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<p>(21) International Application Number: PCT/CA98/01173</p> <p>(22) International Filing Date: 14 December 1998 (14.12.98)</p> <p>(30) Priority Data: 09/017,497 2 February 1998 (02.02.98) US</p> <p>(71) Applicant: CASCADES MULTI-PRO INC. [CA/CA]; 495 Haggerty, Drummondville, Quebec J2C 3G5 (CA).</p> <p>(72) Inventors: GAUDREAU, Roger; 26, rue Boulet, Kingsey Falls, Québec J0A 1B0 (CA). LABBE, Michel; 60, rue Valière, Victoriaville, Québec G6P 9C7 (CA). BARRETTE, Luc; 4840, rue Brousseau, Drummondville, Québec J2E 1E8 (CA). GAGNE, Steeve; Appartement 16, 56, rue Tardif, Kingsey Falls, Québec J0A 1B0 (CA).</p> <p>(74) Agent: ROBIC; 55, Saint Jacques, Montréal, Québec H2Y 3X2 (CA).</p>	<p>(81) Designated States: AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, UZ, VN, YU, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).</p> <p>Published <i>With international search report.</i></p>	
<p>(54) Title: BIODEGRADABLE AND BIOCOMPATIBLE AGRICULTURAL MULCH AND METHOD OF PREPARING SAME</p>		
<p>(57) Abstract</p> <p>The mulch comprises a sheet of cellulose fibres having a basis weight between about 40 g/m² and 60 g/m². The sheet has at least one face coated with a layer of polylactide, which is used in an amount such that it weighs between about 2 g/m² and 15 g/m². The preparation is carried out by depositing on the sheet an amount of a liquid layer of polylactide such that when it solidifies, it weighs between about 2 g/m² and 15 g/m², and allowing the layer to solidify to adhere to the sheet and constitute the mulch. This mulch has a programmed duration of biodegradation which makes it particularly useful in the agricultural field.</p>		

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BIODEGRADABLE AND BIOCOMPATIBLE AGRICULTURAL MULCH AND METHOD OF PREPARING SAME

BACKGROUND OF THE INVENTION

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a) Field of the Invention

This invention relates to biodegradable and biocompatible agricultural mulch and a method of preparing same. More particularly, the present invention is directed to an agricultural mulch having a programmed duration of biodegradation.

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b) Description of Prior Art

Ever since the start of the present century, numerous attempts have been made to produce an agricultural mulch derived from various fibre mats. From this, it was found that no paper or cardboard would resist for a long time to degradation. This is why all the efforts have been concentrated on the necessity of finding an efficient protection against biodegradation.

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On the other hand, it is well known that polylactide (PLA – polymer derived from 2-hydroxy-propanoic acid) is one of the rare polymers which are considered to be truly biodegradable. Its degradation cycle is based on a process of hydrolysis of the polymer chain. It is decomposed into lactose, water and carbon dioxide, PLA is also completely biocompatible. This means that neither the polymer nor its degradation products, are damaging to the health of living organisms. For this reason, the medical use of PLA (surgery) is well known.

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Recent technological developments in the production of PLA, have made it possible to provide large quantities of PLA at competitive prices. Moreover, during its production, it is possible to modify the polymer chain so as to control its resistance against degradation. However, PLA is a material with poor mechanical properties. Since PLA is too crumbly and too brittle, it cannot be used as a film of PLA which can be mounted by means of a standard mechanical unrolling device. PLA therefore needs a support, however, the later must at least preserve all the desired properties of PLA.

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There is therefore a need for a suitable PLA – support combination which

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provides a good heat insulation, so that during the night it preserves humidity of the ground, and during the day, it permits a progressive but not excessive warming of the ground as it often happens in the case of a mulch of plastic material.

5 OBJECTS AND SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a mulch which enables the temperature of the ground to constantly remain within an optimum growth zone, which significantly advantages the plants at the start of the season.

10 It is another object of the present invention to provide a mulch which offers excellent thermal insulation to young seeds at the start of the season, while completely preventing the growth of weeds, which cannot grow through the mulch.

It is another object of the present invention to provide a mulch which makes it possible to dispense with the use of dangerous products by fumigation, such as methyl
15 isothiocyanate, chlorinated hydrocarbons, and the like.

It is still another object of the present invention to provide a mulch which will remain in place until complete biodegradation.

It is still another object of the present invention to provide a method of preparing a mulch which overcomes all the disadvantages of those described in the prior art.

20 These and other objects of the present invention are achieved by providing a biodegradable and biocompatible agricultural mulch comprising a sheet of cellulose fibres, preferably a sheet of paper, having a basic weight between about 40 g/m² and 60 g/m². The sheet has at least one face coated with a layer of polylactide. The layer is used in an amount such that it weighs between about 2 g/m² and 15 g/m².

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DETAILED DESCRIPTION OF THE INVENTION

In practice, the sheet is preferably a sheet of paper made of recycled cellulose fibres. Its thickness may vary between 2 points and 4 points. Normally, one face
30 opposite the layer of PLA is coated with biological additives, such as 10-6-0, 0-20-0, 0-0-22 and mixtures thereof.

The layer of polylactide preferably comprises a light reflecting agent, which may be a coloring, and which may be used in amounts from about 3 to 8 weight percent of PLA. The preferred light reflecting agent comprises carbon black, although any other light reflecting agent could be used depending on the amount of light that is intended to be reflected.

The biodegradable and biocompatible agricultural mulch according to the invention may be prepared by :

providing a sheet of cellulose fibres having a basis weight between about 40 g/m² and 60 g/m²,

depositing on the sheet an amount of a liquid layer of polylactide such that when the layer has solidified, it weighs between about 2 g/m² and 15 g/m², and

allowing the layer of PLA to solidify to adhere to the sheet and to constitute the mulch therewith.

Depositing of the PLA layer onto the sheet is normally carried out by hot extrusion of PLA to produce a liquid and placing a layer of the liquid onto the sheet, which is normally a sheet of paper, preferably recycled paper.

Since it is possible to modify the polymer chain of PLA, it is possible to adjust its resistance to biodegradation, and therefore its life duration, which contributes to make it a privileged material for the production of an agricultural mulch. It will indeed be realized that it is then possible to optimize the protection of young growth as a function of the needs of different varieties of vegetables and trees.

One will find that PLA is a perfect addition to a mat of cellulose fibres. This combination produces a mulch which meets the requirements of modern agricultural production : sufficient useful life to last during an entire seasonal growth, and mechanized installation. At the start of the season, the fibre mat offers excellent thermal insulation to young seeds while completely preventing the growth of weeds, which cannot grow through the mulch according to the invention as is the case with a mulch of plastic material.

Once in place, and after the paper support has been biodegraded, the PLA film need no support and will remain in place until it has been completely biodegraded. At the end of the season, no particular disposition will be required. A simple plowing will

be sufficient to incorporate the remaining PLA into the soil. Since biodegradation has converted PLA into a material which is even more brittle, it will offer no resistance to the mechanical working of the soil. Moreover, the natural fertilizing properties of lactose, which is a residue resulting from biodegradation of PLA, are added to the soil.

5 PLA is a material which is naturally transparent. It is therefore possible to color it as desired : white to limit heat transmission or with any other color which would optimize the yields of the plants.

 Of course, the invention is not limited to the method of preparation described above, and any other method which is well known to those skilled in the art falls within
10 the scope and spirit of the present invention.

CLAIMS

1. A biodegradable and biocompatible agricultural mulch comprising :
5 a sheet of cellulose fibres having a basis weight between about 40 g/m² and 60
m/g²,
said sheet having at least one face coated with a layer of polylactide, said layer
being used in an amount such that said layer weights between about 2 g/m² and 15 g/m².
- 10 2. A biodegradable and biocompatible agricultural mulch according to claim 1,
wherein said sheet comprises a paper.
3. A biodegradable and biocompatible agricultural mulch according to claim 2,
wherein said paper has a thickness between 2 and 4 points.
- 15 4. A biodegradable and biocompatible agricultural mulch according to claim 2
or 3 wherein said paper is made of recycled cellulose fibres.
5. A biodegradable and biocompatible agricultural mulch according to any one
20 of claims 1 to 4 having one face opposite said layer coated with biological additives.
6. A biodegradable and biocompatible agricultural mulch according to claim 5,
wherein said biological additives are selected from the group consisting of 10-6-0, 0-20-
0, 0-0-22 and mixtures thereof.
- 25 7. A biodegradable and biocompatible agricultural mulch according to any one
of claims 1 to 6 wherein said layer of polylactide comprises a light reflecting agent.
8. A biodegradable and biocompatible agricultural mulch according to claim 7,
30 wherein said light reflecting agent consists of a coloring agent.

9. A biodegradable and biocompatible agricultural mulch according to claim 8, which comprises about 3 to 8 weight percent light reflecting agent.

10. A biodegradable and biocompatible agricultural mulch according to claim 5 9 wherein said light reflecting agent comprises carbon black.

11. A method for preparing a biodegradable and biocompatible agricultural mulch which comprises :

10 providing a sheet of cellulose fibres having a basis weight between about 40 g/m² and 60 g/m²,

depositing on said sheet an amount of a liquid layer of polylactide such that when said layer solidifies, it weighs between about 2 g/m² and 15 g/m², and

allowing said layer to solidify to adhere to said sheet and constitute said mulch.

15 12. A method according to claim 11, wherein said polylactide is extruded onto said sheet.

INTERNATIONAL SEARCH REPORT

Int'l Application No
PCT/CA 98/01173

A. CLASSIFICATION OF SUBJECT MATTER
 IPC 6 C08G63/08 C09D167/04 B32B29/06 D21H19/28 D21H19/80
 B65D65/46

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
 Minimum documentation searched (classification system followed by classification symbols)
 IPC 6 C08G C09D B32B B65D D21H

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 458 933 A (SUSKIND STUART P) 17 October 1995 see column 1, line 48-49 - column 6, line 51-59; claims 11-13,19; figures 1,4,6,9-12	1, 2, 11, 12
X	see column 7, line 5-15-25; examples ---	5
X	EP 0 514 137 A (MITSUI TOATSU CHEMICALS) 19 November 1992	1, 2
Y	see claim 1; examples 7-12 ---	4, 11
X	US 5 446 123 A (EICHEN CONN ROBIN S ET AL) 29 August 1995 see the whole document ---	1, 2, 7, 8, 11, 12
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Further documents are listed in the continuation of box C.

Patent family members are listed in annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
23 April 1999	06/05/1999

Name and mailing address of the ISA European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax: (+31-70) 340-3016	Authorized officer Derz, T
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C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	DATABASE WPI Section Ch, Week 9722 Derwent Publications Ltd., London, GB; Class A82, AN 97-242366 XP002100987 & JP 09 078494 A (MITSUI TOATSU CHEM INC) , 25 March 1997 see abstract	1,2
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