DERIVATION DEVICE, DERIVATION METHOD, AND PROGRAM

BACKGROUND

1. TECHNICAL FIELD

[0001] The present invention relates to a derivation apparatus, a derivation method, and a program.

2. RELATED ART

[0002] Patent document 1 describes that “the produce delivery management system acquires after-ripening information including information whether produce stored in a storage warehouse 5 needs after-ripening until delivery date and time as well as including an after-ripening temperature for after-ripening produce in a case in which the after-ripening is required. Furthermore, the temperature inside the warehouse of a cooling box 1 in a case in which the produce is delivered from the storage warehouse 5 to a delivery destination 7 is determined to be an after-ripening temperature or a temperature for storage based on the after-ripening information that is acquired. In addition, delivery instruction information that represents an instruction for delivery at a temperature that is determined is transmitted to an in-vehicle apparatus that is mounted on a delivery vehicle”.

Prior Art Document

Patent document

Patent Document 1: Japanese Patent Application Publication No. 2020-30605

TECHNICAL PROBLEM

[0003] An adjusting agent that suppresses absorption of ethylene gas to produce and fresh flowers, to suppress ripening or deterioration of the produce and the fresh flowers is known. When such adjusting agent is used during transportation of produce and fresh flowers, it is desired to reduce the burden of a process of determining the usage amount of the adjusting agent.

GENERAL DISCLOSURE

[0004] A derivation apparatus according to an aspect of the present invention may include an acquisition unit that acquires: type information indicating a type of an article that is produce or a fresh flower, shipping amount information indicating a shipping amount of the article, volume information indicating a volume of a box that accommodates the article, and transportation period information indicating a transportation period in which the article is transported from a shipping source to a delivery destination. The derivation apparatus may include a first coefficient identification unit that specifies a first coefficient for the type indicated in the type information, by referring to first coefficient information that indicates a first coefficient for each type, the first coefficient indicating an amount of ethylene per at least one of unit time or unit weight that advances a ripening degree or a degradation degree of the article, among amounts of ethylene generated by the article. The derivation apparatus may include a second coefficient identification unit that specifies a second coefficient for the type indicated in the type information, by referring to second coefficient information that indicates a second coefficient for each type, the second coefficient indicating a usage per unit ethylene amount of an adjusting agent for adjusting a ripening degree or a degradation degree of the article that is advanced by ethylene generated by the article. The derivation apparatus may include an ethylene amount derivation unit that derives an ethylene amount by which a ripening degree or a degradation degree of the article is advanced in the transportation period

based on the first coefficient that is specified, a shipping amount of the article, the volume, and the transportation period. The derivation apparatus may include a usage derivation unit that derives a usage of the adjusting agent that is used during the transportation period based on the ethylene amount that is derived and the second coefficient that is specified.

[0005] In the derivation apparatus, the acquisition unit may acquire the type information and the shipping amount information for each of a plurality of articles that are accommodated in the box. The ethylene amount derivation unit may derive an ethylene amount for the box by summing up the ethylene amount for each of the plurality of articles. The usage derivation unit may derive a usage of the adjusting agent based on the ethylene amount for the box.

[0006] In any of the derivation apparatuses, the acquisition unit may further acquire transportation temperature information that indicates a temperature around the article until a time point at which the article that is accommodated in the box is transported from a shipping source to the delivery destination. The first coefficient information may indicate a temperature adjustment coefficient corresponding to the temperature. The ethylene amount derivation unit may derive the ethylene amount based on the first coefficient that is adjusted with the temperature adjustment coefficient corresponding to the temperature that is indicated by the transportation temperature information.

[0007] In any of the derivation apparatuses, the acquisition unit may further acquire ventilation information that indicates a ventilation state of the box. The first coefficient information may indicate a ventilation adjustment coefficient corresponding to the ventilation state. The ethylene amount derivation unit may derive the ethylene amount based on the first coefficient that is adjusted with the ventilation adjustment coefficient corresponding to the ventilation state that is indicated by the ventilation information.

[0008] In any of the derivation apparatuses, the acquisition unit may further acquire storage period information that indicates a storage period from a harvest of the article to the shipping. The first coefficient information may indicate storage period adjustment coefficient corresponding to the storage period. The ethylene amount derivation unit may derive, for a type that is indicated in the type information, the ethylene amount based on the first coefficient that is adjusted with the storage period adjustment coefficient corresponding to the storage period indicated in the storage period information.

[0009] In any of the derivation apparatuses, the acquisition unit may further acquire storage temperature information that indicates a storage temperature from a harvest of the article to the shipping. The first coefficient information may indicate storage temperature adjustment coefficient corresponding to the storage temperature. The ethylene amount derivation unit may adjust, for a type that is indicated in the type information, the ethylene amount based on the first coefficient that is adjusted with the storage temperature adjustment coefficient corresponding to the storage temperature indicated in the storage temperature information.

[0010] In any of the derivation apparatuses, the acquisition unit may further acquire degree information indicating a ripening degree or a degradation degree that should be satisfied at a time point at which the article is delivered to the delivery destination. The first coefficient information may indicate degree adjustment coefficient corresponding to a ripening degree or a degradation degree that should be satisfied at a time point at which the article is delivered to the delivery destination. For the type indicated in the type information, the ethylene amount derivation unit may derive the ethylene amount based on the first coefficient that is adjusted with the degree adjustment coefficient corresponding to the ripening degree or the degradation degree indicated in the degree information.

[0011] In any of the derivation apparatuses, the second coefficient information may indicate, for each type of a plurality of adjusting agents, a second coefficient corresponding to a type of an article. The usage derivation unit may derive, for each of the plurality of adjusting agents, a usage corresponding to the type of the article. The derivation apparatus may further include a determining unit that determines, among the plurality of adjusting agents, an adjusting agent whose usage satisfies a predetermined condition, as an adjusting agent to be used for the article.

[0012] In any of the derivation apparatuses, the determining unit may determine, among the plurality of adjusting agents, an adjusting agent having the smallest usage as an adjusting agent that satisfies the predetermined condition.

[0013] In any of the derivation apparatuses, the acquisition unit may further acquire, during an intermediate period for transportation of the article from the shipping source to the delivery destination, intermediate information indicating ethylene concentration in the box during the intermediate period. When an ethylene amount based on the ethylene concentration indicated in the intermediate information is greater than the ethylene amount derived by the ethylene amount derivation unit, the usage derivation unit may further derive an additional usage of the adjusting agent to be added in the box based on a difference between the ethylene amount derived by the ethylene amount derivation unit and the ethylene amount based on the ethylene concentration indicated in the intermediate information.

[0014] In any of the derivation apparatuses, the acquisition unit may further acquire, during an intermediate period for transportation of the article from the shipping source to the delivery destination, intermediate information indicating the temperature in the box during the

intermediate period. The ethylene amount derivation unit may derive an ethylene amount in the box based on the first coefficient that is adjusted with a temperature adjustment coefficient corresponding to the temperature indicated in the transportation temperature information, a shipping amount of the article, the volume, and the intermediate period, and may derive an actual ethylene amount in the box based on the first coefficient that is adjusted with a temperature adjustment coefficient corresponding to the temperature indicated in the intermediate information, a shipping amount of the article, the volume, and the intermediate period. When the actual ethylene amount is greater than the ethylene amount derived for the intermediate period by the ethylene amount derivation unit, the usage derivation unit may further derive an additional usage of the adjusting agent to be added in the box based on a difference between the ethylene amount derived for the intermediate period and the actual ethylene amount.

[0015] In any of the derivation apparatuses, the acquisition unit may further acquire completion information indicating an ethylene concentration in the box at a time point at which a transportation of the article to the delivery destination is completed. When a difference between an ethylene amount in the box that is based on an ethylene concentration indicated in the completion information and the ethylene amount derived by the ethylene amount derivation unit is greater than or equal to a threshold, the derivation apparatus may further include a notification unit that notifies that a ripening degree or a degradation degree that should be satisfied at a time point at which the article is transported to the delivery destination is not satisfied.

[0016] In any of the derivation apparatuses, the adjusting agent may include 1-methylcyclopropene or 2,5-Norbornadiene. The adjusting agent may include activated carbon or zeolite.

[0017] A system according to an aspect of the present invention may include: any of the derivation apparatuses, and a first terminal including a receiving unit that receives a usage of the adjusting agent derived by the usage derivation unit and a notification unit that notifies the usage of the adjusting agent.

[0018] In the system, the first terminal may further include a transmission unit that transmits the volume information and the transportation period information to the derivation apparatus. The system may further include a second terminal including a transmission unit that transmits the type information, the shipping amount information, and delivery destination information in which the delivery destination is indicated to the derivation apparatus.

[0019] A derivation method according to an aspect of the present invention may include acquiring, by an acquisition unit, type information indicating a type of an article that is produce or a fresh flower, shipping amount information indicating a shipping amount of the article, volume information indicating a volume of a box that accommodates the article, and transportation period information indicating a transportation period in which the article is transported from a shipping source to a delivery destination. The derivation method may include specifying, by a first coefficient identification unit, a first coefficient for the type indicated in the type information, by referring to first coefficient information that indicates a first coefficient for each type, the first coefficient indicating an ethylene amount per at least one of unit time or unit weight that advances a ripening degree or a degradation degree of the article, among amounts of ethylene generated by the article. The derivation method may include specifying, by a second coefficient identification unit, a second coefficient for the type indicated in the type information, by referring to second coefficient information that indicates a second coefficient for each type, the second coefficient indicating a usage per unit ethylene amount of an adjusting agent for adjusting a ripening degree or a degradation degree of the

article that is advanced by ethylene generated by the article. The derivation method may include deriving, by an ethylene amount derivation unit, an ethylene amount by which a ripening degree or a degradation degree of the article is advanced in the transportation period based on the first coefficient, a shipping amount of the article, the volume, and the transportation period that are specified. The derivation method may include deriving, by a usage derivation unit, a usage of the adjusting agent that is used during the transportation period based on the ethylene amount that is derived and the second coefficient that is specified.

[0020] A program according to an aspect of the present invention may cause a computer to function as an acquisition unit that acquires: type information indicating a type of an article that is produce or a fresh flower, shipping amount information indicating a shipping amount of the article, volume information indicating a volume of a box that accommodates the article, and transportation period information indicating a transportation period in which the article is transported from a shipping source to a delivery destination. The program may cause a computer to function as a first coefficient identification unit that specifies a first coefficient for the type indicated in the type information, by referring to first coefficient information that indicates a first coefficient for each type, the first coefficient indicating an ethylene amount per at least one of unit time or unit weight that advances a ripening degree or a degradation degree of the article, among amounts of ethylene generated by the article. The program may cause a computer to function as a second coefficient identification unit that specifies a second coefficient for the type indicated in the type information, by referring to second coefficient information that indicates a second coefficient for each type, the second coefficient indicating a usage per a unit ethylene amount of an adjusting agent for adjusting a ripening degree or a degradation degree of the article that is advanced by ethylene generated by the article. The

program may cause a computer to function as an ethylene amount derivation unit that derives an ethylene amount by which a ripening degree or a degradation degree of the article is advanced in the transportation period based on the first coefficient that is specified, a shipping amount of the article, the volume, and the transportation period. The program may cause a computer to function as a usage derivation unit that derives a usage of the adjusting agent that is used during the transportation period based on the ethylene amount that is derived and the second coefficient that is specified.

[0021] The summary clause does not necessarily describe all necessary features of the embodiments of the present invention. In addition, the invention may also be a sub-combination of the features described above.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] Fig. 1 shows an overall configuration of a system that derives a usage of an adjusting agent.

Fig. 2 shows an example of a functional block of a derivation apparatus.

Fig. 3 shows an example of ethylene coefficient information.

Fig. 4 shows an example of an adjusting agent coefficient information.

Fig. 5 shows an example of a functional block of an ordering terminal.

Fig. 6 shows an example of a functional block of a shipping terminal.

Fig. 7 shows an example of a functional block of a transportation terminal.

Fig. 8 shows a series of flows from an order to a delivery of an article.

Fig. 9 shows an example of an input screen of ordering information displayed on an ordering terminal.

Fig. 10 shows an example of an ordering information screen that is displayed on a shipping terminal 300 when an order of an article is accepted.

Fig. 11 is a flowchart shows an example of a procedure of determining a usage of an adjusting agent by a derivation apparatus.

Fig. 12 shows an example of a hardware configuration.

DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0023] Hereinafter, the present invention will be described through embodiments of the invention, but the following embodiments do not limit the invention according to the claims. In addition, not all of the combinations of features described in the embodiments are essential to the solution of the invention.

[0024] Fig. 1 shows an overall configuration of a system 10 that derives a usage of an adjusting agent. The system 10 includes a derivation apparatus 100, an ordering terminal 200, a shipping terminal 300, and a transportation terminal 400.

[0025] Produce and fresh flowers (cut flower) are known to generate ethylene gas, and further adsorb the ethylene gas, which causes them to ripen or deteriorate. Therefore, for example, with anticipation of ripening during transportation, the produce are shipped before they have a ripening degree enough for eating, to adjust a ripening degree at the time of delivery.

[0026] On the other hand, known are an adjusting agent such as 1-methylcyclopropene (1-MCP) or 2,5-norbornadiene (NBD) that suppresses the ripening or deterioration of the produce and the fresh flowers by preventing the produce and the fresh flowers from adsorbing of ethylene gas, or an adjusting agent such as activated carbon or zeolite that suppresses the ripening or deterioration of the produce and the fresh flowers by preventing the produce and the fresh flowers from adsorbing ethylene gas by adsorbing the ethylene gas. If it is possible to prevent the produce or the fresh flowers from adsorbing ethylene gas by utilizing such an adjusting agent during transportation, the produce or the fresh flowers can be prevented from advancing of ripening or deterioration during transportation. Accordingly, by utilizing such an adjusting agent, the produce can be prevented from passing a time at which they are ripe enough for eating at a delivery destination.

[0027] However, ethylene generation amount, and ethylene susceptibility that indicates an indicator of ease of adsorbing ethylene are different for each type of the produce and the fresh flowers, usage of an adjusting agent that is required during transportation is different for each type of the produce and the fresh flowers. The usage of an adjusting agent required during transportation can vary depending on a transportation period, a ventilation state during transportation, or the like. Accordingly, it is not easy to derive a usage of an adjusting agent with accurately.

[0028] Therefore, in the system 10 according to the present embodiment, in response to an article that is the produce or the fresh flower, a usage of an adjusting agent to be used at the time of transportation is accurately derived.

[0029] Fig. 2 shows an example of a functional block of a derivation apparatus 100. The derivation apparatus 100 includes an acquisition unit 102, an ethylene coefficient identification

unit 104, an adjusting agent coefficient identification unit 106, an ethylene amount derivation unit 108, a usage derivation unit 110, a determining unit 112, a notification unit 114, and a storage unit 120.

[0030] The acquisition unit 102 acquires, from the ordering terminal 200 of a delivery destination of an article, shipping amount information indicating: delivery destination information indicating a location of the delivery destination; type information indicating a type of the article that is the produce or the fresh flower; and a shipping amount of the article. The type of the article may be the variety of the respective produce or fresh flowers. The acquisition unit 102 may further acquire, from the ordering terminal 200, delivery time information indicating a desired delivery date of the article, and degree information indicating a ripening degree or a degradation degree that should be satisfied at a time point at which the article is delivered to the delivery destination.

[0031] The acquisition unit 102 may further acquire, from the shipping terminal 300 of a shipping source of the article, volume information indicating the volume of a box in which the article is to be accommodated when being transported to the delivery destination, and transportation period information indicating a transportation period in which the article is transported from a shipping source to a delivery destination. The shipping terminal 300 may acquire, from the ordering terminal 200 via the derivation apparatus 100, the delivery destination information, the type information, the shipping amount information, and the delivery time information. Based on the delivery destination information, the type information, the shipping amount information, and the delivery time information, the shipping terminal 300 may derive a volume of a box in a case of transporting the article, and a transportation period in a case of transporting the article the delivery destination, to provide them to the derivation apparatus 100.

[0032] The storage unit 120 stores ethylene coefficient information indicating ethylene coefficient indicating, for each type, an ethylene amount per at least one of unit time or unit weight that advances the ripening degree or the degradation degree of the article among the amounts of ethylene generated by the article. The storage unit 120 further stores adjusting agent coefficient information indicating an adjusting agent coefficient, for each type, indicating a usage per unit ethylene amount of an adjusting agent for adjusting a ripening degree or a degradation degree of the article that is advanced by ethylene generated by the article. The ethylene coefficient is an example of a first coefficient, and the adjusting agent coefficient is an example of a second coefficient.

[0033] The ethylene coefficient may include an ethylene generation amount coefficient (μL/kg・Hr) indicating an amount of ethylene generated by the produce or the fresh flowers per unit time and unit weight, and an ethylene susceptibility coefficient indicating a degree to which the produce or the fresh flowers are susceptible to ripening or deterioration due to the effect of the ethylene. The ethylene generation coefficient and the ethylene susceptibility coefficient depend on the variety of the produce or the fresh flowers. The ethylene generation coefficient and the ethylene susceptibility coefficient may depend on a ripening degree or a degradation degree of the produce at the time of shipping.

[0034] Fig. 3 shows an example of ethylene coefficient information. The storage unit 120 stores, for each article type, as an ethylene coefficient, ethylene coefficient information indicating an ethylene generation amount coefficient G, and an ethylene susceptibility coefficient S.

[0035] The adjusting agent coefficient includes an adjusting agent volatilization amount coefficient V indicating the amount by which the adjusting agent is volatilized per unit weight,

and an adsorption coefficient A indicating a degree to which the produce or the fresh flowers adsorbs the adjusting agent. The adjusting agent coefficient depends on a type of the adjusting agent, and the variety of the produce or the fresh flowers. When the adjusting agent is activated carbon adsorbing ethylene gas, zeolite, or the like, the adjusting agent coefficient may include an adsorption coefficient A indicating a degree to which the adjusting agent itself adsorbs ethylene per unit weight, instead of an adsorption coefficient A indicating a degree to which the produce or the fresh flowers adsorbs the adjusting agent.

[0036] Fig. 4 shows an example of adjusting agent coefficient information. The adjusting agent coefficient information indicated in Fig. 4 indicates information that is related to an adjusting agent of a type of being adsorbed to produce or fresh flowers. The storage unit 120 stores adjusting agent coefficient information indicating the adjusting agent volatilization amount coefficient V and the adsorption coefficient A as an adjusting agent coefficient for each article type. The adjusting agent volatilization amount coefficient V may vary for each type of the adjusting agent. The adsorption coefficient A may depend on a type of the adjusting agent, and the variety of the produce or the fresh flowers.

[0037] A ripening degree or a degradation degree of produce or fresh flowers are observed by an experiment for each type of the produce or the fresh flowers, the ethylene generation amount coefficient G, the ethylene susceptibility coefficient S, the adjusting agent volatilization amount coefficient V, and the adsorption coefficient A may be predetermined based on an observation result, and stored in the storage unit 120.

[0038] The ethylene coefficient identification unit 104 specifies an ethylene coefficient for a type of article that is a transportation target with reference to the ethylene coefficient information stored in the storage unit 120. The ethylene coefficient identification unit 104

may specify an ethylene generation amount coefficient G and an ethylene susceptibility coefficient S as ethylene coefficients for the type of article that is the transportation target.

[0039] The adjusting agent coefficient identification unit 106 specifies, for an adjusting agent that is a target of use, an adjusting agent volatilization amount coefficient V and an adsorption coefficient A corresponding to the type of article that is the transportation target with reference to the adjusting agent coefficient information stored in the storage unit 120.

[0040] The ethylene amount derivation unit 108 derives, in a transportation period, an ethylene amount by which a ripening degree or a degradation degree of an article is advanced based on the ethylene generation amount coefficient G and the ethylene susceptibility coefficient S that are specified, a shipping amount of the article, a volume of a box used for transportation of the article, and the transportation period. The ethylene amount derivation unit 108 derives molar concentration of ethylene (mol/L) as an ethylene amount per unit volume of an ethylene amount by which the ripening degree or the degradation degree of the article is advanced, by ethylene generation amount coefficient G (μL/kg・Hr) × ethylene susceptibility coefficient S × transportation period (Hr) × shipping amount (kg) / volume of ethylene per mole (μl/mol) / volume of box (L). The ethylene generation amount coefficient G may be a value that is indicated in a stepwise manner by a size of a generation amount of ethylene of the produce or the fresh flowers. The ethylene generation amount coefficient G may include a coefficient G_H when a generation amount of ethylene of the produce or the fresh flowers is large, a coefficient G_M when the generation amount is medium level, and a coefficient G_L when the generation amount is small. For example, G_H may be 2.0, G_M may be 1.0, and G_L may be 0.8.

[0041] The usage derivation unit 110 derives a usage of an adjusting agent to be used during the transportation period based on the ethylene amount, the adjusting agent volatilization amount coefficient V, and the adsorption coefficient A that are specified. The usage derivation unit 110 derives a usage U (kg) of an adjusting agent so that a molar concentration (mol/L) of an adjusting agent that is derived with adjusting agent volatilization amount coefficient V × adsorption coefficient A × usage U of adjusting agent (kg) / volume per mole of adjusting agent (μl/mol) / volume of box (L) is consistent with a molar concentration of ethylene (mol/L) of ethylene derived by the ethylene amount derivation unit 108.

[0042] The generation amount of ethylene of the produce or the fresh flowers varies depending on the temperature of surroundings. Accordingly, the ethylene amount derivation unit 108 may adjust the ethylene coefficient in response to the temperature during transportation. Therefore, the acquisition unit 102 may further acquire, from the shipping terminal 300, transportation temperature information indicating the temperature around an article during a period in which the article accommodated in a box is transported from a shipping source to a delivery destination. The storage unit 120 may store ethylene coefficient information indicating a temperature adjustment coefficient corresponding to the temperature. The temperature adjustment coefficient may be a coefficient indicating a relationship between the temperature during transportation of the article and an amount of ethylene generated by the article. When the article is produce or fresh flowers of a type in which the amount of ethylene that is generated tends to decrease if the temperature is too low or too high, the temperature adjustment coefficient may include, for example, a coefficient T_L in a case in which the temperature is less than or equal to 10℃, a coefficient T_M in a case in which the temperature is from 10℃ to 20℃, a coefficient T_H in a case in which the temperature is from 20℃ to 25℃, a coefficient T_M in a case in which the temperature is from

25℃ to 35℃, and a coefficient T_L in a case in which the temperature is greater than or equal to 35℃. Herein, it may be $T_L < T_M < T_H$. The ethylene amount derivation unit 108 may derive the ethylene amount by multiplying the ethylene coefficient by a temperature adjustment coefficient T. the ethylene amount derivation unit 108 may derive a molar concentration of ethylene (mol/L) indicating an ethylene amount per unit volume that advances a ripening degree or a degradation degree of an article, by ethylene generation amount coefficient G (μL/kg·Hr) × ethylene susceptibility coefficient S × temperature adjustment coefficient T × transportation period (Hr) × shipping amount (kg) / volume of ethylene per mole (μl/mol) / volume of box (L).

[0043] Even if the shipping amount of the article is the same, the ethylene amount by which the ripening degree or the degradation degree of the article is advanced is different as long as the ventilation state of the box is different. For example, the ethylene amount by which the ripening degree or the degradation degree of the article is advanced is different between a case in which the box accommodates the article in a sealed state or a case in which the box accommodates the article while ventilating with a ventilation function. Therefore, the acquisition unit 102 may further acquire, from the shipping terminal 300, ventilation information indicating a ventilation state of the box. The ventilation information may indicate whether the box has a ventilation function as a ventilation state of the box. The storage unit 120 may store ethylene coefficient information indicating a ventilation adjustment coefficient corresponding to the ventilation state. The ventilation adjustment coefficient may be a coefficient indicating a relationship between the ventilation function of the box and the ethylene amount in the box, for example, may be a value which is set to a small ventilation adjustment coefficient when the ventilation function of the box is high and set to a large ventilation adjustment coefficient when the ventilation function of the box is low. The

ventilation adjustment coefficient may include a coefficient B_H in a case in which the box has no ventilation function, and a coefficient B_L in a case in which the box has a ventilation function. For example, the coefficient B_H may be 1.0, the coefficient B_L may be a value less than 1.0, for example, 0.5, etc. The ethylene amount derivation unit 108 may derive molar concentration of ethylene (mol/L) indicating an ethylene amount per unit volume of an ethylene amount by which the ripening degree or the degradation degree of the article is advanced, by ethylene generation amount coefficient G (μL/kg・Hr) × ethylene susceptibility coefficient S × temperature adjustment coefficient T × ventilation adjustment coefficient B × transportation period (Hr) × shipping amount (kg) / volume of ethylene per mole (μl/mol) / volume of box (L).

[0044] If the storage period from the harvest of the produce or the fresh flowers to the shipment is different, an amount of ethylene generated during transportation by produce or fresh flowers and an ethylene amount that is adsorbed are different even if the transportation period is the same. Therefore, the acquisition unit 102 may further acquire, from the shipping terminal 300, storage period information indicating a storage period from the harvest of the article to the shipping. The storage unit 120 may store ethylene coefficient information indicating a storage period adjustment coefficient K corresponding to the storage period. The storage period adjustment coefficient K may be a coefficient indicating a relationship between the storage period and an amount of ethylene generated by the article. When the article is produce or fresh flowers of a type in which the amount of ethylene that is generated tends to increase until a certain period passes from the harvest of the article, and tends to decrease after the certain period passes, the storage period adjustment coefficient may include, for example, a coefficient K_M in a case in which a period passed from the harvest is one day to two days, a coefficient K_H in a case in which the period is three to five days, and a coefficient K_L in a case in which the period is greater than or equal to six days. Herein, it may be $K_L < K_M < K_H$.

The ethylene amount derivation unit 108 may derive molar concentration of ethylene (mol/L) indicating an ethylene amount per unit volume of an ethylene amount by which the ripening degree or the degradation degree of the article is advanced, by ethylene generation amount coefficient G (μL/kg・Hr) × ethylene susceptibility coefficient S × temperature adjustment coefficient T × ventilation adjustment coefficient B × storage period adjustment coefficient K × transportation period (Hr) × shipping amount (kg) / volume of ethylene per mole (μl/mol) / volume of box (L). The ethylene amount derivation unit 108 may not need to perform adjustment by either one of the temperature adjustment coefficient T or the ventilation adjustment coefficient B.

[0045] If the temperature of the storage period from the harvest of the produce or the fresh flowers to the shipment is different, an amount of ethylene generated during transportation by produce or fresh flowers and an ethylene amount that is adsorbed are different even if the transportation period is the same. Therefore, the acquisition unit 102 may further acquire, from the shipping terminal 300, storage temperature information indicating a storage temperature from the harvest of the produce or the fresh flowers to the shipment. The storage unit 120 may store ethylene coefficient information indicating a storage temperature adjustment coefficient M corresponding to the storage temperature. The storage period adjustment coefficient K may be a coefficient indicating a relationship between the temperature during the storage period of the article and an amount of ethylene generated by the article. The storage temperature adjustment coefficient M may include, for example, a coefficient M_L in a case in which the temperature is less than or equal to 10℃, a coefficient M_M in a case in which the temperature is from 10℃ to 20℃, and a coefficient M_H in a case in which the temperature is greater than or equal to 20℃. Herein, it may be $M_L < M_M < M_H$. The ethylene amount derivation unit 108 may derive molar concentration of ethylene (mol/L)

indicating an ethylene amount per unit volume of an ethylene amount by which the ripening degree or the degradation degree of the article is advanced, by ethylene generation amount coefficient G (μL/kg・Hr) × ethylene susceptibility coefficient S × temperature adjustment coefficient T × ventilation adjustment coefficient B × storage period adjustment coefficient K × storage temperature adjustment coefficient M × transportation period (Hr) × shipping amount (kg) / volume of ethylene per mole (μl/mol) / volume of box (L).

[0046] The temperature adjustment coefficient T, the ventilation adjustment coefficient B, the storage period adjustment coefficient K, and the storage temperature adjustment coefficient M may be predetermined by an experiment, or the like. At least one of the temperature adjustment coefficient T, the ventilation adjustment coefficient B, the storage period adjustment coefficient K, or the storage temperature adjustment coefficient M may be predetermined for each type of produce or fresh flowers.

[0047] The acquisition unit 102 may further acquire, from the ordering terminal 200, degree information indicating a ripening degree or a degradation degree that should be satisfied at a time point at which the produce or the fresh flowers are delivered. The storage unit 120 may store ethylene coefficient information indicating a degree adjustment coefficient D corresponding to a ripening degree or a degradation degree that should be satisfied at a time of delivery to a delivery destination. For example, the ripening degree may include a plurality of degree levels. The ripening degree may include three levels of hard, enough for eating, and fully ripened. Each level of these ripening degrees may be used in association with a code or a numerical value. The ethylene coefficient information may indicate a degree adjustment coefficient for each degree. The ethylene coefficient information may include a coefficient D_H indicating a degree of hard, D_M indicating a degree of enough for eating, and D_L indicating a degree of fully ripened. Because it is required to increase the ethylene amount

that should be reduced as a state of the produce at the time of delivery is hard, it may be $D_H > D_M > D_L$. The ethylene amount derivation unit 108 may derive molar concentration of ethylene (mol/L) indicating an ethylene amount by which the ripening degree or the degradation degree of the article is advanced, by ethylene generation amount coefficient G (μL/kg・Hr) × ethylene susceptibility coefficient S × temperature adjustment coefficient T × ventilation adjustment coefficient B × storage period adjustment coefficient K × storage temperature adjustment coefficient M × degree coefficient D × transportation period (Hr) × shipping amount (kg) / volume of ethylene per mole (μl/mol) / volume of box (L).

[0048] For each of a plurality of adjusting agents indicated in adjusting agent coefficient information, the usage derivation unit 110 may derive a usage of the adjusting agent corresponding to the type of article that is the produce or the fresh flower. The determining unit 112 may determine, among the plurality of adjusting agents, an adjusting agent whose usage satisfies a predetermined condition, as an adjusting agent to be used for the article. The determining unit 112 may determine, among the plurality of adjusting agents, an adjusting agent whose usage is the smallest, as an adjusting agent to be used for the article.

[0049] A plurality of types of produce or fresh flowers may be accommodated in one box. In this case, the ethylene amount derivation unit 108 may derive ethylene amounts for respective types of the produce or fresh flowers accommodated in the box, sum up the ethylene amounts that are derived, to derive an ethylene amount for one box. The ethylene amount derivation unit 108 may derive molar concentrations of ethylene for respective types of the produce or fresh flowers accommodated in the box, sum up the molar concentrations of ethylene that are derived, to derive a molar concentration of ethylene for one box. The usage derivation unit 110 may derive a usage of an adjusting agent to be used during the transportation period based on the ethylene amount for one box that is derived by the

ethylene amount derivation unit 108, the adjusting agent volatilization amount coefficient V, and the adsorption coefficient A that are specified. The usage derivation unit 110 may derive a usage U (kg) of an adjusting agent so that a molar concentration (mol/L) of an adjusting agent that is derived with adjusting agent volatilization amount coefficient V × adsorption coefficient A × usage U of adjusting agent (kg) / volume per mole of adjusting agent (μl/mol) / volume of box (L) is consistent with a molar concentration of ethylene (mol/L) of ethylene per one box derived by the ethylene amount derivation unit 108.

[0050] In addition, the amount of ethylene generated by the produce or the fresh flower may be greater than expected due to variation of the temperature or the like during transportation. In such a case, a ripening degree or a degradation degree of the produce or the fresh flower can be adjusted if a usage of an adjusting agent on the way of transportation can be added.

[0051] Therefore, a sensor that measures an ethylene concentration in a box may be provided. The transportation terminal 400 may receive a molar concentration of ethylene from the sensor as an ethylene concentration. The acquisition unit 102 may further acquire, via the transportation terminal 400, in an intermediate period of transportation of the article from a shipping source to a delivery destination, intermediate information indicating the molar concentration of ethylene in the box in the intermediate period as an ethylene concentration from the sensor.

[0052] When an ethylene amount based on the ethylene concentration indicated in the intermediate information is greater than the ethylene amount derived by the ethylene amount derivation unit 108, the usage derivation unit 110 may further derive an additional usage of the adjusting agent to be added in the box based on a difference between the ethylene amount

derived by the ethylene amount derivation unit 108 and the ethylene amount based on the ethylene concentration indicated in the intermediate information. In this case, a comparison between the amount of ethylene derived by the ethylene amount derivation unit 108 and the amount of ethylene based on the ethylene concentration that is indicated in the intermediate information may be performed based on a comparison between a predicted ethylene amount (E1) at a timing at which the intermediate information is acquired and an actual ethylene amount (E2) based on an actual ethylene concentration that is indicated in the intermediate information. The predicted ethylene amount (E1) may be derived as a molar concentration of ethylene (mol/L) indicating an ethylene amount per unit volume, by ethylene generation amount coefficient G (μL/kg・Hr) × temperature adjustment coefficient T × ventilation adjustment coefficient B × storage period adjustment coefficient K × storage temperature adjustment coefficient M × a period from the start of transportation to a timing of acquiring the intermediate information (Hr) × shipping amount (kg) / volume of ethylene per mole (μl/mol) / volume of box (L). The usage derivation unit 110 may further derive an additional usage of an adjusting agent that should be added in the box based on a difference between a usage of the adjusting agent derived based on the ethylene amount that is derived by the ethylene amount derivation unit 108 and a usage of the adjusting agent derived by the ethylene amount derivation unit 108 based on an ethylene amount that is based on the ethylene concentration indicated in the intermediate information, the adjusting agent volatilization amount coefficient V, and the adsorption coefficient A. Note that the usage derivation unit 110 may derive an additional usage of an adjusting agent that should be added in the box in response to a case in which a difference between the predicted ethylene amount (E1) and the actual ethylene amount (E2) satisfies a predetermined condition (for example, exceeds a threshold).

[0053] A sensor that measures the temperature in the box may be provided. The transportation terminal 400 may receive the temperature in the box from the sensor. The acquisition unit 102 may acquire, via the transportation terminal 400, in an intermediate period of transportation of the article from a shipping source to a delivery destination, intermediate information indicating the temperature in the box that is measured by the sensor in the intermediate period. The ethylene amount derivation unit 108 derives a predicted ethylene amount (E1) in the box based on the ethylene generation amount coefficient G, the ethylene susceptibility coefficient S, the temperature adjustment coefficient T corresponding to the temperature indicated in the transportation temperature information, the intermediate period, a shipping amount of the article, and a volume of the box. Furthermore, the ethylene amount derivation unit 108 derives an actual ethylene amount (E2) in the box based on the ethylene generation amount coefficient G, the ethylene susceptibility coefficient S, the temperature adjustment coefficient T corresponding to the temperature in the box that is measured by the sensor, the an adjustment period t' to which the temperature adjustment coefficient T is applied, a shipping amount of the article, and a volume of the box. In this case, the actual ethylene amount (E2) may derive an ethylene generation amount for each adjustment period t' by using the temperature adjustment coefficient T corresponding to the temperature in the box, to be derived based on the sum thereof. For example, the actual ethylene amount (E2) may derive a molar concentration of ethylene (mol/L) indicating an ethylene amount per unit volume for each adjustment period t' by generation amount coefficient G μL/kg・Hr × temperature adjustment coefficient T × ventilation adjustment coefficient B × storage period adjustment coefficient K × storage temperature adjustment coefficient M × adjustment period t' (Hr) × shipping amount (kg) / volume of ethylene per mole (μl/mol) / volume of box (L), to be derived as the sum thereof. When the ethylene amount

(E1) is greater than the ethylene amount (E2), the usage derivation unit 110 may derive an additional usage of an adjusting agent that should be added in the box based on a difference between the ethylene amount (E1) and the ethylene amount (E2). The usage derivation unit 110 may further derive an additional usage of an adjusting agent that should be added in the box based on a difference between the usage of the adjusting agent derived based on the ethylene amount (E1) and a usage of the adjusting agent derived based on the ethylene amount (E2). Note that the usage derivation unit 110 may derive an additional usage of an adjusting agent that should be added in the box in response to a case in which a difference between the predicted ethylene amount (E1) and the actual ethylene amount (E2) satisfies a predetermined condition (for example, exceeds a threshold).

[0054] When an ethylene amount in the box that is predicted before shipping is different from an ethylene amount in the box that is measured at an actual time of delivery, a ripening degree or a degradation degree of an article that is requested by a delivery destination may be different from a ripening degree or a degradation degree of an article that is actually delivered. Such a difference from a request may be notified to a delivery destination or a shipping source to reduce a trouble in the delivery. Furthermore, it can prevent the article from becoming unusable due to reasons such as the ripening degree being too advanced, reducing food loss, or the like.

[0055] Therefore, the acquisition unit 102 may further acquire, via the transportation terminal 400, completion information indicating an ethylene concentration in the box at a time point at which transportation of the article to the delivery destination is completed. When a difference between the actual ethylene amount in the box that is based on the ethylene concentration indicated in the completion information and the predicted ethylene amount derived by the ethylene amount derivation unit 108 is greater than or equal to a threshold, the

notification unit 114 may notify that a ripening degree or a degradation degree that should be satisfied at a time point at which the article is transported to the delivery destination is not satisfied. The notification unit 114 may notify that the ripening degree of the article is not advanced than the ripening degree that is desired when the predicted ethylene amount that is derived by the ethylene amount derivation unit 108 is greater than the actual ethylene amount in the box that is based on the ethylene concentration indicated in the completion information. The notification unit 114 may notify that the ripening degree of the article is advanced than the ripening degree that is desired when the predicted ethylene amount that is derived by the ethylene amount derivation unit 108 is less than the actual ethylene amount in the box that is based on the ethylene concentration indicated in the completion information.

[0056] Fig. 5 shows an example of a functional block of an ordering terminal 200. The ordering terminal 200 may be a personal computer, a smartphone, a tablet terminal, or the like. The ordering terminal 200 may include a receiving unit 202, a transmission unit 204, and a display unit 206. The receiving unit 202 receives a various types of information. The transmission unit 204 transmits a various types of information. The receiving unit 202 and the transmission unit 204 may exchange the various types of information ith another apparatus with wireless communication. The transmission unit 204 may transmit type information of an article that is a delivery target, shipping amount information, and delivery destination information indicating a delivery destination to the derivation apparatus 100. The transmission unit 204 may further transmit, to the derivation apparatus 100, degree information indicating a ripening degree or a degradation degree that should be satisfied by the article at the time of delivery. The transmission unit 204 may further transmit delivery deadline information indicating a desired delivery date of an article to the derivation apparatus 100. The display unit 206 displays the various types of information. The display unit 206

may be a touch panel display. The display unit 206 accepts a various types of operations from a user, and the transmission unit 204 may transmit, to the derivation apparatus 100, information that is received in response to a user operation.

[0057] Fig. 6 shows an example of a functional block of a shipping terminal 300. The shipping terminal 300 may be a personal computer, a smartphone, a tablet terminal, or the like. The shipping terminal 300 includes a receiving unit 302, a transmission unit 304, and a display unit 306. The receiving unit 302 and the transmission unit 304 may exchange the various types of information ith another apparatus with wireless communication.

[0058] The receiving unit 302 receives a various types of information. The receiving unit 302 may receive ordering information from the ordering terminal 200 via the derivation apparatus 100. The ordering information may indicate a type of article requested to be delivered, a shipping amount, a desired delivery date, a delivery destination, and a ripening degree or a degradation degree that should be satisfied by the article at the time of delivery. The receiving unit 302 receives a usage of an adjusting agent that is derived by the usage derivation unit 110. The transmission unit 304 transmits a various types of information. The transmission unit 304 transmits, to the derivation apparatus 100, harvest season information indicating a harvest season of the article that is a delivery target. Note that, instead of the above-described description or in addition to the above-described description, the transmission unit 304, storage period information indicating a storage period from the harvest of the article to the shipment may be transmitted to the derivation apparatus 100.

[0059] The display unit 306 displays the various types of information. The display unit 306 may be a touch panel display. The display unit 306 accepts a various types of operations from

a user, and the transmission unit 204 may transmit, to the derivation apparatus 100, information that is received in response to a user operation.

[0060] Fig. 7 shows an example of a functional block of a transportation terminal 400 and a box 450. The transportation terminal 400 may be a personal computer, a smartphone, a tablet terminal, or the like. The box 450 includes an ethylene sensor 452 and a temperature sensor 454. The box 450 may include at least one of the ethylene sensor 452 or the temperature sensor 454. The ethylene sensor 452 and the temperature sensor 454 may be provided in an accommodation space that accommodates the article. The ethylene sensor 452 measures an ethylene concentration in the box 450. The temperature sensor 454 measures the temperature in the box 450. The transportation terminal 400 may be a navigation terminal that is mounted on a vehicle that transports the article. The transportation terminal 400 includes a receiving unit 402, a transmission unit 404, and a display unit 406. The receiving unit 402 and the transmission unit 404 may exchange the various types of information ith another apparatus with wireless communication. The receiving unit 402 may receive ethylene concentration information indicating the ethylene concentration in the box 450 from the ethylene sensor 452. The receiving unit 402 may receive temperature information indicating the temperature in the box 450 from the temperature sensor 454.

[0061] The transmission unit 404 transmits at least one of the ethylene concentration information or the temperature information to the derivation apparatus 100 as intermediate information indicating the environment in the box 450 on the way of transportation of the article. The display unit 406 displays the various types of information. The display unit 406 may be a touch panel display. The receiving unit 402 receives, from the derivation apparatus 100, additional adjusting agent information indicating a usage of an adjusting agent that should

be added on the way of transportation, and the display unit 406 displays a type of the adjusting agent indicated in the additional adjusting agent information and an additional usage of an adjusting agent.

[0062] Fig. 8 shows a series of flows from an order to a delivery of an article. In response to an instruction from a customer, the ordering terminal 200 transmits, to the derivation apparatus 100, ordering information of an article that is desired (S100). Fig. 9 is an example of an input screen F200 of ordering information displayed on an ordering terminal 200. The input screen F200 includes a field F210 that selects the variety of the article that is requested to be delivered, a field F212 that inputs a shipping amount of the article that is requested, a field F214 that indicates a ripening degree that should be satisfied by the article at the time of delivery, and a field F216 that inputs a desired delivery date. Furthermore, the input screen F200 includes an order button F218 that outputs an instruction for requesting an order of an article at a time point at which the input of the various types of information is completed.

[0063] The derivation apparatus 100 receives the ordering information from the ordering terminal 200 (S102). In order to notify the shipping source an ordering request, the derivation apparatus 100 transmits the ordering information to the shipping terminal 300 (S104). When the ordering information is received (S106), the shipping terminal 300 derives a volume of a box in a case of transporting the article, a transportation period in a case of transporting the article to a delivery destination, and transmits the volume and the transportation period that are derived to the derivation apparatus 100 as transportation information along with harvest season (S108).

[0064] When the harvest season is received from the shipping terminal 300 (S110), the derivation apparatus 100 derives a usage of an adjusting agent (S112). The derivation

apparatus 100 transmits the usage of the adjusting agent along with a type of the adjusting agent to the shipping terminal 300 (S114).

[0065] When the type and the usage of the adjusting agent are received from the derivation apparatus 100 (S116), the shipping terminal 300 weighs the adjusting agent (S118). The shipping terminal 300 transmits the usage of the adjusting agent to the weighing apparatus that weighs the adjusting agent, and the weighing apparatus may weigh the adjusting agent according to the usage. When the weighing is completed, the article is packed into the box (S120). In the packing, the adjusting agent is also input in the box.

[0066] Fig. 10 shows an example of an ordering information screen F300 that is displayed on a shipping terminal 300 when an order of an article is accepted. The ordering information screen F300 includes a field F310 indicating a various types of information of the article that is ordered from the ordering terminal 200, and a field F312 that inputs the harvest season of the article. When the input of the harvest season is completed, the ordering information screen F300 further includes a calculation button F314 for requesting to derive a usage of an adjusting agent. When the calculation button F314 is pushed, harvest season information indicating the harvest season is transmitted to the derivation apparatus 100. The ordering information screen F300 further includes a field F316 indicating a type of the adjusting agent and a field F318 indicating the usage of the adjusting agent as adjusting agent usage information that is provided from the derivation apparatus 100.

[0067] When the article is packed, the box accommodating the article is loaded on a truck or the like and transported (S120). The transportation terminal 400 transmits intermediate information indicating at least one of a predetermined timing on the way of transportation, an ethylene concentration in the box, and the temperature in the box to the derivation apparatus

100 (S122). When the derivation apparatus 100 receives the intermediate information (S124), the derivation apparatus 100 derives an ethylene amount (E1) in the box that is predicted based on transportation information and derives an actual ethylene amount (E2) in the box based on the intermediate information. The usage derivation unit 110 derives an additional usage of an adjusting agent that should be added in the box based on a difference between the usage of the adjusting agent derived based on the ethylene amount (E1) and a usage of the adjusting agent derived based on the ethylene amount (E2). When the adjusting agent needs to be added in the box, the derivation apparatus 100 transmits, to transportation terminal 400, additional adjusting agent information indicating an additional usage of the adjusting agent that should be added in the box (S126).

[0068] When the additional adjusting agent information is received from the derivation apparatus 100 (S128), the transportation terminal 400 displays, on a display unit 406, that the adjusting agent needs to be added, and a usage of the adjusting agent that is required. Subsequently, in response to a notification, the adjusting agent is added in the box. The predetermined timing on the way of transportation may be a time point such as a time point at which the article arrives at a relay spot at which a reshipping operation of a package from a large truck to a medium-sized or small truck is performed. In addition, when the package is transported by a ship, the predetermined timing on the way of transportation may be on the way of sailing.

[0069] Subsequently, the article is delivered (S130), and the article is received (S132). At the time of delivery, the transportation terminal 400 may transmit, to derivation apparatus 100, completion information indicating the ethylene concentration in the box at the time of delivery. When a difference between the ethylene amount in the box that is based on the ethylene concentration indicated in the completion information and the ethylene amount

derived by the ethylene amount derivation unit 108 is greater than or equal to a threshold, the derivation apparatus 100 may notify the ordering terminal 200 that a ripening degree or a degradation degree that should be satisfied at a time point at which the article is transported to the delivery destination is not satisfied. The derivation apparatus 100 may notify the ordering terminal 200 that the ripening degree of the article is not advanced than the ripening degree that is desired when the ethylene amount that is derived by the ethylene amount derivation unit 108 is greater than the ethylene amount in the box that is based on the ethylene concentration indicated in the completion information. The notification unit 114 may notify the ordering terminal 200 that the ripening degree of the article is advanced than the ripening degree that is desired when the ethylene amount that is derived by the ethylene amount derivation unit 108 is less than the ethylene amount in the box that is based on the ethylene concentration indicated in the completion information.

[0070] Fig. 11 is a flowchart shows an example of a procedure of determining a usage of an adjusting agent by a derivation apparatus 100.

[0071] The acquisition unit 102 acquires, from the ordering terminal 200, ordering information indicating a type of article requested to be delivered, a shipping amount, a desired delivery date, a delivery destination, and a ripening degree or a degradation degree that should be satisfied by the article at the time of delivery. The acquisition unit 102 acquires, from the shipping terminal 300, a transportation information indicating: a volume of the box in a case of transporting the article; a transportation period in a case of transporting the article to the delivery destination; a harvest season; and storage information indicating a storage period and a storage temperature of the article, wherein the storage period is a period during which the article is stored from the harvest until a time point at which the article is shipped from a shipping source (S202).

[0072] The ethylene amount derivation unit 108 derives, in a transportation period, an ethylene amount by which a ripening degree or a degradation degree of an article is advanced based on the ethylene generation amount coefficient G and the ethylene susceptibility coefficient S, a shipping amount of the article, a volume of a box used for transportation of the article, and the transportation period. The usage derivation unit 110 derives, for each adjusting agent that is an available candidate, a usage of an adjusting agent to be used during the transportation period based on the ethylene amount, the adjusting agent volatilization amount coefficient V, and the adsorption coefficient A that are specified (S204). The ethylene amount derivation unit 108 may derive molar concentration of ethylene (mol/L) indicating an ethylene amount by which the ripening degree or the degradation degree of the article is advanced, by ethylene generation amount coefficient G × (ethylene susceptibility coefficient S × temperature adjustment coefficient T × ventilation adjustment coefficient B × storage period adjustment coefficient K × storage temperature adjustment coefficient M × degree coefficient D × transportation period (Hr) × shipping amount (kg) / volume of ethylene per mole (μl/mol) / volume of box (L). The usage derivation unit 110 may derive, for each adjusting agent that is an available candidate, a usage U of an adjusting agent so that a molar concentration (mol/L) of an adjusting agent that is derived with adjusting agent volatilization amount coefficient V × adsorption coefficient A × usage U of adjusting agent (kg) / volume per mole of adjusting agent (μl/mol) / volume of box (L) is consistent with a molar concentration of ethylene (mol/L) of ethylene derived by the ethylene amount derivation unit 108.

[0073] The determining unit 112 determines, among the plurality of adjusting agents, an adjusting agent whose usage U (kg) is the smallest, as an adjusting agent to be used for the article (S206).

[0074] Hereinabove, according to the present embodiment, a usage of the adjusting agent can be derived, according to a type of produce or a fresh flower, a shipping amount, a transportation period, a ripening degree or a degradation degree at the time of delivery, or the like, wherein the adjusting agent suppresses the advancing of the ripening degree or the degradation degree of the produce or the fresh flower due to ethylene that is required to maintain the ripening degree or the degradation degree at the time of delivery during the transportation period of the produce or the fresh flower. Accordingly, the usage of the adjusting agent can be easily figured out.

[0075] FIG. 12 shows an example of a computer 1200 where a plurality of aspects of the present invention may be entirely or partially embodied. Programs installed in the computer 1200 can cause the computer 1200 to function as operations associated with the apparatus according to the embodiments of the present invention or one or more "units" of the apparatus. Alternatively, the programs can cause the computer 1200 to execute the operations or the one or more "units". The programs can cause the computer 1200 to execute a process according to the embodiments of the present invention or steps of the process. Such programs may be executed by a CPU 1212 to cause the computer 1200 to perform specific operations associated with some or all of the blocks in the flowcharts and block diagrams described in the present specification.

[0076] The computer 1200 according to the present embodiment includes the CPU1212 and an RAM 1214, which are mutually connected by a host controller 1210. The computer 1200 also includes a communication interface 1222 and an input/output unit, which are connected to the host controller 1210 via an input/output controller 1220. The computer 1200 also includes an ROM 1230.

The CPU 1212 operates according to the programs stored in the ROM 1230 and the RAM 1214, thereby controlling each unit.

[0077] The communication interface 1222 communicates with other electronic devices via a network. A hard disk drive may store the programs and data used by the CPU 1212 in the computer 1200. The ROM 1230 stores therein boot programs or the like executed by the computer 1200 at the time of activation, and/or programs depending on hardware of the computer 1200. A program is provided via a computer-readable recording medium such as a CD-ROM, a USB memory, or an IC card, or via a network. The programs are installed in the RAM 1214 or the ROM 1230 which is also an example of the computer-readable recording medium, and executed by the CPU 1212. Information processing described in these programs is read by the computer 1200, and provides cooperation between the programs and the various types of hardware resources described above. The apparatus or method may be configured by implementing operations or processings of information according to use of the computer 1200.

[0078] For example, in a case where a communication is performed between the computer 1200 and an external device, the CPU 1212 may execute a communication program loaded in the RAM 1214 and instruct the communication interface 1222 to perform communication processing based on a process written in the communication program. The communication interface 1222, under the control of the CPU 1212, reads transmission data stored in a transmission buffer region provided in a recording medium such as the RAM 1214 or the USB memory, transmits the read transmission data to the network, or writes reception data received from the network to a reception buffer region or the like provided on the recording medium.

[0079] In addition, the CPU 1212 may cause all or necessary portion of a file or a database stored in an external recording medium such as a USB memory, to be read by the RAM 1214, and execute various types of processing on the data on the RAM 1214. Next, the CPU 1212 may write the processed data back in the external recording medium.

[0080] Various types of information, such as various types of programs, data, tables, and databases, may be stored in the recording medium to undergo information processing. The CPU 1212 may execute, on the data read from the RAM 1214, various types of processing including various types of operations, information processing, conditional judgement, conditional branching, unconditional branching, information search/replacement, or the like described throughout the present disclosure and specified by instruction sequences of the programs, to write the results back to the RAM 1214. In addition, the CPU 1212 may search for information in a file, a database, or the like in the recording medium. For example, when a plurality of entries, each having an attribute value of a first attribute associated with an attribute value of a second attribute, are stored in the recording medium, the CPU 1212 may retrieve, out of the plurality of entries, an entry with the attribute value of the first attribute specified that meets a condition, read the attribute value of the second attribute stored in said entry, and thereby acquiring the attribute value of the second attribute associated with the first attribute satisfying a predetermined condition.

[0081] The programs or software modules described above may be stored in a computer-readable storage medium on or near the computer 1200. In addition, a recording medium such as a hard disk or a RAM provided in a server system connected to a dedicated communication network or the Internet can be used as the computer-readable storage medium, so that the programs are provided to the computer 1200 via the network.

[0082] Computer-readable medium may include any tangible device that can store instructions for execution by a suitable device. As a result, the computer-readable medium having instructions stored therein includes an article of manufacture including instructions which can be executed to create means for performing operations specified in the flowcharts or block diagrams. Examples of the computer-readable medium may include an electronic storage medium, a magnetic storage medium, an optical storage medium, an electromagnetic storage medium, a semiconductor storage medium, and the like. More specific examples of the computer-readable medium may include a floppy disk, a diskette, a hard disk, a random access memory (RAM), a read only memory (ROM), an erasable programmable read only memory (EPROM or a flash memory), an electrically erasable programmable read only memory (EEPROM (registered trademark)), a static random access memory (SRAM), a compact disc read only memory (CD-ROM), a digital versatile disk (DVD), a Blu-ray (registered trademark) disk, a memory stick, an integrated circuit card, and the like.

[0083] Computer-readable instructions may include either a source code or an object code written in any combination of one or more programming languages. The source code or the object code includes a conventional procedural programming language. The conventional procedural programming language may be assembler instructions, instruction-set-architecture (ISA) instructions, machine instructions, machine dependent instructions, microcode, firmware instructions, state-setting data, or an object-oriented programming language such as Smalltalk (registered trademark), JAVA (registered trademark), C++, etc., and programming languages, such as the "C" programming language or similar programming languages.
Computer-readable instructions may be provided to a processor of a general-purpose computer, special purpose computer, or other programmable data processing apparatus, or to programmable circuitry, locally or via a local area network (LAN), a wide area network (WAN)

such as the Internet, etc. The processor or the programmable circuitry may execute the computer-readable instructions to create means for performing operations specified in the flowcharts or block diagrams. Examples of the processor include a computer processor, a processing unit, a microprocessor, a digital signal processor, a controller, a microcontroller, and the like.

[0084] While the present invention has been described by way of the embodiments, the technical scope of the present invention is not limited to the scope described in the above-described embodiments. It is apparent to persons skilled in the art that various alterations or improvements can be made to the above-described embodiments. It is also apparent from the described scope of the claims that the embodiments added with such alterations or improvements can be included the technical scope of the present invention.

[0085] The operations, procedures, steps, stages, or the like of each process performed by a device, system, program, and method shown in the claims, specification, or drawings can be performed in any order as long as the order is not indicated by "prior to," "before," or the like and as long as the output from a previous process is not used in a later process. Even if the operation flow is described using phrases such as "first" or "then" in the claims, specification, or drawings, it does not necessarily mean that the process must be performed in this order.

EXPLANATION OF REFERENCES

[0086] 10 system

100 derivation apparatus

102 acquisition unit

104 ethylene coefficient identification unit

106 adjusting agent coefficient identification unit

108 ethylene amount derivation unit

110 usage derivation unit

112 determining unit

114 notification unit

120 storage unit

200 ordering terminal

202 receiving unit

204 transmission unit

206 display unit

300 shipping terminal

302 receiving unit

304 transmission unit

306 display unit

400 transportation terminal

402 receiving unit

404 transmission unit

406 display unit

450 box

452 ethylene sensor

454 temperature sensor

1200 computer;

1210 host controller;

1212 CPU

1214 RAM

1220 input/output controller;

1222 communication interface;

1230 ROM.

WHAT IS CLAIMED IS:

1. A derivation apparatus, comprising:

an acquisition unit that acquires: type information indicating a type of an article that is produce or a fresh flower, shipping amount information indicating a shipping amount of the article, volume information indicating a volume of a box that accommodates the article, and transportation period information indicating a transportation period in which the article is transported from a shipping source to a delivery destination;

a first coefficient identification unit that specifies a first coefficient for the type indicated in the type information, by referring to first coefficient information that indicates a first coefficient for each type, the first coefficient indicating an amount of ethylene per at least one of unit time or unit weight that advances a ripening degree or a degradation degree of the article, among amounts of ethylene generated by the article;

a second coefficient identification unit that specifies a second coefficient for the type indicated in the type information, by referring to second coefficient information that indicates a second coefficient for each type, the second coefficient indicating a usage per unit ethylene amount of an adjusting agent for adjusting a ripening degree or a degradation degree of the article that is advanced by ethylene generated by the article;

an ethylene amount derivation unit that derives an ethylene amount by which a ripening degree or a degradation degree of the article is advanced in the transportation period based on the first coefficient that is specified, a shipping amount of the article, the volume, and the transportation period; and

a usage derivation unit that derives a usage of the adjusting agent that is used during the transportation period based on the ethylene amount that is derived and the second coefficient that is specified.

2. The derivation apparatus according to claim 1, wherein:

the acquisition unit acquires the type information and the shipping amount information for each of a plurality of articles that are accommodated in the box;

the ethylene amount derivation unit derives an ethylene amount for the box by summing up the ethylene amount for each of the plurality of articles; and

the usage derivation unit derives a usage of the adjusting agent based on the ethylene amount for the box.

3. The derivation apparatus according to claim 1, wherein:

the acquisition unit further acquires transportation temperature information that indicates a temperature around the article until a time point at which the article that is accommodated in the box is transported from a shipping source to the delivery destination;

the first coefficient information indicates a temperature adjustment coefficient corresponding to the temperature; and

the ethylene amount derivation unit derives the ethylene amount based on the first coefficient that is adjusted with the temperature adjustment coefficient corresponding to the temperature that is indicated by the transportation temperature information.

4. The derivation apparatus according to claim 1, wherein

the acquisition unit further acquires ventilation information that indicates a ventilation state of the box;

the first coefficient information indicates a ventilation adjustment coefficient corresponding to the ventilation state; and

the ethylene amount derivation unit derives the ethylene amount based on the first coefficient that is adjusted with the ventilation adjustment coefficient corresponding to the ventilation state that is indicated by the ventilation information.

5. The derivation apparatus according to claim 1, wherein

the acquisition unit further acquires storage period information that indicates a storage period from a harvest of the article to the shipping;

the first coefficient information indicates storage period adjustment coefficient corresponding to the storage period;

the ethylene amount derivation unit derives, for a type that is indicated in the type information, the ethylene amount based on the first coefficient that is adjusted with the storage period adjustment coefficient corresponding to the storage period indicated in the storage period information.

6. The derivation apparatus according to claim 1, wherein

the acquisition unit further acquires storage temperature information that indicates a storage temperature from a harvest of the article to the shipping;

the first coefficient information indicates storage temperature adjustment coefficient corresponding to the storage temperature;

the ethylene amount derivation unit adjusts, for a type that is indicated in the type information, the ethylene amount based on the first coefficient that is adjusted with the storage temperature adjustment coefficient corresponding to the storage temperature indicated in the storage temperature information.

7. The derivation apparatus according to claim 1, wherein

the acquisition unit further acquires degree information indicating a ripening degree or a degradation degree that should be satisfied at a time point at which the article is delivered to the delivery destination;

the first coefficient information indicates degree adjustment coefficient corresponding to a ripening degree or a degradation degree that should be satisfied at a time point at which the article is delivered to the delivery destination;

for the type indicated in the type information, the ethylene amount derivation unit derives the ethylene amount based on the first coefficient that is adjusted with the degree adjustment coefficient corresponding to the ripening degree or the degradation degree indicated in the degree information.

8. The derivation apparatus according to claim 1, wherein

the second coefficient information indicates, for each type of a plurality of adjusting agents, a second coefficient corresponding to a type of an article; and

the usage derivation unit derives, for each of the plurality of adjusting agents, a usage corresponding to the type of the article, wherein the derivation apparatus further comprises:

a determining unit that determines, among the plurality of adjusting agents, an adjusting agent whose usage satisfies a predetermined condition, as an adjusting agent to be used for the article.

9. The derivation apparatus according to claim 8, wherein

the determining unit determines, among the plurality of adjusting agents, an adjusting agent having the smallest usage as an adjusting agent that satisfies the predetermined condition.

10. The derivation apparatus according to claim 1, wherein:

the acquisition unit further acquires, during an intermediate period for transportation of the article from the shipping source to the delivery destination, intermediate information indicating ethylene concentration in the box during the intermediate period; and

when an ethylene amount based on the ethylene concentration indicated in the intermediate information is greater than the ethylene amount derived by the ethylene amount derivation unit, the usage derivation unit further derives an additional usage of the adjusting

agent to be added in the box based on a difference between the ethylene amount derived by the ethylene amount derivation unit and the ethylene amount based on the ethylene concentration indicated in the intermediate information.

11. The derivation apparatus according to claim 3 wherein:

the acquisition unit further acquires during an intermediate period for transportation of the article from the shipping source to the delivery destination, intermediate information indicating the temperature in the box during the intermediate period, wherein the ethylene amount derivation unit derives:

an ethylene amount in the box based on the first coefficient that is adjusted with a temperature adjustment coefficient corresponding to the temperature indicated in the transportation temperature information, a shipping amount of the article, the volume, and the intermediate period; and

an actual ethylene amount in the box based on the first coefficient that is adjusted with a temperature adjustment coefficient corresponding to the temperature indicated in the intermediate information, a shipping amount of the article, the volume, and the intermediate period, and wherein the usage derivation unit further derives:

when the actual ethylene amount is greater than the ethylene amount derived for the intermediate period by the ethylene amount derivation unit, an additional usage of the adjusting agent to be added in the box based on a difference between the ethylene amount derived for the intermediate period and the actual ethylene amount.

12. The derivation apparatus according to claim 3 wherein:

the acquisition unit further acquires completion information indicating an ethylene concentration in the box at a time point at which a transportation of the article to the delivery destination is completed, wherein the derivation apparatus further comprises:

when a difference between an ethylene amount in the box that is based on an ethylene concentration indicated in the completion information and the ethylene amount derived by the ethylene amount derivation unit is greater than or equal to a threshold, a notification unit that notifies that a ripening degree or a degradation degree that should be satisfied at a time point at which the article is transported to the delivery destination is not satisfied.

13. A system, comprising:

the derivation apparatus according to any one of claim 1 to 12; and

a first terminal including a receiving unit that receives a usage of the adjusting agent derived by the usage derivation unit; and a notification unit that notifies the usage of the adjusting agent.

14. The system according to claim 13, wherein

the first terminal further includes a transmission unit that transmits the volume information and the transportation period information to the derivation apparatus, and wherein the system further comprises:

a second terminal including a transmission unit that transmits the type information, the shipping amount information, and delivery destination information in which the delivery destination is indicated to the derivation apparatus.

15. A derivation method, comprising:

acquiring, by an acquisition unit, type information indicating a type of an article that is produce or a fresh flower, shipping amount information indicating a shipping amount of the article, volume information indicating a volume of a box that accommodates the article, and transportation period information indicating a transportation period in which the article is transported from a shipping source to a delivery destination;

specifying, by a first coefficient identification unit, a first coefficient for the type indicated in the type information, by referring to first coefficient information that indicates a first coefficient for each type, the first coefficient indicating an amount of ethylene per at least one of unit time or unit weight that advances a ripening degree or a degradation degree of the article, among amounts of ethylene generated by the article;

specifying, by a second coefficient identification unit, a second coefficient for the type indicated in the type information, by referring to second coefficient information that indicates a second coefficient for each type, the second coefficient indicating a usage per unit ethylene amount of an adjusting agent for adjusting a ripening degree or a degradation degree of the article that is advanced by ethylene generated by the article;

deriving, by an ethylene amount derivation unit, an ethylene amount by which a ripening degree or a degradation degree of the article is advanced in the transportation period

based on the first coefficient that is specified, a shipping amount of the article, the volume, and the transportation period; and

deriving, by a usage derivation unit, a usage of the adjusting agent that is used during the transportation period based on the ethylene amount that is derived and the second coefficient that is specified.

16. A program that causes a computer to function as:

an acquisition unit that acquires: type information indicating a type of an article that is produce or a fresh flower, shipping amount information indicating a shipping amount of the article, volume information indicating a volume of a box that accommodates the article, and transportation period information indicating a transportation period in which the article is transported from a shipping source to a delivery destination;

a first coefficient identification unit that specifies a first coefficient for the type indicated in the type information, by referring to first coefficient information that indicates a first coefficient for each type, the first coefficient indicating an amount of ethylene per at least one of unit time or unit weight that advances a ripening degree or a degradation degree of the article, among amounts of ethylene generated by the article;

a second coefficient identification unit that specifies a second coefficient for the type indicated in the type information, by referring to second coefficient information that indicates a second coefficient for each type, the second coefficient indicating a usage per unit ethylene amount of an adjusting agent for adjusting a ripening degree or a degradation degree of the article that is advanced by ethylene generated by the article;

an ethylene amount derivation unit that derives an ethylene amount by which a ripening degree or a degradation degree of the article is advanced in the transportation period based on the first coefficient that is specified, a shipping amount of the article, the volume, and the transportation period; and

a usage derivation unit that derives a usage of the adjusting agent that is used during the transportation period based on the ethylene amount that is derived and the second coefficient that is specified.