Notice

DESCRIPTION CN115010816A

A starch extraction device and method for duckweed

一种浮萍淀粉提取设备及提取方法

[0001]

Technical Field

技术领域

[n0001]

This invention relates to the field of duckweed starch extraction, and in particular to a duckweed starch extraction device and a duckweed starch extraction method.

本发明涉及浮萍淀粉提取领域，特别是一种浮萍淀粉提取设备及浮萍淀粉提取方法。

[0003]

Background Technology

背景技术

[n0002]

Duckweed is an aquatic plant and the world's smallest monocotyledonous flowering plant. It has the characteristics of rapid growth and efficient starch accumulation. Moreover, it can efficiently absorb elements such as nitrogen, phosphorus, and cadmium from wastewater. Furthermore, it does not compete with humans for food or land, making it one of the most promising strategic energy plants for future biofuel development.

浮萍是一种水生植物，是世界上最小的单子叶开花植物，具有快速生长和高效积累淀粉的特性，而且可以高效吸收污水中的氮、磷及镉等元素，且不与人争粮、不与粮争地，是一种未来生物燃料最具有发展潜力的战略性能源植物之一。

Jay J Cheng reported that the annual yield of duckweed starch can reach 28 t/hm², while the annual yield of corn starch is only 5 t/hm².

Jay J Cheng报道浮萍淀粉年产量可达28t/hm²，而玉米淀粉年产量仅为5t/hm²。

G. Oron et al. reported that the growth rate of duckweed reached 0.1-0.35 g (dry weight)/g (dry weight) d, with an annual yield as high as 55 t/hm² (dry weight), while that of maize was only 4.9 t/hm².

G.Oron等报道浮萍生长速率达到0.1-0.35g(干重)/g(干重)d，年产量高达55t/hm²(干重)，而玉米仅为4.9t/hm²。

Most of the starch granules of duckweed are distributed between 1-5μm, which are small starch granules. Due to their small size and narrow molecular size range, small starch granules play a special role in the production of biodegradable materials, fat substitutes, carrier materials, and cosmetics. However, there are currently no reports on the large-scale extraction of duckweed starch. The available methods for extracting duckweed starch are

quite numerous and complex, making them unsuitable for large-scale extraction, which hinders the industrial application of duckweed starch.

浮萍淀粉颗粒大部分分布在1-5μm之间，属于小颗粒淀粉，由于小颗粒淀粉具有颗粒细小、分子大小范围窄等特点，在制作生物降解材料、脂肪替代物、载体材料、化妆品中有着特殊的作用。 但是目前关于浮萍淀粉的规模化提取方面还未见相关报道，可查询到的浮萍淀粉提取方法，步骤也较为繁多、复杂，不适合大规模提取，致使浮萍淀粉的产业化应用受到一定阻碍。

[0005]

Summary of the Invention

发明内容

[n0003]

This invention addresses the aforementioned deficiencies in current duckweed starch extraction equipment and methods by proposing a duckweed starch extraction device and method. It utilizes the high-speed rotation of a rotary crusher to break down the cell walls of duckweed cells, allowing for the full release of starch within the duckweed. This achieves a simple and efficient extraction of starch from duckweed, providing a method that is simple, easy to operate, and low in cost.

本发明针对目前浮萍淀粉提取设备及方法中存在的上述缺陷，提出了一种浮萍淀粉提取设备及浮萍淀粉提取方法，其利用旋转破碎刀的高速旋转，将浮萍细胞的细胞壁破碎，使浮萍内的淀粉充分释放，实现了简单、高效地从浮萍中提取淀粉，提供方法简单，操作方便，成本低。

[n0004]

The technical solution of the present invention is: a duckweed starch extraction device, comprising a box and a crushing mechanism, wherein the crushing mechanism is fixed on the upper surface of the box;

本发明的技术方案是：一种浮萍淀粉提取设备，其中，包括箱体和破碎机构，破碎机构固定在箱体的上表面；

[n0005]

The crushing mechanism includes an outer wall and a bottom wall. The outer wall is fixed to the bottom wall, and the bottom wall is fixed to the housing. Several baffles are fixed at intervals along the annular inner surface of the outer wall. The baffles divide the annular cavity inside the outer wall into several crushing chambers. A rotating crushing blade is

provided on the bottom wall corresponding to each crushing chamber. The rotating crushing blade is connected to the output shaft of the motor, and the motor is installed inside the housing.

所述破碎机构包括外壁和底壁，外壁固定在底壁上，底壁固定在箱体上，沿外壁的环形内表面间隔固定有数个挡板，挡板将外壁内的环形腔体分为数个破碎腔，与每个破碎腔对应的底壁上设有旋转破碎刀，旋转破碎刀与电机的输出轴连接，电机设置在箱体内。

[n0006]

The crushing mechanism is equipped with a rotating crushing blade in the middle.

所述破碎机构的中部设有旋转破碎刀。

[n0007]

The crushing mechanism may further include an inner wall, which is fixed to the bottom wall and disposed inside the outer wall. There is an annular gap between the outer wall and the inner wall. Several outer wall baffles are fixed at intervals along the annular inner surface of the outer wall and several inner wall baffles are fixed at intervals along the annular outer

surface of the inner wall. The outer wall baffles divide the annular cavity between the outer wall and the inner wall into several crushing chambers. Rotary crushing blades are respectively provided on the bottom wall corresponding to each crushing chamber.

所述破碎机构还可以包括内壁，内壁固定在底壁上，内壁设置在外壁内侧，外壁和内壁之间存在环形的间隙，沿外壁的环形内表面间隔固定有数个外壁挡板，沿内壁的环形外表面间隔固定有数个内壁挡板，外壁挡板将外壁和内壁之间的环形腔体分为数个破碎腔，与每个破碎腔对应的底壁上分别设有旋转破碎刀。

In this application, the outer wall baffle and the inner wall baffle can be arranged in a corresponding manner or in an alternating manner.

本申请中，外壁挡板和内壁挡板之间可以呈对应设置，也可以呈交错设置。

[n0008]

In this invention, the bottom of the box is provided with a support base.

本发明，所述箱体的底部设有支撑座。

The support base provides support for the box.

支撑座对箱体起到了支撑作用。

[n0009]

The enclosure includes a front door, a rear door, and side walls, all of which are connected to each other via hinges.

所述箱体包括前开门、后开门和侧壁，前开门、后开门与侧壁之间均通过合页连接。

[n0010]

It also includes a top cover with several entrances and an exit at the bottom of the outer wall.

还包括顶盖，顶盖上设有数个入口，外壁的底部设有出口。

[n0011]

The bottom wall can also be an integral part of the box body.

所述底壁也可以与箱体呈一体式结构。

[n0012]

This invention also includes a method for extracting starch from duckweed using the aforementioned duckweed starch extraction equipment, comprising the following steps:

本发明还包括一种利用上述浮萍淀粉提取设备实现浮萍淀粉提取的方法，包括以下步骤：

[n0013]

(1) Use a duckweed starch extraction device to break up the duckweed in the solution: during the breaking up process, the device works for 2 minutes, then stops for 4 minutes, and repeats this process several times.

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(1)利用浮萍淀粉提取设备将溶液中的浮萍破碎：破碎过程中，设备工作2分钟后，停止4分钟，并重复数次；

[n0014]

(2) The crushed solution is discharged from the outlet, filtered through a 200-mesh sieve, and the filtrate is collected.

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(2)将经过破碎处理的溶液从出口处排出，采用200目筛网对溶液进行过滤，并对滤液进行收集；

[n0015]

(3) Place the filtered solution into a container and let it stand at room temperature for precipitation. The precipitation time should be at least 2 hours. The substance that settles at the bottom of the container after standing is starch. Therefore, the starch can be directly removed from the bottom of the solution.

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(3)将过滤后的溶液放入容器中，在常温下进行静置沉淀，沉淀时间至少为2小时，静置后沉淀于容器底部的物质即为淀粉，因此在溶液的底部可以直接将淀粉取出。

The sedimentation container is preferably a conical barrel with an inverted triangular bottom.

所述沉淀容器优选为底部呈倒三角形的锥形桶。

[n0016]

The beneficial effects of this invention are:

本发明的有益效果是：

[n0017]

(1) By setting up baffles, the rotating crusher blades drive the duckweed slurry to rotate at high speed, which plays a role in turbulence of the rotating duckweed slurry and is conducive to the crushing of duckweed by the rotating crusher blades.

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(1)通过设置挡板，在旋转破碎刀带动浮萍浆液高速旋转的过程中，对旋转的浮萍浆液起到了扰流的作用，有利于旋转破碎刀对浮萍的破碎；

[n0018]

(2) By using baffles, multiple crushing chambers are formed inside the equipment. Rotary crushing blades are set in each crushing chamber respectively, which can increase the effective working volume of the entire crushing chamber and improve the crushing effect on duckweed; (3) By using the high-speed rotation of the rotary crushing blades, the cell walls of duckweed are broken, and its starch is fully released, realizing the simple and efficient extraction of starch from duckweed. The method is simple, easy to operate, and low in cost.

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(2)通过挡板，使设备内形成多个破碎腔，对应的在各破碎腔内分别设置旋转破碎刀，可以增大整个破碎腔体的有效工作体积，提高了对浮萍的破碎效果；(3)利用旋转破碎刀的高速旋转，将浮萍的细胞壁破碎，使其淀粉充分释放，实现了简单、高效地从浮萍中提取淀粉，提供方法简单，操作方便，成本低。

[0022]

Attached Figure Description

附图说明

[n0019]

Figure 1 is a front view of the duckweed starch extraction equipment;

图1是浮萍淀粉提取设备的主视图；

[n0020]

Figure 2 is a top view of the duckweed starch extraction equipment;

图2是浮萍淀粉提取设备的俯视图；

[n0021]

Figure 3 is a structural schematic diagram of the box;

图3是箱体的结构示意图；

[n0022]

Figure 4 is a flowchart of the method for extracting starch from duckweed.

图4是浮萍淀粉提取方法的流程图。

[n0023]

In the diagram: 1 Top cover; 2 Outer wall; 3 Outer wall baffle; 4 Support base; 5 Box body; 6 Crushing chamber; 7 Inner wall baffle; 8 Inner wall; 9 Rotary crusher blade; 10 Hinge; 11 Front door; 12 Feed port.

图中：1顶盖；2外壁；3外壁挡板；4支撑座；5箱体；6破碎腔；7内壁挡板；8内壁；9旋转破碎刀；10合页；11前开门；12上料口。

[0028]

Detailed Implementation

具体实施方式

[n0024]

To make the above-mentioned objects, features and advantages of the present invention more apparent and understandable, the specific embodiments of the present invention will be described in detail below with reference to the accompanying drawings.

为了使本发明的上述目的、特征和优点能够更加明显易懂，下面结合附图对本发明的具体实施方式做详细的说明。

[n0025]

Specific details are set forth in the following description in order to provide a full understanding of the invention.

在以下描述中阐述了具体细节以便于充分理解本发明。

However, the present invention can be implemented in many other ways different from those described herein, and those skilled in the art can make similar extensions without departing from the spirit of the invention.

但是本发明能够以多种不同于在此描述的其它方式来实施，本领域技术人员可以在不违背本发明内涵的情况下做类似推广。

Therefore, this invention is not limited to the specific embodiments disclosed below.

因此本发明不受下面公开的具体实施方式的限制。

[n0026]

Example 1

实施例1

[n0027]

As shown in Figures 1 to 3, the duckweed starch extraction device of the present invention includes a box body 5 and a crushing mechanism. The crushing mechanism is fixed on the upper surface of the box body 5, and a support seat 4 is provided at the bottom of the box body 5. The support seat 4 provides support and buffer for the box body 5.

如图1至图3所示，本发明所述的浮萍淀粉提取设备包括箱体5和破碎机构，破碎机构固定在箱体5的上表面，箱体5的底部设有支撑座4，支撑座4对箱体5起到了支撑和缓冲作用。

[n0028]

The enclosure 5 includes a front door 11, a rear door, and a side wall. The front door 11, the rear door, and the side wall are all connected by hinges 10. Equipment such as motors can be placed inside the enclosure 5.

箱体5包括前开门11、后开门和侧壁，前开门11、后开门与侧壁之间均通过合页10连接，电机等设备可以放置在箱体5内。

[n0029]

The crushing mechanism includes a top cover 1, an outer wall 2, an inner wall 8, and a bottom wall. The outer wall 2 and the inner wall 8 are fixed to the bottom wall, and the bottom wall is fixed to the box body 5. The bottom wall can also be an integral structure with the box body 5.

破碎机构包括顶盖1、外壁2、内壁8和底壁，外壁2和内壁8固定在底壁上，底壁固定在箱体5上，底壁也可以与箱体5呈一体式结构。

The inner wall 8 is located inside the outer wall 2. The outer wall 2 and the inner wall 8 are annular. The inner wall 8 is located inside the outer wall 2. There is an annular gap between the outer wall 2 and the inner wall 8.

内壁8设置在外壁2内，外壁2和内壁8呈环形，内壁8设置在外壁2内侧，外壁2和内壁8之间存在环形的间隙。

Several outer wall baffles 3 are fixed at intervals along the annular inner surface of the outer wall 2, and the outer wall baffles 3 divide the annular cavity between the outer wall 2 and the inner wall 8 into several crushing chambers 6.

沿外壁2的环形内表面间隔固定有数个外壁挡板3，外壁挡板3将外壁2和内壁8之间的环形腔体分为数个破碎腔6。

A rotating crusher 9 is provided on the bottom wall corresponding to each crushing chamber 6. The rotating crusher 9 is connected to the output shaft of the motor. The rotation of the motor drives the rotating crusher 9 to rotate at high speed. The motor is located inside the housing 5.

与每个破碎腔6对应的底壁上设有旋转破碎刀9，旋转破碎刀9与电机的输出轴连接，电机转动带动旋转破碎刀9高速旋转，电机设置在箱体5内。

Several inner wall baffles 7 are fixed at intervals along the annular outer surface of the inner wall 8. The outer wall baffles 3 and the inner wall baffles 7 can be arranged in a corresponding manner or in an alternating manner.

沿内壁8的环形外表面间隔固定有数个内壁挡板7，外壁挡板3和内壁挡板7之间可以呈对应设置，也可以呈交错设置。

In this embodiment, the outer wall baffle 3 and the inner wall baffle 7 are arranged in a corresponding manner, and the outer wall baffle 3 and the inner wall baffle 7 simultaneously serve to divide the annular cavity between the outer wall 2 and the inner wall 8.

本实施例中，外壁挡板3和内壁挡板7之间呈对应设置，外壁挡板3和内壁挡板7同时对外壁2和内壁8之间的环形腔体起到了分割的作用。

When the rotating blade 9 drives the solution containing duckweed to rotate, the outer wall baffle 3 and the inner wall baffle 7 also play a role in turbulence, which is more conducive to breaking the duckweed.

当旋转破碎刀9带动含有浮萍的溶液旋转时，外壁挡板3和内壁挡板7还起到了扰流的作用，更有利于将浮萍破碎。

The top cover 1 is provided with several inlets 12, through which the solution containing duckweed enters each crushing chamber 6.

顶盖1上设有数个入口12，含有浮萍的溶液通过入口12进入各破碎腔6内。

The bottom of the outer wall 2 is provided with an outlet, from which the solution after crushing flows out.

外壁2的底部设有出口，经破碎处理后的溶液从出口处流出。

[n0030]

When the starch extraction equipment is working, a solution containing duckweed is injected into the crushing chamber 6 through inlet 12. The motor is started, and the motor drives the rotating crushing blade 9 to rotate at high speed. During the high-speed rotation of the rotating crushing blade 9, the solution circulates at high speed in the crushing chamber 6 under the obstruction of two outer wall baffles and two inner wall baffles. This causes the rotating crushing blade 9 to continuously act on the duckweed in the solution, breaking the cell walls of the duckweed and releasing the starch in the duckweed directly into the solution.

该淀粉提取设备在工作时，将含有浮萍的溶液通过入口12注入破碎腔6内，启动电机，电机带动旋转破碎刀9高速旋转，旋转破碎刀9高速旋转过程中，在两个外壁挡板和两个内壁挡板的阻挡作用下，溶液在破碎腔6内高速循环旋转，使旋转破碎刀9不断的作用于溶液中的浮萍，将溶液中的浮萍的细胞壁破碎，使浮萍中的淀粉直接释放至溶液中。

[n0031]

The present invention also includes a method for extracting starch from duckweed using the above-mentioned duckweed starch extraction equipment, as shown in Figure 4. The method includes the following steps:

本发明还包括一种利用上述浮萍淀粉提取设备实现浮萍淀粉提取的方法，如图4所示，该方法包括以下步骤：

[n0032]

The first step is to use the aforementioned equipment to break up the duckweed in the solution.

第一步，利用上述设备将溶液中的浮萍破碎。

[n0033]

First, duckweed is added through inlet 12 along with an appropriate amount of clean water. Then, the motor in the device is activated, causing the rotating crusher 9 to rotate at high speed. During the high-speed rotation of the rotating crusher 9, the cell walls of the duckweed are broken, and the starch in the cells is released into the solution.

首先，通过入口12加入浮萍，同时加入适量清水，然后，设备中的电机动作，使旋转破碎刀9高速旋转，旋转破碎刀9高速旋转过程中，将浮萍的细胞壁破碎，细胞中的淀粉释放至溶液中。

In the crushing procedure, the equipment operates for 2 minutes, then stops for 4 minutes, and this process is repeated several times.

破碎规程中，设备工作2分钟后，停止4分钟，并重复上述动作数次。

The purpose is to prevent the starch from undergoing thermal denaturation due to high-speed rotation and heat generation.

其目的是防止高速旋转发热，导致淀粉产生热变性。

In practice, duckweed has a higher starch content in the afternoon, so it is preferred to use duckweed in the afternoon for starch extraction.

实际操作过程中，下午的浮萍淀粉含量较高，因此优先选用下午的浮萍提取淀粉。

[n0034]

The second step is to discharge the crushed duckweed slurry from the outlet, filter the slurry through a 200-mesh sieve, and collect the filtrate.

第二步，将经过破碎处理的浮萍浆液从出口处排出，采用200目筛网对浆液进行过滤，并收集滤液。

[n0035]

The third step is to put the filtered slurry into a container and let it stand at room temperature for sedimentation. The sedimentation time is at least 2 hours. In this embodiment, the preferred sedimentation time is 5 hours. The substance that settles at the bottom of the container after standing is starch. Therefore, the starch can be directly removed from the bottom of the solution.

第三步，将过滤后的浆液放入容器中，在常温下进行静置沉淀，沉淀时间至少为2小时，本实施例中，优选的沉淀时间为5小时，静置后沉淀在容器底部的物质即为淀粉，因此在溶液的底部可以直接将淀粉取出。

In this embodiment, the sedimentation container is preferably a conical barrel with an inverted triangular bottom.

本实施例中，沉淀容器优选为底部呈倒三角形的锥形桶。

[n0036]

Example 2

实施例2

[n0037]

Unlike Embodiment 1, in this embodiment, the inner side of the outer wall 2 is not provided with an inner wall. At this time, the outer wall 2 is fixed to the bottom wall, and the bottom wall is fixed to the box body 5. Several baffles are fixed at intervals along the annular inner surface of the outer wall 2. The baffles divide the annular cavity inside the outer wall into several crushing chambers 6. A rotating crushing blade 9 is provided on the bottom wall corresponding to each crushing chamber 6. The rotating crushing blade 9 is connected to the output shaft of the motor.

与实施例1不同的是，本实施例中，外壁2的内侧没有设置内壁，此时外壁2固定在底壁上，底壁固定在箱体5上，沿外壁2的环形内表面间隔固定有数个挡板，挡板将外壁内的环形腔体分为数个破碎腔6，与每个破碎腔6对应的底壁上分别设有旋转破碎刀9，旋转破碎刀9与电机的输出轴连接。

Meanwhile, a rotating crusher 9 is also provided in the middle of the crushing mechanism, that is, at the center of the bottom wall.

同时，破碎机构的中部即底壁的中心位置处也设有旋转破碎刀9。

[n0038]

Everything else is the same as in Example 1.

其他同实施例1。

[n0039]

The above provides a detailed description of the duckweed starch extraction equipment and method provided by this invention.

以上对本发明所提供的浮萍淀粉提取设备及浮萍淀粉提取方法进行了详细介绍。

This article uses specific examples to illustrate the principles and implementation methods of the present invention. The above description of the embodiments is only for the purpose of helping to understand the method and core ideas of the present invention.

本文中应用了具体个例对本发明的原理及实施方式进行了阐述，以上实施例的说明只是用于帮助理解本发明的方法及其核心思想。

It should be noted that those skilled in the art can make various improvements and modifications to this invention without departing from its principles, and these improvements and modifications also fall within the scope of protection of the claims of this invention.

应当指出，对于本技术领域的普通技术人员来说，在不脱离本发明原理的前提下，还可以对本发明进行若干改进和修饰，这些改进和修饰也落入本发明权利要求的保护范围内。

The above description of the disclosed embodiments enables those skilled in the art to implement or use the present invention.

对所公开的实施例的上述说明，使本领域专业技术人员能够实现或使用本发明。

Various modifications to these embodiments will be readily apparent to those skilled in the art, and the general principles defined herein may be implemented in other embodiments without departing from the spirit or scope of the invention.

对这些实施例的多种修改对本领域的专业技术人员来说将是显而易见的，本文中所定义的一般原理可以在不脱离本发明的精神或范围的情况下，在其它实施例中实现。

Therefore, the present invention is not to be limited to the embodiments shown herein, but is to be accorded the widest scope consistent with the principles and novel features disclosed herein.

因此，本发明将不会被限制于本文所示的这些实施例，而是要符合与本文所公开的原理和新颖特点相一致的最宽的范围。