compounds.

As a result, metabolites of ginseng saponin such as 20(S)-protopanaxadiol 20-O-beta-D-glucopyranoside, 20(S)-protopanaxadiol and 20(S)-protopanaxatriol being contained in the sample of Examples 1 to 6 were detected at the \( R' \) value of 0.63, 0.70 and 0.83, respectively, and therefore, it is confirmed that fermented red ginseng contains those saponin metabolites.

Experimental Example 2: Rodent treadmill exercise experiment

Method

The mice prepared in Reference Example 1 were made to run on the treadmill for 30 minute each day for 4 consecutive days. The exercise load consisted of running at a speed of 10 m/minute for 10 minute, at 13 m/minute for another 10 minute, and at 16 m/minute for the last 10 minute, with 0 degree of inclination. On the 5th day of the experiment, the time to exhaustion for treadmill running was determined for the exercise. The time to exhaustion is defined as the time between the commencement of exercise and the first occurrence of the experimental animal failing to keep up with the treadmill machine for a period of 3 minute to more. The speed of the treadmill used for measurement of the time to exhaustion was 20 m/minute.

Result

While the mean time to exhaustion for forced treadmill running was 56.88±3.44 minute for the control group, the time was increased to 79.43±8.74 minute for the non-processed red ginseng group, and 98.96 ± 5.72 minute for the fermented red ginseng prepared in Example 1 group.

Experimental Example 3: Body weight measurement

The body weight of mice prepared in Reference Example 1 were measured with automatic weight measurement equipment (Jenix, Dongsintonsang, Korea).

At the result, comparing with 28.2 ± 0.5 g in the control group, the body weight were significantly reduced to 25.6 ± 0.6 g in the Comparative Example 1 group and 26.5 ± 0.6 in the non-processed red ginseng group.

The invention being thus described, it will be obvious that the same may be varied in many ways. Such variations are not to be regarded as a departure from the spirit and scope of the present invention, and all such modifications as would be obvious to one skilled in the art are intended to be included within the scope of the following claims.

Industrial Applicability

The fermented red ginseng treated by human intestinal-bacteria according to the
The present invention is significantly effective in the anti-obesity activity, energy improving activity or blood circulation improving effect, therefore it is useful as a healthcare food with safe and efficacy.
Claims

1. A fermented red ginseng comprising ginsenoside-Rg3, ginsenoside-Rg2 and ginsenoside-Rh2 as specific components of red ginseng as well as at least one saponin metabolites selected from 20(S)-protopanaxadiol 20-O-beta-D-glucopyranoside, 20(S)-protopanaxadiol and 20(S)-protopanaxatriol as the metabolites thereof.

2. A fermented red ginseng prepared by the process comprising the steps consisting of: inoculating a bacteria having saponin degrading ability into fresh ginseng; culturing said ginseng; subjecting the cultured ginseng to repetitive steaming and drying steps.

3. The fermented red ginseng according to claim 1 or 2 wherein said red ginseng is the root of Panax genus plant comprising at least one selected from the group consisting of Panax ginseng C. A. Meyer (Korean ginseng), Panax quinquefolia L (American ginseng), Panax notoginseng F. H Chen (Sanch ginseng), Panax japonica C. A. Meyer (Chikusetsu ginseng), Panax pseudo-ginseng Wall. Subsp. Himalaicus Hara (Himalayan ginseng), and Panax vietnamensis Ha et Grushv. (Vietnamese ginseng).

4. The fermented red ginseng according to claim 2 wherein said bacteria comprises at least one or the mixture thereof selected from the group consisting of Lactic acid bacteria, Bifidobacterium genus bacteria and Saccharomyces genus bacteria.

5. A process for preparing fermented red ginseng comprising the steps consisting of: inoculating a bacteria having saponin degrading ability into fresh ginseng; culturing said ginseng; subjecting the cultured ginseng to repetitive steaming and drying steps.

6. The process for preparing fermented red ginseng according to claim 5 wherein said bacteria comprises at least one or the mixture thereof selected from the group consisting of Lactic acid bacteria, Bifidobacterium genus bacteria and Saccharomyces genus bacteria.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC7 A23L 1/212

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)

A23L1/212, A23L1/30, A23L 2/38, A23K1/00

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

Korean Patents and applications for inventions since 1975

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

D/B: eKIPASS

KEY WORD: ginseng, saponin, fermentation, protopanaxadiol, glucopyranoside, bacteria

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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<td>Y</td>
<td>KR 1998-040224 A(KIM, JIN HA), 17 AUGUST 1998 claim 1-3</td>
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<tr>
<td>Y</td>
<td>JP 10-14523 A(NAGAOKA JITSUGYO KK ), 20 JANUARY 1998 claim 1, 7, 10, 11</td>
<td>2,4,5,6</td>
</tr>
<tr>
<td>Y</td>
<td>KR 10-0329259 B1(KIM, BONG SUP), 7 MARCH 2002 claim 1, 2</td>
<td>1-6</td>
</tr>
<tr>
<td>Y</td>
<td>KR2001-0000578 A(JUNG, IL SU), 5 JANUARY 2001 claim 1</td>
<td>2,4,5,6</td>
</tr>
<tr>
<td>A</td>
<td>JP 11-169135 A (NAGAOKA JITSUGYO KK ), 29 JUNE 1999 see the whole document</td>
<td>2-6</td>
</tr>
<tr>
<td>A</td>
<td>KR 1999-0084454 A(KT&amp;G), 6 DECEMBER 1999 see the whole document</td>
<td>1</td>
</tr>
<tr>
<td>A</td>
<td>KR 1987-0000879 A(JONG, HYEN GI), 10 MARCH 1987 see the whole document</td>
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<td>07-03-2002</td>
<td>None</td>
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<td>KR 2001-0000578 A</td>
<td>05-01-2001</td>
<td>None</td>
<td></td>
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<tr>
<td>JP 11-168135 A</td>
<td>29-06-1999</td>
<td>None</td>
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<td>KR 1999-0084454 A</td>
<td>06-12-1999</td>
<td>None</td>
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<tr>
<td>KR 1987-0000679 A</td>
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