

PROCESSING SYSTEM AND METHOD

Field of Invention

The present invention generally relates to a processing system and a processing
5 method for processing articles using ozone.

Background

Timber and wood products are articles that are exposed to infestation problems, for
example, infestation by insects and other pests. These infestation problems become
10 more severe when the articles become enclosed over an extended period of time for
storage or for transportation.

Many processing methods are available for processing these articles prior to storage
or transportation. The main objective of these processing methods is to prevent
15 infestation by and growing of insects and for removing or retarding growth of algae
and fungi in these articles.

One such processing method includes use of methyl bromide for fumigating these
articles. There was previously a wide spread use of methyl bromide for fumigating
20 timber, packaging materials and pallets. However, as some of these articles are
subsequently used for containing or transporting food items and methyl bromide that
settles on these article are toxic, this processing method is generally unsafe.
Additionally, methyl bromide fumigation only last a couple of weeks and does not
prevent re-infestation by insects. This is undesirable as these articles may be
25 transported in containers over air, land and/or sea for extended durations during which
re-infestation will definitely occur.

Another one of the processing methods includes kiln drying. In kiln drying, the
articles, for example wood furnitures, are subjected to constant high temperature
30 within an enclosure with constant airflow out of the enclosure for expelling moisture
from the enclosure. The articles are then loaded onto the transport after kiln drying.
Similar to the use of methyl bromide fumigation, although the high temperature of

kiln drying is able to destroy pest and insects in the articles, it does not prevent re-infestation during transportation of the articles.

Many countries have put quarantine regulations in place to protect their native forests from the introduction of wood pests. The International Plant Protection Convention (IPPC) Secretariat, part of the Food and Agriculture Organization (FAO) of the United Nations, has issued ISPM 15 (International Standards for Phytosanitary Measures) guideline for regulating wood packaging material in international trade.

The ISPM 15 guideline requires heat treatment of solid wood articles, for example by kiln drying to a temperature of 56°C for at least 30 minutes. Again, even by following the ISPM 15 guideline for heat treatment, re-infestation cannot be substantially prevented.

There is therefore a need for a processing system and a processing method for effectively processing articles for keeping them substantially pest free during transportation or prolonged storage.

Summary

In accordance with a first aspect of the invention, there is disclosed a processing system comprising a transportable enclosure for defining a processing space and an opening to the processing space. The transportable enclosure is for receiving at least one article into the processing space. The processing system further comprises an ozonator for generating and discharging ozone (O₃) into the processing space for exposing the at least one article received into the processing space. The processing system also comprises a barrier for substantially impeding escape of ozone discharged into the processing space through the opening, whereby substantially exposing the at least one article in the processing space to ozone over a predetermined duration substantially at least one of repels pest from, eradicate pest from and disinfect the at least one article in the processing space.

In accordance to a second aspect of the invention, there is disclosed a processing method comprising providing a transportable enclosure and an ozonator with the ozonator being for generating ozone (O_3). The processing method further comprises deploying the transportable enclosure for defining a processing space and an opening to the processing space, disposing at least one article in the processing space, the opening providing access to the processing space and substantially covering the opening of the transportable enclosure with a barrier. The processing method also comprises discharging ozone generated by the ozonator into the processing space for substantially exposing the at least one article in the processing space to ozone, whereby substantially exposing the at least one article in the processing space to ozone over a predetermined duration substantially at least one of repels pest from, eradicate pest from and disinfect the at least one article in the processing space.

15 **Brief Description Of The Drawings**

Embodiments of the invention are disclosed hereinafter with reference to the drawings, in which:

FIG. 1 is a system representation of a processing system according to an embodiment of the invention; and

FIG. 2 shows a process flow diagram of a processing method for utilising the processing system of FIG.1.

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Detailed Description

A processing system and a processing method are described hereinafter for addressing the foregoing problems.

30 An embodiment of the invention, a processing system 20 is described with reference to FIG. 1 and FIG. 2. The processing system 20 comprises a transportable enclosure 22, a barrier 24 and an ozonator 26. The transportable enclosure 22 defines a processing space 28 and an opening 30 to the processing space 28. The transportable

enclosure 22 is preferably a steel shipping container being shaped for carriage and transportation by sea or land transport. The barrier 24 is preferably coupled to the transportable enclosure 22 for substantially covering the opening 30 thereof. Preferably, the barrier 24 is a flexible panel for extending over the opening 30 of the transportable enclosure 22. Alternatively, the barrier 24 is a door pivotably or slidably coupled to the transportable enclosure 22 and operable for covering the opening 30.

The ozonator 26 generates ozone (O_3) preferably by corona discharge. However, this does not preclude the ozonator 26 from generating ozone by ultraviolet irradiation or electrolysis. The ozonator 26 is preferably structurally integrated with the transportable enclosure 22. Alternatively, the ozonator 26 is formed integral with the barrier 24 or is coupled to the barrier 24 for generating and discharging ozone into the processing space 28.

The processing space 28 is for receiving articles 32 therein for processing by ozone generated by the ozonator 26. The articles 32 are, for example, timber or wooden furniture. The processing system 20 further comprises an air mover 34 coupled to the transportable enclosure 22 for circulating ozone discharged into the processing space 28. The air mover 34 is preferably an air blower or a fan. Alternatively, the air mover 34 is formed integral with the ozonator 26.

The articles 32 are exposed to further infestation by insects and other bio-forms when kept in an enclosed space over a period of time during transportation thereof. Such infestation usually starts even before the articles 32 are placed in the enclosed space. By circulating ozone within the processing space 28 and exposing the articles 32 in the processing space 28 to ozone over a predetermined duration, insects and other bio-forms are eradicated from the articles 32. Further re-infestation of the articles 32 by insects or other bio-forms is also substantially prevented. Exposing the articles 32 to ozone in the processing space also substantially disinfects the articles 32 and retards growth of algae and fungus on the articles 32. The articles 32 are preferably placed on pallets when placed in the processing space 28 to enable the articles 32 to be substantially exposed to ozone.

The processing system 20 further comprises a controller (not shown) and a sensor (also not shown) coupled to the controller. The controller is for controlling the amount of ozone generated by the ozonator 26. The sensor is preferably disposed within the processing space 28 for detecting and for providing as data input to the controller the level of ozone in the processing space 28. The data input received from the sensor allows the controller to determine and control the amount of ozone generated by the ozonator 26 based on the level of ozone in the processing space 28.

Preferably, the processing system 20 further comprises an air filter 40 for displacing and filtering air in the processing space 28 therethrough. Preferably, the air filter 40 also enables insects that have been repelled from the articles and into the air to be trapped by the air filter 40.

Preferably, the transportable enclosure 22 further comprises vents (not shown) for facilitating exhaust of air and escape of insects carried in the air out of the processing space 28. The vents are preferably further conduit-coupled to an exhaust location or system (not shown) for delivery of insects to a predefined location away from the transportable enclosure 22. In the processing system 20, the air filter 40 and the vents are employed either in combination or independently.

The ozonator 26, the air mover 34, the controller and the air filter 40 are preferably electrically powered by a mobile power source, for example, a portable battery array or a generator set (both not shown). This further facilitates transportability of the processing system 20 between locations and facilitates carriage of the processing system 20 by sea, air or land transport vehicles. Alternatively, the ozonator 26, the air mover 34, the controller and the air filter 40 is coupled to a manifold (not shown), for example an electrical socket cluster, coupled to the transportable enclosure 22 which in turn, is coupled to an external electrical power source.

The processing system 20 is preferably provided in a processing method 200 for processing the articles 32. The transportable enclosure 22 of the processing system 20 is first deployed in a step 202 to facilitate access into the processing space 28. In a step 204, the articles 32 are placed within the processing space 28 via the opening 30.

The opening 30 is then covered using the barrier 24 in a step 206. In a step 208, the ozonator 26 generates and discharges ozone into the processing space 28. Ozone in the processing space 28 is kept at a predetermined level by the controller. The articles 32 are then left in the processing space 28 for a predetermined duration in a step 210. During the predetermined duration, air within the transportable enclosure 22 is circulated which consequently circulates the ozone therein. Additionally, the air filter 40 further functions to trap airborne insects that have emerged from the articles 32. After the predetermined duration, the opening 30 is uncovered and the articles 32 are removed from the processing space 28 in a step 212.

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The transportable enclosure 22 enables the steps of the processing method to be performed even during transportation of the transportable enclosure 22 by a vehicle between locations.

15 Alternatively, the transportable enclosure 22 is a tent-like structure constructed from flexible panels, for example fabric panels extending over a metal frame or plastic panels. The tent-like structure enables the transportable enclosure 22 to be collapsible for facilitating portability thereof.

20 Additionally, the transportable enclosure 22 is internally lined with a bulk bag (not shown). The bulk bag allows proper containment of rice grains in the transportable enclosure 22 and further facilitates handling of the rice grains. When the bulk bag is used, the ozonator 26 is preferably further coupled to the bulk bag for enabling discharge of ozone generated by the ozonator 26 into the bulk bag.

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In the foregoing manner, a processing system and a processing method is described according to one embodiment of the invention for addressing the foregoing disadvantages of conventional fumigation methods. Although only one embodiment of the invention is disclosed, it will be apparent to one skilled in the art in view of this disclosure that numerous changes and/or modification can be made without departing from the scope and spirit of the invention.

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Claims

1. A processing system comprising:

a transportable enclosure for defining a processing space and an opening to the processing space, the transportable enclosure for receiving at least one article into the processing space;

an ozonator for generating and discharging ozone (O₃) into the processing space for exposing the at least one article received into the processing space; and

a barrier for substantially impeding escape of ozone discharged into the processing space through the opening,

whereby substantially exposing the at least one article in the processing space to ozone over a predetermined duration substantially at least one of repels pest from, eradicate pest from and disinfect the at least one article in the processing space.

2. The processing system as in claim 1, further comprising:

an air mover for circulating ozone discharged into the processing space.

3. The processing system as in claim 2, the air mover being formed integral with the ozonator.

4. The processing system as in claim 1, the ozonator being integrated with one of the transportable enclosure and the barrier.

5. The processing system as in claim 1, the ozonator being coupled to one of the transportable enclosure and the barrier.

6. The processing system as in claim 1, further comprising:

a controller for controlling the amount of ozone at least one of generated by the ozonator and discharged into the processing space by the ozonator.

7. The processing system as in claim 6, further comprising:
 a sensor for detecting and for providing as data input to the controller
 the level of ozone in the processing space, the controller controlling the
 amount of ozone discharged into the processing space based on the data input.
- 5 8. The processing system as in claim 1, the transportable enclosure being a
 container.
9. The processing system as in claim 8, the barrier being one of at least one door
 10 coupled to the container and a panel being couplable to the opening of the
 container.
10. The processing system as in claim 8, the transportable container being shaped
 for transport by a vehicle.
- 15 11. The processing system as in claim 1, the transportable container being a tent,
 the tent comprising a plurality of panels for defining the processing space, at
 least one of the plurality of panels being the barrier.
- 20 12. The processing system as in claim 1, wherein ozone is generated by the
 ozonator by at least one of corona discharge, ultraviolet irradiation and
 electrolysis.
13. The processing system as in claim 1, the at least one article being at least one
 25 of furniture, timber and food items.
14. A processing method comprising:
 providing a transportable enclosure and an ozonator, the transportable
 enclosure for defining a processing space and an opening to the processing
 30 space, the ozonator for generating ozone (O₃);
 disposing at least one article in the processing space, the opening
 providing access to the processing space;

substantially covering the opening of the transportable enclosure with a barrier; and

discharging ozone generated by the ozonator into the processing space for substantially exposing the at least one article in the processing space to ozone,

whereby substantially exposing the at least one article in the processing space to ozone over a predetermined duration substantially at least one of repels pest from, eradicate pest from and disinfect the at least one article in the processing space.

15. The processing method as in claim 14, further comprising:
circulating ozone discharged into the processing space by an air mover.
16. The processing method as in claim 15, the air mover being formed integral with the ozonator.
17. The processing method as in claim 14, the ozonator being integrated with one of the transportable enclosure and the barrier.
18. The processing method as in claim 14, the ozonator being coupled to one of the transportable enclosure and the barrier.
19. The processing method as in claim 14, further comprising:
controlling the amount of ozone at least one of generated by the ozonator and discharged into the processing space by the ozonator using a controller.
20. The processing method as in claim 19, further comprising:
detecting using a sensor and providing as data input to the controller the level of ozone in the processing space, the controller controlling the amount of ozone discharged into the processing space based on the data input.

21. The processing method as in claim 14, the transportable enclosure being a container.
- 5 22. The processing method as in claim 21, the barrier being one of at least one door coupled to the container and a panel being couplable to the opening of the container.
23. The processing method as in claim 21, the transportable container being shaped for transport by a vehicle.
- 10 24. The processing method as in claim 14, the transportable container being a tent, the tent comprising a plurality of panels for defining the processing space, at least one of the plurality of panels being the barrier.
- 15 25. The processing method as in claim 14, wherein ozone is generated by the ozonator by at least one of corona discharge, ultraviolet irradiation and electrolysis.
- 20 26. The processing method as in claim 14, the at least one article being at least one of furniture, timber and food items.