

(19)



SUOMI - FINLAND  
(FI)

PATENTTI- JA REKISTERIHALLITUS  
PATENT- OCH REGISTERSTYRELSEN  
FINNISH PATENT AND REGISTRATION OFFICE

(10) **FI 129366 B**  
(12) **PATENTTIJULKAISU**  
**PATENTSKRIFT**  
**PATENT SPECIFICATION**

(45) Patentti myönnetty - Patent beviljats - Patent granted **31.12.2021**  
(51) Kansainvälinen patenttiluokitus - Internationell patentklassifikation -  
International patent classification  
**F41J 1/01 (2006.01)**  
**F41J 9/16 (2006.01)**  
(21) Patenttihakemus - Patentansökning - Patent application 20195836  
(22) Tekemispäivä - Ingivningsdag - Filing date **01.10.2019**  
(23) Saapumispäivä - Ankomstdag - Reception date **01.10.2019**  
(43) Tullut julkiseksi - Blivit offentlig - Available to the public **02.04.2021**

(73) Haltija - Innehavare - Proprietor  
**1 • Teres Targets Oy, c/o Antti Heinonen Ansionrinne 22, 13100 HÄMEENLINNA, SUOMI - FINLAND, (FI)**

(72) Keksijä - Uppfinnare - Inventor  
**1 • Heinonen, Antti, HÄMEENLINNA, SUOMI - FINLAND, (FI)**

(74) Asiamies - Ombud - Agent  
**Papula Oy, P.O. Box 981, 00101 Helsinki**

(54) Keksinnön nimitys - Uppfinningens benämning - Title of the invention  
**AMPUMAMAALI**  
**Skjutmål**  
**SHOOTING TARGET**

(56) Viitejulkaisut - Anförda publikationer - References cited  
US 5788243 A, US 2002060428 A1, CN 107588687 A, US 4623150 A

(57) Tiivistelmä - Sammandrag - Abstract

Esitetään ammutakohde, joka käsittää kasvipohjaisia partikkeleita, ligniiniä tai niiden yhdistelmää määränä, joka on vähintään 80 painoprosenttia ammutakohteen kokonaispainosta laskettuna. Lisäksi esitetään menetelmä ammutakohteen valmistamiseksi ja ammutakohteen käyttö.

A shooting target comprising plant-based particles, lignin or a combination thereof in an amount of at least 80 weight-% based on the total weight of the shooting target is disclosed. Further is disclosed a method for producing a shooting target and the use of the shooting target.

**SHOOTING TARGET****TECHNICAL FIELD**

5 The present disclosure relates to a shooting target comprising plant-based particles, lignin or a combination thereof. The present disclosure further relates to a method for producing a shooting target comprising plant-based particles, lignin or a combination thereof. The present disclosure further relates  
10 to the use of the shooting target.

**BACKGROUND**

Shooting sports, including clay pigeon shooting or clay target shooting, are popular sporting  
15 activities in several countries. Due their popularity, an enormous amount of targets are being consumed annually.

Conventional clay targets or clay pigeons, typically used for these sports, generally include  
20 non-biodegradable components, such as pitches, tars and other petroleum products which are used as binders for limestone-containing targets. These are also essential components for the limestone-containing targets to strengthen the target so that it can be  
25 stored, shipped and launched without breaking. However, these components are also very hazardous for the health and the environment as they do not decompose and may penetrate for example to the soil. The pH of the field may further be changed which may affect the  
30 whole ecosystem.

Some alternatives are presented in US 5788243 A, US 2002060428 A1, CN 107588687 A, and US 4623150 A.

Thus there remains a need to find better and more sustainable options for the target compositions.

35

**SUMMARY**

A shooting target comprising lignin in an amount of at least 80 weight-% based on the total weight of the shooting target, or comprising plant-based particles and lignin in an amount of at least 80 weight-% based on the total weight of the shooting target, wherein the ratio of plant-based particles to lignin is 90-80/10-20, or 80-70/20-30, or 70-60/30-40, or 60-50/40-50, or 50-40/50-60, or 40-30/60-70, or 30-20/70-80, or 20-10/80-90, is disclosed.

A method for producing a shooting target is disclosed. The method may comprise:

a) forming a mixture comprising lignin in an amount of at least 80 weight-% based on the total weight of the mixture or a mixture comprising plant-based particles and lignin in an amount of at least 80 weight-% based on the total weight of the shooting target, wherein the ratio of plant-based particles to lignin is 90-80/10-20, or 80-70/20-30, or 70-60/30-40, or 60-50/40-50, or 50-40/50-60, or 40-30/60-70, or 30-20/70-80, or 20-10/80-90; and

b) pressing the mixture from step a) for moulding the mixture into a shooting target of a predetermined size and shape, wherein the mixture from step a) is kept at a temperature of 0 - 150 °C during the step of pressing.

Use of the shooting target for clay pigeon shooting or clay target shooting, such as skeet shooting, trap shooting, and/or sporting clays is disclosed.

**DETAILED DESCRIPTION**

The present application relates to a shooting target and to a method for preparing a shooting target.

The shooting target comprises plant-based particles, lignin or a combination thereof in an amount of at least 80 weight-% based on the total weight of the shooting target.

5           In one embodiment, the shooting target comprises lignin and wood particles, wherein the shooting target comprises at least 80 weight-% lignin and wood particles based on the total weight of the shooting target. In one embodiment, the shooting  
10 target comprises wood particles and lignin in an amount of at least 80 weight-% based on the total weight of the shooting target.

In the context of this specification, the term "shooting target" refers to flying targets which  
15 may be thrown by a trap e.g. during the sport of target shooting.

In one embodiment, the shooting target is biodegradable. In one embodiment, the shooting target is a biodegradable shooting target.

20           In one embodiment, the shooting target comprises plant-based particles, lignin or a combination thereof in an amount of at least 85 weight-%, or at least 90 weight-%, or at least 95 weight-%, or at least 99 weight-% based on the total  
25 weight of the shooting target. In one embodiment, the shooting target comprises wood particles and lignin in an amount of at least 80 weight-%, or at least 85 weight-%, or at least 90 weight-%, or at least 95 weight-%, or at least 99 weight-%, based on the total  
30 weight of the shooting target.

In one embodiment, the shooting target comprises plant-based particles and lignin, and the ratio of plant-based particles to lignin is 99-90/1-10, or 90-80/10-20, or 80-70/20-30, or 70-60/30-40, or  
35 60-50/40-50, or 50-40/50-60, or 40-30/60-70, or 30-20/70-80, or 20-10/80-90, or 10-1/90-99. In one embodiment, the shooting target comprises wood

particles and lignin, and the ratio of wood particles to lignin in the shooting target is 99-90/1-10, or 90-80/10-20, or 80-70/20-30, or 70-60/30-40, or 60-50/40-50, or 50-40/50-60, or 40-30/60-70, or 30-20/70-80, or 20-10/80-90, or 10-1/90-99.

In one embodiment, the ratio of plant-based particles to lignin in the shooting target is 95/5, or 90/10, or 85/15, or 80/20, or 75/25, or 70/30, or 65/35, or 60/40, or 50/50, or 45/55, or 40/60, or 35/65, or 30/70, or 25/75, or 20/80, or 15/85, or 10/90, or 5/95. In one embodiment, the ratio of wood particles to lignin in the shooting target is 95/5, or 90/10, or 85/15, or 80/20, or 75/25, or 70/30, or 65/35, or 60/40, or 50/50, or 45/55, or 40/60, or 35/65, or 30/70, or 25/75, or 20/80, or 15/85, or 10/90, or 5/95.

In one embodiment, the plant-based particles are particles originating from wood, agricultural residues, grasses, or other plant substances. In one embodiment, the plant-based particles are particles of straw, leaves, bark, seeds, hulls, flowers, vegetables or fruits. In one embodiment, the plant-based particles are particles of cotton, corn, wheat, oat, rye, barley, rice, flax, hemp, manila hemp, sisal hemp, jute, ramie, kenaf, bagasse, bamboo or reed.

In one embodiment, the plant-based particles are wood particles. In one embodiment, the wood particles are selected from a group consisting of sawings, wood chips, sawdust, sawmill chips, sawmill shavings, and any combination thereof. The type of wood used for the producing the shooting target is not particularly limited. In one embodiment, the wood for producing the shooting target is selected from a group consisting of softwood, hardwood, and any combination thereof. In one embodiment, the wood for producing the shooting target is softwood. In one embodiment, the wood for producing the shooting target is hardwood. In

one embodiment, the wood for producing the shooting target is selected from a group consisting of pine, poplar, beech, aspen, spruce, birch, mahogany, walnut, oak, ash, maple, cherry, cedar, fir, larch, elm, 5 eucalyptus, willow, basswood, bamboo, palm tree and any combination thereof. The method has the added utility that it is suitable for several types of wood. The wood may be considered as leftover wood from the forest industry. Thus, the raw materials for 10 production of the shooting targets with the method of the current application are inexpensive and easily available.

In one embodiment, the shooting target consists of wood particles and lignin.

15 In the context of this specification, the term "lignin" may refer to lignin originating from any suitable lignin source. Lignin is a complex natural polymer found in the cell walls of plants. Lignocellulosic biomass is typically nonedible plant 20 material, including dedicated crops of wood and grass, and agro-forest residues. Lignocellulosic biomass is mainly composed of cellulose, hemicellulose, and lignin. It should be further noted that the wood particles itself include certain amounts of lignin.

25 In one embodiment, the lignin is essentially pure lignin. By the expression "essentially pure lignin" should be understood as at least 70% pure lignin, or at least 80% pure lignin, or at least 90% pure lignin, or at least 95 % pure lignin, or at least 30 98% pure lignin. In one embodiment, the essentially pure lignin comprises at most 30%, or at most 20%, or at most 10%, or at most 10%, or at most 2 %, of other components and/or impurities.

35 In one embodiment of the present invention the lignin is selected from a group consisting of kraft lignin, steam explosion lignin, biorefinery lignin, supercritical separation lignin, hydrolysis

lignin, biomass originating lignin, lignin from alkaline pulping process, lignin from soda process, lignin from organosolv pulping, lignin from an enzymatic process, and any combinations thereof. In  
5 one embodiment of the present invention, the lignin is wood based lignin. The lignin can originate from softwood, hardwood, annual plants or from any combination thereof.

In one embodiment, the lignin is "kraft  
10 lignin". Kraft lignin may be isolated from black liquor obtained from the kraft pulping process used for wood pulping. The black liquor from the pulping process may comprise components from different softwood and hardwood species in various proportions.  
15 Kraft lignin may, for example, be Lineo™-type lignin.

In one embodiment, the lignin is steam explosion lignin. Steam explosion may be a biomass pretreatment process. In this process, high pressure steam is applied on lignocellulosic material for a  
20 short period of time followed by sudden explosion leading to the fiberization of the biomass. Steam explosion may also refer to a pulping and extraction method which is applicable for wood and other organic material.

In one embodiment, the biorefinery lignin refers to, unless otherwise stated, to lignin recovered from a refining facility or process converting biomass into fuels, chemicals and other materials.  
25

In one embodiment, the supercritical separation lignin refers to lignin which is separated from lignocellulosic material by supercritical fluid extraction. In this process, one component (lignin) is separated from another using supercritical fluids as  
30 the extracting solvent. Carbon dioxide (CO<sub>2</sub>) is the most used supercritical fluid, sometimes modified by co-solvents such as ethanol or methanol.  
35

In one embodiment, the lignin originates from a hydrolysis process. Lignin derived from the hydrolysis process can be recovered from paper-pulp or wood-chemical processes.

5 In one embodiment, the lignin originates from biomass. Lignin differs naturally in content and composition between biomass materials at various levels, e.g., between species, within species and between components (such as wood and bark), and is  
10 influenced by plant growth stage and environmental stress.

In one embodiment, the lignin originates from an alkaline pulping process. This refers to an alkali process where biomass is liquefied with strong alkali  
15 followed by neutralization. Lignin is obtained via precipitation.

In one embodiment, the lignin originates from a soda process, which refers to the traditional chemical pulping method where the fibrous material is  
20 heated in pressurized reactor in the presence of sodium hydroxide. In the process, lignin is separated from the cellulose and suspends into the liquid phase. The liquid phase, black liquor, due to the presence of lignin, is separated from the solid phase containing  
25 liberated cellulose.

In one embodiment, the lignin is from organosolv pulping. Organosolv pulping refers to a pulping technique where organic solvent is used to solubilize lignin and hemicellulose. Organosolv  
30 processes aim to fractionate the lignocellulosic biomass as much as possible into individual major fractions. Organosolv lignin has generally a high purity level.

In the context of this specification, the  
35 term "biodegradable" may refer to material which through a biological process is capable of decomposing into carbon dioxide, water, and biomass.

In one embodiment, the plant-based particles have an average particle size of 0.6 - 1 mm. In one embodiment, the wood particles have an average particle size of 0.6 - 1 mm. The particle size is not particularly limited and may vary depending on the raw material available.

In one embodiment, the moisture content of the shooting target is less than 65 % relative humidity.

In one embodiment, the shooting target comprises at least one additive. The at least one additive may be selected from the group consisting of surfactants, binding agents, organic binders, releasing agents, set-controlling agents, brittleness-promoting agents, stabilizing agents, pigments, colorants, catalysts, lubricants, and any combination thereof.

In one embodiment, the strength of the shooting target is 150 - 300 N. The shooting target may be stored, transported and launched from a trap without breaking. In addition, the shooting target is sufficiently frangible so that it readily breaks into small fragments when hit by a shotgun.

In one embodiment, the shooting target does not contain limestone and/or coal tar. The shooting target has the added utility that it comprises or consists only of components that are not harmful for the environment.

In one embodiment, the shooting target is coated with a protective layer. In one embodiment, the shooting target is painted with an environmentally sustainable paint, such as lime paint. In one embodiment, the shooting target is glazed. In one embodiment, the thickness of the protective layer is at most 1000  $\mu\text{m}$ , or at most 700  $\mu\text{m}$ , or at most 500  $\mu\text{m}$ , or at most 300  $\mu\text{m}$ .

In one embodiment, the shooting target is coloured. In one embodiment, the colour of the shooting target is selected from a group consisting of fluorescent orange, black, white, and yellow. The shooting target may also have other colours.

In one embodiment, the shooting target is a skeet shooting target, trap shooting target, or a sporting clays target.

In one embodiment, the shooting target has the shape of an inverted saucer. It may also have other shapes.

The shooting targets may be released in a combination of singles and/or doubles. The shooting targets may be thrown in a variety of trajectories, angles, speeds, elevations and distances. The composition, shape or other properties of the shooting target do not limit the trajectories, angles, speeds, elevations or distances which may be used to throw the target. They further do not limit the amount of targets that may be thrown at once.

In one embodiment, the type of the shooting target is selected from a group consisting of standard, midi, mini, battue/duck, rabbit/autorabbit/Jackrabbit, rocket, ZZ, and any combination thereof. Depending on the type of the shooting target, the size i.e. the weight, diameter, and height of the shooting target may vary.

Standard targets are most commonly used. Their size may vary depending on whether an American or International competition is at stake.

Midi targets may have a similar profile to the standard but are smaller in size. These targets may be faster than the standard types.

Mini targets may be even smaller than midi targets. They may be suitable for more experienced shooters.

Battue or duck targets may have a flat profile which may cause it to fly fast for a distance and then roll and drop rapidly. They are often thrown so that they initially appear edge on and may then  
5 roll sideways as they fall to the ground.

Rabbit or auto rabbit or Jackrabbit targets may have the same diameter as a standard but as the name implies, it may simulate a running rabbit. The target may be rolled along the ground, bucking and  
10 bouncing as it goes. In order to take this punishment the rabbit target may have a thick rim.

Rocket targets may be heavy, thick-rimmed targets with the same diameter as the standard targets. They tend to slow down in flight less quickly  
15 than the standard targets.

"ZZ" targets are special plastic targets, wherein the center part may have the diameter of a standard target whereas the outer part may be a propeller. When launched from a special trap that both  
20 spins and oscillates, these targets may fly with an inconsistent trajectory. These targets are mainly used in the discipline known as "Helice" but may be used in other target shooting sports as well.

In one embodiment, the size of the shooting target complies with the set international standards.  
25 In one embodiment, the size of the shooting target complies with the standards for the American competitions. In one embodiment, the size of the shooting target complies with the standards for the  
30 International competitions.

In one embodiment, the weight of the shooting target is 20 - 140 g, or 30 - 120 g, or 50 - 110 g, or, 70 - 105 g, or 80 - 100 g. In one embodiment, the weight of the shooting target is 120 g, or 105 g, or  
35 100 g. In one embodiment, the weight of the shooting target is 80 g, or 76 g, or 74 g. In one embodiment, the weight of the shooting target is 35 g, or 32 g.

In one embodiment, the shooting target has an overall diameter of 50 - 120 mm, or 60 - 110 mm, or 90 - 105 mm. In one embodiment, the shooting target has an overall diameter of 110 mm, or 108 mm, or 107 mm.

5 In one embodiment, the shooting target has an overall diameter of 90 mm. In one embodiment, the shooting target has an overall diameter of 60 mm.

In one embodiment, the height of the shooting target is 5 - 30 mm, or 9 - 26, or 14 - 21, or 16 - 20

10 mm. In one embodiment, the height of the shooting target is 29 mm, or 28 mm, 26 mm, or 25 mm, or 23 mm, or 22 mm, or 21 mm, or 20 mm. In one embodiment, the height of the shooting target is 16 mm, or 14 mm, or 9 mm.

15 In one embodiment, the shooting target has a weight of 105 g and an overall diameter of 110 mm and is 25-26 mm in height.

In one embodiment, the shooting target has a weight of 100 g (3.5 oz) and an overall diameter of

20 108 mm (4.3 in) and is 28.0-29.0 mm (1.10-1.14 in) in height.

The present method further relates to a method for producing a shooting target, wherein the method comprises:

25 a) forming a mixture comprising plant-based particles, lignin or a combination thereof in an amount of at least 80 weight-% based on the total weight of the mixture; and

b) pressing the mixture from step a) for

30 moulding the mixture into a shooting target of a pre-determined size and shape, wherein the mixture from step a) is kept at a temperature of 0 - 150 °C during the step of pressing.

In one embodiment, step a) comprises forming

35 a mixture comprising wood particles and lignin in an amount of at least 80 weight-% based on the total weight of the mixture. In one embodiment, step a)

comprises forming a mixture comprising plant-based particles, lignin or a combination thereof in an amount of at least 85 weight-%, or at least 90 weight-%, or at least 95 weight-%, or at least 99 weight-%, based on the total weight of the shooting target. In one embodiment, step a) comprises forming a mixture comprising wood particles and lignin in an amount of at least 80 weight-%, or at least 85 weight-%, or at least 90 weight-%, or at least 95 weight-%, or at least 99 weight-%, based on the total weight of the mixture.

In one embodiment, the pressing in step b) is carried out by using a pressing force of 1 - 100 MPa, or 50 - 90 MPa, or 80 - 85 MPa.

In one embodiment, during step b), the mixture from step a) is kept at a temperature of 5 - 145 °C, or 10 - 140 °C, or 15 - 135 °C, or 20 - 130 °C, or 30 - 120 °C, or 50 - 110 °C, or 60 - 90 °C, or 70 - 80 °C. In one embodiment, the mixture from step a) is heated during step b). In one embodiment, the heating in step b) is carried out at a temperature of 30 - 150 °C, or 40 - 130 °C, or 50 - 120 °C, or 60 - 110 °C, or 70 - 90 °C.

In one embodiment, step b) is continued for 0.5 - 20 minutes, or 1 - 15 minutes, or 3 - 10 minutes, or 4 - 5 minutes. The temperature of the heating may affect the duration of step b). At lower temperatures, a longer time may be needed for step b). On the other hand, at higher temperatures, step b) may need a shorter time. Further, the pressing force may have similar effects to the duration of step b) as the temperature. With a higher pressing force, the step b) may be shorter whereas with a lower pressing force, step b) may need a longer time.

In one embodiment, the method comprises coating the shooting target with a protective layer. In one embodiment, the protective layer is formed by

painting. In one embodiment, the shooting target is painted with lime paint.

In one embodiment, the method comprises drying the shooting target after step b). Drying of the shooting target may be necessary to reduce the moisture content of the shooting target. In one embodiment, the shooting target is stored in an environment, where the moisture content is kept constant in order to reach a desired moisture content for the shooting target.

The present application further relates to the use of the shooting target for clay pigeon shooting or clay target shooting, such as skeet shooting, trap shooting, and/or sporting clays.

Clay pigeon shooting may have at least 20 different forms of regulated competition called disciplines, wherein skeet shooting, trap shooting, and sporting clays are regarded as the main categories. In skeet shooting targets may be thrown in singles and doubles from 2 trap houses situated about 40 meters apart, at opposite ends of a semicircular arc on which there are seven shooting positions. The targets are thrown at set trajectories and speeds. The main disciplines in this group are English skeet, Olympic skeet and American (NSSA) skeet. In trap shooting targets are thrown either as singles or doubles from one or more traps situated some 15 m in front of the shooter, and are generally going away from the firing point at varying speeds, angles and elevations. The most common disciplines in this group are Down-The-Line (DTL) Single Barrel, Double Rise, Automatic Ball Trap (ABT), Olympic Trap, Double Trap, Universal Trench, Helice (or ZZ). Sporting clays is an English Sporting discipline. In this discipline, targets are thrown in a great variety of trajectories, angles, speeds, elevations and distances. The discipline was originally devised to simulate live

quarry shooting, hence some of the names commonly used on sporting stands: springing teal, driven pheasant, bolting rabbit, crossing pigeon, dropping duck, etc. Disciplines in this group include English sporting, international (FITASC) sporting, super sporting sportrap, and Compak sporting.

The shooting target has the added utility of providing an environmentally sound option for the current shooting targets without increasing the costs of the targets. Further, the present method has the added utility of providing a simple and inexpensive manner for the preparation of shooting targets.

#### **EXAMPLES**

Reference will now be made in detail to various embodiments.

The description below discloses some embodiments in such a detail that a person skilled in the art is able to utilize the embodiments based on the disclosure. Not all steps or features of the embodiments are discussed in detail, as many of the steps or features will be obvious for the person skilled in the art based on this specification.

Example 1 - Producing shooting targets

In this example shooting targets were produced in the following manner:

Firstly, a mixture comprising pine wood particles and lignin was formed. The ratio of wood particles to lignin in the mixture was 40/60 based on their weights. The average particle size of the wood particles was 0.6 - 1 mm. The mixture was stored in order to stabilize the relative humidity thereof to a value of 65 %.

Then samples of 100 - 120 g of the mixture were placed in molds having the form of a shooting

target with a predetermined size and shape. Then the same were pressed in the molds by using a pressing force of 10 kN while the samples were simultaneously heated to a temperature of 80 °C. The pressing was continued for 5-7 minutes after which the molds were opened and shooting targets of a predetermined shape and size were formed. The formed shooting targets were then coated with a protective layer of lime paint such that the whole outer surface of the shooting target was covered. When the protective layer had been allowed to dry the shooting targets were packed for transportation.

Following the above described procedure the following shooting targets were produced by varying the above described parameters in the following manners:

Sample number	Ratio of lignin to wood particles (weight-%)	Temperature during the pressing step (°C)
1	20/80	20
2	40/60	20
3	60/40	20
4	80/20	20
5	100/0	20
6	20/80	50
7	40/60	50
8	60/40	50
9	80/20	50
10	100/0	50
11	20/80	80
12	40/60	80
13	60/40	80
14	80/20	80
15	100/0	80

The density of the formed shooting targets were calculated by measuring the sized of the shooting targets with a slide gauge and by weighing the same, after which the masses and volumes were calculated. The volumes were calculated by the formula for calculating the volume of a cylinder, i.e. volume=area\*height ( $V=A*h$ ). Also the maximum strength of the shooting targets were measured by pressing the shooting target until it breaks into pieces. The results are presented in the below table

Mixture number	Density of the shooting target (kg/m <sup>3</sup> )	Maximum strength of the shooting target (N)
1	820	33
2	910	80
3	980	120
4	1050	120
5	1070	83
6	980	85
7	1050	150
8	1060	166
9	1090	135
10	1130	126
11	1040	138
12	1060	184
13	1100	168
14	1140	112
15	1200	25

From the above results, it can be concluded that the formed shooting targets were suitable to be used as shooting targets for e.g. skeet shooting etc.

It is obvious to a person skilled in the art that with the advancement of technology, the basic idea may be implemented in various ways. The embodiments are thus not limited to the examples  
5 described above; instead they may vary within the scope of the claims.

The embodiments described hereinbefore may be used in any combination with each other. Several of the embodiments may be combined together to form a  
10 further embodiment. A product, a method, or a use disclosed herein, may comprise at least one of the embodiments described hereinbefore. It will be understood that the benefits and advantages described above may relate to one embodiment or may relate to several em-  
15 bodiments. The embodiments are not limited to those that solve any or all of the stated problems or those that have any or all of the stated benefits and advantages. It will further be understood that reference to 'an' item refers to one or more of those  
20 items. The term "comprising" or "containing" is used in this specification to mean including the feature(s) or act(s) followed thereafter, without excluding the presence of one or more additional features or acts.

25

**CLAIMS**

1. A shooting target comprising lignin in an amount of at least 80 weight-% based on the total weight of the shooting target, or comprising plant-based particles and lignin in an amount of at least 80 weight-% based on the total weight of the shooting target, wherein the ratio of plant-based particles to lignin is 90-80/10-20, or 80-70/20-30, or 70-60/30-40, or 60-50/40-50, or 50-40/50-60, or 40-30/60-70, or 30-20/70-80, or 20-10/80-90.

2. The shooting target of claim 1, wherein the shooting target comprises plant-based particles, lignin or a combination thereof in an amount of at least 85 weight-%, or at least 90 weight-%, or at least 95 weight-%, or at least 99 weight-%, based on the total weight of the shooting target.

3. The shooting target of any one of the preceding claims, wherein the plant-based particles are wood particles.

4. The shooting target of claim 3, wherein the wood particles are selected from a group consisting of sawings, wood chips, sawdust, sawmill chips, sawmill shavings, and any combination thereof.

5. The shooting target of any one of the preceding claims, wherein the plant-based particles have an average particle size of 0.6 - 1 mm.

6. The shooting target of any one of the preceding claims, wherein the moisture content of the shooting target is less than 65 % relative humidity.

7. The shooting target of any one of the preceding claims, wherein the strength of the shooting target is 150 - 300 N.

8. The shooting target of any one of the preceding claims, wherein the shooting target is biodegradable.

9. The shooting target of any one of the preceding claims, wherein the shooting target does not contain limestone and/or coal tar.

5 10. The shooting target of any one of the preceding claims, wherein the shooting target is coated with a protective layer.

10 11. The shooting target of any one of the preceding claims, wherein the shooting target is a skeet shooting target, trap shooting target, or a sporting clays target.

12. A method for producing a shooting target, wherein the method comprises:

15 a) forming a mixture comprising lignin in an amount of at least 80 weight-% based on the total weight of the mixture or a mixture comprising plant-based particles and lignin in an amount of at least 80 weight-% based on the total weight of the shooting target, wherein the ratio of plant-based particles to lignin is 90-80/10-20, or 80-70/20-30, or 70-60/30-40, 20 or 60-50/40-50, or 50-40/50-60, or 40-30/60-70, or 30-20/70-80, or 20-10/80-90; and

25 b) pressing the mixture from step a) for moulding the mixture into a shooting target of a predetermined size and shape, wherein the mixture from step a) is kept at a temperature of 0 - 150 °C during the step of pressing.

13. The method of claim 12, wherein step b) is continued for 0.5 - 20 minutes, or 1 - 15 minutes, or 3 - 10 minutes, or 4 - 5 minutes.

30 14. The method of any one of claims 12 - 13, wherein the pressing in step b) is carried out by using a pressing force of 1 - 100 MPa, or 50 - 90 MPa, or 80 - 85 MPa.

35 15. The method of any one of the claims 12 - 14, wherein, during step b), the mixture from step a) is kept at a temperature of 5 - 145 °C, or 10 - 140 °C,

or 15 - 135 °C, or 20 - 130 °C, or 30 - 120 °C, or 50 - 110 °C, or 60 - 90 °C, or 70 - 80 °C.

16. The method of any one of the claims 12 - 15, wherein the method comprises coating the shooting target with a protective layer.

17. Use of the shooting target of any one of claims 1 - 11 for clay pigeon shooting or clay target shooting, such as skeet shooting, trap shooting, and/or sporting clays.

10

**PATENTTIVAATIMUKSET**

1. Ammuntakohde, joka käsittää ligniiniä määrän, joka on ainakin 80 paino-% ammuntakohteen kokonaispainoon perustuen, tai joka käsittää kasvipohjaisia partikkeleita ja ligniiniä määrän, joka on ainakin 80 paino-% ammuntakohteen kokonaispainoon perustuen, jolloin kasvipohjaisten partikkelien suhde ligniiniin on 90-80/10-20, tai 80-70/20-30, tai 70-60/30-40, tai 60-50/40-50, tai 50-40/50-60, tai 40-30/60-70, tai 30-20/70-80, tai 20-10/80-90.

2. Patenttivaatimuksen 1 mukainen ammuntakohde, jolloin ammuntakohde käsittää kasvipohjaisia partikkeleita, ligniiniä tai niiden yhdistelmää määrän, joka on ainakin 85 paino-% tai ainakin 90 paino-% tai ainakin 95 paino-% tai ainakin 99 paino-% ammuntakohteen kokonaispainoon perustuen.

3. Jonkin edeltävistä patenttivaatimuksista mukainen ammuntakohde, jossa kasvipohjaiset partikkelit ovat puupartikkeleita.

4. Patenttivaatimuksen 3 mukainen ammuntakohde, jossa puupartikkelit on valittu ryhmästä, johon kuuluvat sahanpuru, puuhake, sahajauho, sahalaitoksen hake, sahalaitoksen lastut ja mikä tahansa näiden yhdistelmä.

5. Jonkin edeltävistä patenttivaatimuksista mukainen ammuntakohde, jossa kasvipohjaisten partikkelien keskimääräinen partikkelikoko on 0,6 - 1 mm.

6. Jonkin edeltävistä patenttivaatimuksista mukainen ammuntakohde, jolloin ammuntakohteen kosteuspitoisuus on alle 65 % suhteellista kosteutta.

7. Jonkin edeltävistä patenttivaatimuksista mukainen ammuntakohde, jolloin ammuntakohteen lujuus on N.

8. Jonkin edeltävistä patenttivaatimuksista mukainen ammuntakohde, jolloin ammuntakohde on biohajoava.

9. Jonkin edeltävistä patenttivaatimuksista mukainen ammutakohde, jolloin ammutakohde ei sisällä kalkkikiveä ja/tai kivihiilitervaa.

5 10. Jonkin edeltävistä patenttivaatimuksista mukainen ammutakohde, jolloin ammutakohde on päällystetty suojakerroksella.

10 11. Jonkin edeltävistä patenttivaatimuksista mukainen ammutakohde, jolloin ammutakohde on skeet-ammuntakohde, trap-ammuntakohde tai sporting clays -ammuntakohde.

12. Menetelmä ammutakohteen tuottamiseksi, jolloin menetelmä käsittää, että

15 a) muodostetaan seos, joka käsittää ligniiniä määrän, joka on ainakin 80 paino-% seoksen kokonaispainoon perustuen, tai seos, joka käsittää kasvipohjaisia partikkeleita ja ligniiniä määrän, joka on ainakin 80 paino-% seoksen kokonaispainoon perustuen, jolloin kasvipohjaisten partikkelien suhde ligniiniin on 90-80/10-20, tai 80-70/20-30, tai 70-60/30-40, tai 20 60-50/40-50, tai 50-40/50-60, tai 40-30/60-70, tai 30-20/70-80, tai 20-10/80-90; ja

25 b) puristetaan vaiheen a) seosta seoksen muo-vaamiseksi ennalta määrätyn kokoiseksi ja muotoiseksi ammutakohteeksi, jolloin vaiheen a) seos pidetään lämpötilassa, joka on 0 - 150 °C, puristusvaiheen aikana.

30 13. Patenttivaatimuksen 12 mukainen menetelmä, jossa vaihetta b) jatketaan 0,5 - 20 minuuttia tai 1 - 15 minuuttia tai 3 - 10 minuuttia tai 4 - 5 minuuttia.

14. Jonkin patenttivaatimuksista 12 - 13 mukainen menetelmä, jossa vaihe b) toteutetaan käyttämällä puristusvoimaa, joka on 1 - 100 MPa tai 50 - 90 MPa tai 80 - 85 MPa.

35 15. Jonkin patenttivaatimuksista 12 - 14 mukainen menetelmä, jossa vaiheen b) aikana vaiheen a) seos pidetään lämpötilassa, joka on 5 - 145 °C tai 10

- 140 °C tai 15 - 135 °C tai 20 - 130 °C tai 30 - 120 °C tai 50 - 110 °C tai 60 - 90 °C tai 70 - 80 °C.

16. Jonkin patenttivaatimuksista 12 - 15 mukainen menetelmä, jolloin menetelmä käsittää am-  
5 muntakohteen päällystämisen suojakerroksella.

17. Jonkin patenttivaatimuksista 1 - 11 mukaisen amuntakohteen käyttö kiekkoammuntaan, kuten skeet-ammuntaan, trap-ammuntaan ja/tai sporting clays -ammuntaan.

10