

METHOD FOR IMPROVING AFTERTASTE OF ALCOHOLIC BEVERAGES USING ALLULOSE

Field of the Invention

The present invention relates to an agent for improving an aftertaste of an alcoholic beverage, which includes allulose-containing saccharides, and a method of improving an aftertaste of an alcoholic beverage using allulose.

Description of the Related Art

Ethanol (i.e., ethyl alcohol) contained in foods has an unpleasant flavor such as unique alcohol smell or bitterness. Such an unpleasant flavor becomes stronger with increasing alcohol concentration. Particularly, in the case of distilled alcoholic beverage having a high alcohol concentration, such as soju or rum, increase in sales is slowing down due to the unpleasant flavor thereof. Recent development of soju with low alcohol content or fruit soju with added flavor and increase in sales volume represents changes in preference of consumers who avoid the strong bitterness and smell of alcohol.

There has been proposed a method of using a glycoside-based sweetener such as steviol glycoside or enzyme-treated stevia instead of a sugar-based sweetener such as sucrose or fructose in order to reduce the flavor of soju and to mask a bitterness and tangy taste thereof (Korean Patent No. 10-1320082). However, such a glycoside-based sweetener has poor sensory properties such as delayed sweetness, unique bitterness, or foreign body sensation.

In addition, there has been proposed a method of applying allulose to beer or the like (Japanese Patent No. 5764308). However, in this method, allulose is used to maintain or improve a flavor of raw materials, and use of allulose to suppress a smell and bitterness unique to alcohols has not been proposed yet.

The present inventors have made efforts to reduce smell and bitterness of alcohol of alcoholic foods. As a result, the present inventors found that addition of allulose can mask the smell and bitterness of alcohol for a given amount of alcohol, and thus completed the present invention.

Summary of the Invention

It is one object of the present invention to provide an agent for improving an aftertaste of alcoholic foods, which includes allulose-containing saccharides.

It is another object of the present invention to provide a method of improving an aftertaste of alcoholic foods using allulose.

5 In accordance with one aspect of the present invention, an agent for improving an aftertaste of an alcoholic beverage includes allulose-containing saccharides and ethanol.

The allulose according to the present invention may be extracted directly from natural products, or may be chemically or biologically synthesized, without being limited thereto. In addition, the allulose may be provided in crystal form or in allulose-containing
10 syrup form (i.e., in liquid form).

As used herein, "alcoholic beverage" refers to a beverage containing an edible alcohol (i.e., ethanol).

In one embodiment, the ethanol may be present in an amount of 6% by volume (vol%) to 70 vol%, specifically 6 vol% to 50 vol%, 6 vol% to 45 vol%, 6 vol% to 40 vol%, 6
15 vol% to 30 vol%, 6 vol% to 25 vol%, 6 vol% to 20 vol%, 6 vol% to 18 vol%, 8 vol% to 70 vol%, 8 vol% to 50 vol%, 8 vol% to 45 vol%, 8 vol% to 40 vol%, 8 vol% to 0 vol%, 8 vol% to 25 vol%, 8 vol% to 20 vol%, 8 vol% to 18 vol%, 13 vol% to 70 vol%, 13 vol% to 50 vol%, 13 vol% to 45 vol%, 13 vol% to 40 vol%, 13 vol% to 30 vol%, 13 vol% to 25 vol%,
20 13 vol% to 20 vol%, 13 vol% to 18 vol%, 15 vol% to 70 vol%, 15 vol% to 50 vol%, 15 vol% to 45 vol%, 15 vol% to 40 vol%, 15 vol% to 30 vol%, 15 vol% to 25 vol%, 15 vol% to 20 vol%, or 15 vol% to 18 vol%, based on the total volume of the alcoholic beverage.

In one embodiment, the alcoholic beverage may be a distilled alcoholic beverage or a fermented alcoholic beverage. As used herein, "distilled alcoholic beverage" refers to an alcoholic beverage obtained by distilling alcohol-fermented fruit juices, plant juices, or
25 brewed starches (cereals).

Specifically, the alcoholic beverage may be a distilled alcoholic beverage, more specifically Soju, kaoliang liquor, brandy, Armagnac, whiskey, vodka, rum, gin, tequila or cognac.

In addition, the alcoholic beverage may be a fermented alcoholic beverage, more specifically beer, wine, sake, or makgeolli.
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In one embodiment, the aftertaste may be an alcohol bitterness and/or an alcohol smell.

In one embodiment, improving the aftertaste may include reducing or masking the

alcohol flavor.

In one embodiment, the allulose may be present in an amount of 50 parts by weight to 100 parts by weight, specifically 70 parts by weight to 100 parts by weight, 90 parts by weight to 100 parts by weight, 95 parts by weight to 100 parts by weight, 98 parts by weight to 100 parts by weight, 98.5 parts by weight to 100 parts by weight, 99 parts by weight to 100 parts by weight, or 99.5 parts by weight to 100 parts by weight, relative to 100 parts by weight of the saccharides in terms of dried solid content.

The saccharides may further include at least one sweetener, in addition to allulose. Examples of the sweetener may include any known sweetener, for example, monosaccharides, disaccharides, oligosaccharides, sugar alcohols, and high-strength sweeteners, without being limited thereto. Examples of the monosaccharides may include arabinose, xylose, fructose, tagatose, allose, and galactose. The disaccharides refer to a group of carbohydrates consisting of two monosaccharide units linked together, and examples thereof may include lactose, maltose, trehalose, turanose, and cellobiose. The oligosaccharides refer to a group of carbohydrates consisting of 3 or more monosaccharide units linked together, and examples thereof may include fructooligosaccharide, isomaltooligosaccharide, xylooligosaccharide, gentio-oligosaccharide, maltooligosaccharide, and galactooligosaccharide. The sugar alcohols refer to compounds obtained by reducing a carbonyl group in saccharides, and examples thereof may include erythritol, xylitol, arabitol, mannitol, sorbitol, maltitol, and lactitol. The high-strength sweeteners refers to sweeteners having a sweetness ten times or greater that of sucrose, and examples thereof may include aspartame, acesulfame K, rebaudioside A, and sucralose, without being limited thereto. In another embodiment, the saccharides according to the present invention may be free from sucrose, glucose, or a combination thereof.

In one embodiment, the allulose-containing saccharides may be present in an amount of 0.1 g to 10 g, specifically 0.1 g to 3.0 g or 0.3 g to 3.0 g per 1 L of the alcoholic beverage.

In one embodiment, the allulose may be present in an amount of 5 g to 600 g, specifically 5 g to 170 g, 16 g to 170 g, 5.55 g to 166.7 g, or 16.7 g to 166.7 g per 1 L of the ethanol. Herein, the ethanol as a reference refers to pure ethanol (i.e., 100% ethanol).

In accordance with another aspect of the present invention, a method of improving an aftertaste of an alcoholic beverage includes: adding allulose to the alcoholic beverage; or adding allulose to a beverage, followed by adding ethanol to the beverage.

The alcoholic beverage may be prepared commercially by distilling a mash obtained

through a process in which cereal grains or potatoes, as raw materials, are subjected to alcohol fermentation, followed by aging, or by diluting water-free alcohol with water and adding a sweetener and the like to the diluted alcohol. An allulose-containing alcoholic beverage may be prepared by adding the allulose to the prepared alcoholic beverage, or by adding the allulose to the raw materials in preparation of the alcoholic beverage.

In the method of improving an aftertaste of an alcoholic beverage, the allulose, the ethanol, the alcoholic beverage, the saccharides, the aftertaste, and improving aftertaste are the same as described in the above aspect.

The present invention provides a method in which allulose is added to alcoholic foods having a high alcohol content, especially alcoholic beverages to mask unpleasant alcohol bitterness and smell, thereby considerably improving sensory preference of the foods without using separate additives.

Brief Description of Drawings

Fig. 1 is a graph showing a relationship between alcohol concentration and alcohol bitterness according to Examples and Comparative Examples.

Fig. 2 is a graph showing a relationship between alcohol concentration and alcohol smell according to Examples and Comparative Examples.

(※ In the drawings, * indicates a statistically significant trend ($p < 0.1$), and ** indicates a statistically significant difference ($p < 0.05$).)

Detailed Description of the Invention

Hereinafter, the present invention will be described in more detail with reference to examples. However, it should be noted that these examples are provided for illustration only and should not be construed in any way as limiting the invention. In addition, these examples are provided for more complete understanding of the present invention by one of ordinary skill in the art.

Experimental Example 1: Preparation and quality analysis of diluted soju

Generally, alcoholic beverages have varying alcohol contents depending upon the kind and manufacturing method thereof. Beer has an alcohol content of 4 vol% to 12 vol% (generally 5 vol%), wine has an alcohol content of 6 vol% to 12 vol% (generally 8 vol%), Sake has an alcohol content of 8 vol% to 15 vol% (generally 13 vol%), and soju has an alcohol content of 14 vol% to 20 vol% (generally 18 vol%). For an alcoholic beverage having

an alcohol content of less than 6 wt%, since an unpleasant flavor of alcohol is not significant, diluted soju having an alcohol content of 8.0% or more was prepared to check change in quality due to addition of allulose.

(1) Preparation of diluted soju

Diluted soju samples of Comparative Examples 1 to 3 and Examples 1 to 3 were prepared as follows. First, purified water was added to a rectified spirit having an alcohol concentration of 95 vol%, thereby preparing 10 L of a primarily diluted rectified spirit having an alcohol concentration of 50 vol%. Then, activated carbon powder was mixed with the primarily diluted rectified spirit, followed by aging and deodorization for 1 to 3 hours, and then the resulting mixture was clarified using a filter containing diatomaceous earth (SELECT® A20, BEGEROW Co.). Then, sucrose (purity: 98 wt% or more, White Sucrose, CJ Cheiljedang) or allulose (crystal allulose, purity: 98 wt% or more, CJ Cheiljedang) was mixed with the clarified mixture in amounts as listed in Table 1, followed by adding purified water, thereby preparing 1 L of a secondarily diluted rectified spirit. Then, the secondarily diluted rectified spirit was clarified in the same manner as the primarily diluted rectified spirit.

In addition, purified water was added to the clarified primarily diluted rectified spirit to dilute the spirit to alcohol concentrations as listed in Table 2, thereby preparing Sensory Comparison Examples for sensory evaluation.

Table 1

	Primarily diluted rectified spirit	Sucrose	Allulose	Final volume	Alcohol concentration	Sweetener concentration
Note	50 vol%	-	-	-	-	-
Unit	mL	g	g	mL	vol%	g/L%
Comparative Example 1	160	10		1000	8.0%	1.0%
Comparative Example 2	260	10		1000	13.0%	1.0%
Comparative Example 3	360	10		1000	18.0%	1.0%
Example 1	160		10	1000	8.0%	1.0%
Example 2	260		10	1000	13.0%	1.0%
Example 3	360		10	1000	18.0%	1.0%

Table 2

	Primarily diluted rectified spirit	Sucro se	Allulose	Final volume	Alcohol concent ration	Sweete ner concent ration	Score of smell or bitterness intensity of alcohol in sensory evaluation
Note	50 vol%	-	-	-	-	-	
Unit	mL	g	g	mL	vol%	g/L%	
Sensory comparison A1	100			1000	5.0%	0.0%	1
Sensory comparison A2	120			1000	6.0%	0.0%	3
Sensory comparison A3	140			1000	7.0%	0.0%	5
Sensory comparison A4	160			1000	8.0%	0.0%	7
Sensory comparison A5	180			1000	9.0%	0.0%	9
Sensory comparison B1	200			1000	10.0%	0.0%	1
Sensory Comparison B2	220			1000	11.0%	0.0%	3
Sensory Comparison B3	240			1000	12.0%	0.0%	5
Sensory comparison B4	260			1000	13.0%	0.0%	7
Sensory comparison B5	280			1000	14.0%	0.0%	9
Sensory comparison C1	300			1000	15.0%	0.0%	1
Sensory comparison C2	320			1000	16.0%	0.0%	3
Sensory comparison C3	340			1000	17.0%	0.0%	5
Sensory comparison C4	360			1000	18.0%	0.0%	7
Sensory comparison C5	380			1000	19.0%	0.0%	9

(2) Sensory Evaluation

Sensory evaluation was carried out by 15 trained panelists. Here, the panelists were provided with the standard products as Sensory Comparison Examples (Table 2) and trained to be fully aware of an unpleasant bitterness and smell inherent to alcohol and compare intensity of the bitterness and smell to match a randomly offered diluted soju sample to the alcohol concentration thereof.

Specifically, sensory evaluation was carried out through the following procedure. First, the panelists were placed in separate rooms, respectively, and then provided with Sensory Comparison Examples to be aware of the bitterness and smell inherent to alcohol, once more, prior to being provided with the samples of Examples and Comparative Examples. Thereafter, the samples of Example 1 and Comparative Example 1, each labelled with a three-digit random number, were provided in a transparent cup one by one in a double-blind fashion. During evaluation, each of the panelists was instructed to hold the sample in his/her mouth to taste the sample before spitting the sample out, to be prevented from becoming intoxicated due to excessive intake. In addition, after evaluation of each sample, the panelists were allowed to rinse their mouths with cooked rice and water to prepare for evaluation of the next sample. Each of the trained panelists evaluated intensity of the smell and bitterness of alcohol of each of the samples of Examples and Comparative Examples on a 9-point scale (as shown in Table 2) with reference to Sensory Comparison Examples.

For evaluation of Example 1 and Comparative Example 1, evaluation of Example 2 and Comparative Example 2, and evaluation of Example 3 and Comparative Example 3, Sensory Comparison Examples A1 to A5, Sensory Comparison Examples B1 to B5, and Sensory Comparison Examples C1 to C5 were provided, respectively. In addition, after each evaluation, the panelists were allowed to rest for at least 12 to 24 hours to avoid confusion due to excessive intake.

For the samples of Example 1 and Comparative Example 1, the samples of Example 2 and Comparative Example 2, and the samples of Example 3 and Comparative Example 3, scores of intensity of the smell or bitterness of alcohol in sensory evaluation (hereinafter, "sensory scores") were converted into alcohol concentration according to Equation 1, Equation 2, and Equation 3, respectively, thereby calculating perceived alcohol concentrations, which in turn were compared with the actual alcohol concentrations to confirm reduction effects in smell and bitterness of alcohol.

<Equation 1>

$$\text{Perceived alcohol concentration (\%)} = (0.005 \times \text{sensory score} + 0.045) \times 100$$

<Equation 2>

$$\text{Perceived alcohol concentration (\%)} = (0.005 \times \text{sensory score} + 0.095) \times 100$$

<Equation 3>

$$\text{Perceived alcohol concentration (\%)} = (0.005 \times \text{sensory score} + 0.145) \times 100$$

Statistical analysis was performed using SAS 9.1 program (SAS Inc., Cary, NC, USA), and sensory evaluation results were analyzed by t-test method. All analysis results were approved at a significance level of $p < 0.05$.

As a result, it was confirmed that the samples of Examples had a perceived alcohol concentration (i.e., intensity of smell and bitterness of alcohol) that is about 0.6% to 0.8% lower than the actual alcohol concentration. In addition, it could be seen that the samples of Examples 1 to 3 containing allulose exhibited a statistically significant decrease ($p < 0.05$) in smell and bitterness of alcohol, as compared with those of Comparative Examples 1 to 3 containing the same amount of saccharides.

Table 3

Sample	Comparative Example 1	Example 1	Comparative Example 2	Example 2	Comparative Example 3	Example 3
Actual alcohol concentration	8.0%		13.0%		18.0%	
Perceived alcohol concentration (bitterness)	7.8%	7.4%	13.1%	12.2%	17.9%	17.3%
p-value	0.013		0.000		0.001	

Table 4

Sample	Comparative Example 1	Example 1	Comparative Example 2	Example 2	Comparative Example 3	Example 3
Actual alcohol concentration	8.0%		13.0%		18.0%	
Perceived alcohol concentration (smell)	7.9%	7.5%	13.1%	12.3%	18.0%	17.4%
p-value	0.021		0.000		0.001	

Experimental Example 2: Preparation and quality analysis of diluted soju having different saccharide concentrations

In order to confirm saccharide concentration-dependent reduction effects in smell

and bitterness of alcohol, changes in quality of diluted soju with varying amount of added allulose were checked for a given alcohol concentration. Here, the alcohol concentration was set to 18%, which is an alcohol concentration of the most typical diluted soju in Korea.

(1) Preparation of diluted soju having different saccharide concentrations

Samples of Comparative Examples 4 to 8, samples of Examples 4 to 8, and Sensory Comparison Examples D1 to D5 were prepared in the same manner as in Experimental Example 1 except that amounts of saccharides were changed as listed in Tables 5 and 6.

Table 5

	Primarily diluted rectified spirit	Sucrose	Allulose	Final volume	Alcohol concentration	Sweetener concentration
Note	50 vol%	-	-	-	-	-
Unit	mL	g	G	mL	vol%	g/L%
Comparative Example 4	350	1		1000	18.0%	0.10%
Comparative Example 5	350	3		1000	18.0%	0.30%
Comparative Example 6	350	10		1000	18.0%	1.00%
Comparative Example 7	350	30		1000	18.0%	3.00%
Comparative Example 8	350	100		1000	18.0%	10.00%
Example 4	350		1	1000	18.0%	0.10%
Example 5	350		3	1000	18.0%	0.30%
Example 6	350		10	1000	18.0%	1.00%
Example 7	350		30	1000	18.0%	3.00%
Example 8	350		100	1000	18.0%	10.00%

Table 6

	Primarily diluted rectified spirit	Sucrose	Allulose	Final volume	Alcohol concentration	Sweetener concentration	Score of smell or bitterness of alcohol in sensory evaluation
Note	50 vol%	-	-	-	-	-	
Unit	mL	g	g	mL	vol%	g/L%	
Sensory comparison D1	300			1000	15.0%	0.0%	1
Sensory comparison D2	320			1000	16.0%	0.0%	3

Sensory comparison D3	340			1000	17.0%	0.0%	5
Sensory comparison D4	360			1000	18.0%	0.0%	7
Sensory comparison D5	380			1000	19.0%	0.0%	9

(2) Sensory evaluation

Sensory evaluation of Examples 4 to 8 and Comparative Examples 4 to 8 was performed in the same manner as in Experimental Example 1. Sensory scores were converted into alcohol concentration according to Equation 3, thereby calculating perceived alcohol concentrations, which, in turn, were compared with the actual alcohol concentrations, respectively, to confirm reduction effects in smell and bitterness of alcohol. Statistical analysis was performed using SAS 9.1 program (SAS Inc., Cary, NC, USA), and sensory evaluation results were analyzed by t-test method.

As a result, it was confirmed that the samples of Examples 4 to 7 having an allulose content of 0.1% to 3.0% exhibited a statistically significant decrease in alcohol bitterness, as compared with those of Comparative Examples containing the same amount of sucrose, and the samples of Examples 5 to 7 having an allulose content of 0.3% to 3.0% exhibited a statistically significant decrease in alcohol smell, as compared with those of Comparative Examples (Table 7, Figs. 1 and 2).

In addition, it was confirmed entirely that bitterness of alcohol decreased due to increase in sweetness with increasing concentration of sucrose or allulose. However, considering that the sweetness intensity of allulose is about 70% that of sucrose, it can be seen that reduction effects in smell and bitterness of alcohol is not due to simply sweetness enhancement by addition of saccharides but due to efficacy of allulose.

Table 7

Sample	Comp. Examp le 4	Examp le 4	Comp. Examp le 5	Examp le 5	Comp. Examp le 6	Examp le 6	Comp. Examp le 7	Examp le 7	Com p. Exa mple 8	Examp le 8
Actual alcohol concentration	18.0%		18.0%		18.0%		18.0%		18.0%	
Saccharid	0.1%		0.3%		1.0%		3.0%		10.0%	

e concentrat ion										
Perceived alcohol concentrat ion (bitterness)	18.1%	17.8%	18.0%	17.7%	17.8%	17.3%	17.5%	16.9%	16.6 %	16.3%
p-value	0.093		0.011		0.001		0.000		0.064	
Perceived alcohol concentrat ion (smell)	18.0%	17.8%	17.9%	17.6%	17.6%	17.1%	17.4%	16.8%	16.7 %	16.4%
p-value	0.029		0.008		0.000		0.000		0.077	

CLAIMS:

1. A method of reducing or masking an aftertaste of an alcoholic beverage, comprising:
adding allulose-containing saccharides to the alcoholic beverage, wherein the ethanol
5 is present in an amount of 8 vol % to 70 vol % based on the total volume of the alcoholic
beverage; or

adding allulose-containing saccharides to a beverage, followed by adding ethanol to
the beverage, wherein the ethanol is present in an amount of 8 vol % to 70 vol % based on the
total volume of the alcoholic beverage,

10 the allulose is added in an amount of 55.5 g to 166.7 g per 1L of the ethanol,
the allulose is added in an amount of 99.5 parts by weight to 100 parts by weight
relative to 100 parts by weight of the saccharides in terms of dried solid content, and
the saccharides is free from sucrose, glucose and the combination thereof.

15 2. The method of reducing or masking an aftertaste of an alcoholic beverage according
to claim 1, wherein the aftertaste is a bitterness or smell of alcohol.