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(54) **Coffin made from biodegradable material and manufacturing method thereof**

(57) The invention relates to a funerary box made of a biodegradable material comprising poly(lactic acid) and a particulate combustible natural auxiliary material. A funerary box of this type is equally suitable for use in an

interment function and a cremation function. Also described is a method of fabricating a funerary box according to the invention by means of injection moulding.

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Description

[0001] The invention in the first instance relates to a funerary box made of a biodegradable material.

[0002] Biodegradable funerary boxes are known to those skilled in the art. For example, WO 99/17705 discloses a box or urn fabricated from biodegradable plastics based on natural materials. The biodegradable plastics are obtained from renewable raw materials. Poly(lactic acid), in addition to plastics from one or more of the materials maize, wheat, potatoes, vegetable oils, sugar-beet, milk and grain or combinations thereof, is mentioned as an example of such biodegradable plastics, particularly for fabricating a transparent lid of the funerary box. The biodegradability of the material ensures that the funerary box, when used as a coffin, is broken down by micro-organisms into the decomposition products water, carbon dioxide and minerals, which also occur naturally in the environment.

[0003] It has been found, however, that a funerary box fabricated from poly(lactic acid) is less suitable for use in cremations. During combustion, a liquid puddle is formed. As a result, the fire spreads, with the risk that the fire will not sustain itself adequately, resulting in incomplete combustion of the box and the mortal remains. This is undesirable with respect to the furnace and the mourners.

[0004] It has also been found that a funerary box injection-moulded from poly(lactic acid) and a particulate combustible auxiliary material may exhibit discolorations and locally variable mechanical properties.

[0005] It is therefore an objective of the invention to provide a funerary box made of a biodegradable material which is not, or only to a lesser extent, subject to the abovementioned drawbacks, or at least to provide a suitable alternative.

[0006] To this end, the funerary box made of a biodegradable material according to the invention is composed of poly(lactic acid) and a particulate combustible natural auxiliary material. Surprisingly, admixture of the starting material for fabricating the funerary box with a particulate combustible natural auxiliary material, particularly with cellulose-containing material, ensures complete combustion of the funerary box and the mortal remains in the course of cremation, resulting in the formation of a quantity of solid ashes without any liquid components. The natural auxiliary material is likewise biodegradable, so that a funerary box used in an interment function is broken down by micro-organisms. The funerary box according to the invention therefore gives rise to low environmental pollution levels, both in the interment function and in the cremation function. In addition to its suitability in both an interment and a cremation function, a subsidiary advantage of the funerary box according to the invention is its reduced weight relative to traditional funerary boxes fabricated from chipboard with a total weight, including the lid, of about 35 to 40 kg. This allows the weight of the funerary box according to the invention to remain below

the maximum lifting weight for an individual as currently defined in the Dutch Occupational Health & Safety Act (about 27 kg).

[0007] Coating the particulate auxiliary material, prior to fabrication of the funerary box, with a coating that will withstand the temperature reached during injection moulding prevents the occurrence of thermal degradation concomitant with impairment of colour and mechanical strength characteristics of the funerary box. A likely assumption is that, while the starting material is being injection-moulded, when the particulate auxiliary material is not protected, the high process temperatures (about 180°C in the case of PLA), process pressures (ranging from about 4 bar for low pressures up to about 10 bar for high-pressure installations) and frictional forces required for injection moulding give rise to partial combustion of the natural auxiliary material. Coating the premature auxiliary material with a moulding-temperature-resistant coating prevents this thermal degradation. For example, the combustion temperature of wood meal is about 180°C, whereas the starting materials are prepared and processed at the melting temperature of poly(lactic acid) (about 200°C). Applying the moulding-temperature-resistant coating prevents the wood meal from undergoing thermal degradation at this temperature.

[0008] Suitable injection moulding-temperature-resistant materials for coating the particles of the auxiliary material include natural waxes, for example. These materials are biodegradable for the interment function, as well as being capable of combusting at the crematorium furnace temperature (>700°C). It is noted, incidentally, that DE 102 23 392 discloses funerary boxes and urns for which the starting material used for fabrication is a readily decomposable, preferably renewable, i.e. regrowing, material. Examples mentioned include, inter alia, vegetable fibres such as various kinds of straw, and/or animal fibres and/or textile fibres, with the addition of adhesives and binders such as cellulose, starch, gelatine, natural resins, waxes and various types of glue.

[0009] Typically, the funerary box will consist of 2 mouldings, viz. a trough and a lid. Advantageously, both the trough and the lid are nestable. With nestability in mind, the trough can be provided with studs, so that the troughs can be stacked exactly straight.

[0010] Components of or for the funerary box according to the invention, such as legs, handles, closures, hinges and ornaments, are advantageously integrated in the funerary box, as is the attachment system for the inner lining. If such components do not form an integral part of the funerary box, the box can be provided with snap-fit systems to which the various components can readily be attached by means of a snap-fit connection. The lid of the funerary box can comprise a rough section, so that wreaths, flowers and bouquets will not readily slide off the box. The bottom of the box can slant upwards and thus be raised at the head of the mortal remains. As there is the risk of two moulded parts of the funerary box not mating precisely, the product is preferably provided with

a shadow rebate.

[0011] The particulate combustible natural auxiliary material is preferably, as already stated earlier, a cellulose-containing material. Suitable examples comprise wood and flax. Wood meal is a particularly suitable auxiliary material. Wood meal consists of small wood particles formed as various types of wood are machined. With a view to the fabrication method to be described below in more detail, the dimensions of the particles of the auxiliary material are preferably in the range of up to 4 mm.

[0012] Advantageously, the quantity of auxiliary material is in the range of from 5 to 30 wt% of the total weight of the funerary box. If the quantity is less, there is the risk of liquid constituents being formed during incineration of the funerary box, with the concomitant risks as described hereinabove. If the quantity of auxiliary material exceeds 30 wt%, the mechanical properties are undesirably impaired. More preferably, the quantity of auxiliary material is 10-20 wt%, in particular about 15 wt%.

[0013] In the second instance, the invention relates to a method of fabricating a funerary box from a biodegradable material. In the prior art, little is known generally on how biodegradable funerary boxes should be fabricated.

[0014] Another objective of the invention is to provide a suitable method of fabricating, by means of injection moulding, a funerary box from a biodegradable material comprising a polymer, in particular poly(lactic acid), and a particulate combustible natural auxiliary material.

[0015] According to the invention, the method to this end comprises the steps of coating the particulate auxiliary material with a moulding-temperature-resistant coating, of preparing and injection-moulding the biodegradable material.

[0016] The above-described preferred embodiments and preferred measures with respect to the first aspect correspondingly apply to the method according to the invention.

[0017] If desired, one or more biodegradable modifiers can be added. Since the natural auxiliary material such as wood meal renders the poly(lactic acid) more brittle, a toughening aid can be admixed if desired. One example thereof is Ecoflex, an aliphatic copolyester - obtainable from BASF - produced by reacting butanediol, adipic acid and terephthalic acid, which has a positive effect on elongation at break.

[0018] The injection moulding is preferably carried out by means of the cascade technique. Cascade injection moulding is a technique for managing with a low(er) pressure in the mould by making use of a plurality of (sealable) sprues in the mould, a subsequent sprue being activated each time the flow front has passed through. In so doing, it is advantageous to work from the centre towards the edges.

[0019] In a further preferred embodiment of the invention, the preparation step comprises the substeps of blending powdered poly(lactic acid) and a particulate combustible auxiliary material which is coated with a moulding-temperature-resistant coating, and of extrud-

ing the blended composition.

Claims

1. Funerary box made of a biodegradable material comprising poly(lactic acid) and a particulate combustible natural auxiliary material, the auxiliary material being coated with a moulding-temperature-resistant coating.
2. Funerary box according to claim 1, wherein the auxiliary material is a cellulose-containing material.
3. Funerary box according to either one of the preceding claims, wherein the auxiliary material is selected from wood or flax.
4. Funerary box according to any one of the preceding claims, wherein the dimensions of the particles of the auxiliary material are in the range of up to 4 mm.
5. Funerary box according to any one of the preceding claims, wherein the quantity of auxiliary material is in the range of from 5 to 30 wt% of the total weight of the funerary box.
6. Funerary box according to any one of the preceding claims, wherein the biodegradable material comprises a toughness-enhancing agent.
7. Method of fabricating a funerary box from a biodegradable material comprising a polymer, in particular poly(lactic acid), and a particulate combustible natural auxiliary material, said method comprising the steps of coating the particulate auxiliary material with a moulding-temperature-resistant coating, of preparing and injection-moulding the biodegradable material.
8. Method according to claim 7, wherein the injection moulding is cascade injection moulding.
9. Method according to either one of claims 7 and 8, wherein the biodegradable material comprises a toughness-enhancing agent.
10. Method according to any one of the preceding claims 7-9, wherein the preparation comprises the substeps of blending powdered poly(lactic acid) and a particulate combustible auxiliary material which is coated with a moulding-temperature-resistant coating, and of extruding the blended composition.



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 06 07 6934

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
D,A	WO 99/17705 A (OEHMI FORSCHUNG UND INGENIEURTECHNIK GMBH; TRANSFELD, PETER) 15 April 1999 (1999-04-15) * page 3, line 26 - line 33 * -----	1,7	INV. A61G17/00
A,D	DE 102 23 392 A1 (ELARGO ENGINEERING GMBH) 4 December 2003 (2003-12-04) * paragraph [0008] - paragraph [0010] * -----	1,7	
			TECHNICAL FIELDS SEARCHED (IPC)
			A61G
The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 6 February 2007	Examiner Ong, Hong Djien
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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06-02-2007

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
WO 9917705	A	15-04-1999	DE 19744331 A1	15-04-1999
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REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

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- WO 9917705 A [0002]
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