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**APPLICATION
FOR
SINGAPORE LETTERS PATENT**

TITLE

**AN IMPROVED PROCESS FOR MAKING ARTICLES USEFUL FOR
VARIETY OF PURPOSES PARTICULARLY FOR SERVING AND/OR
HOLDING FOOD PRODUCTS, SAID ARTICLES AND A DEVICE FOR
MAKING SUCH ARTICLES.**

APPLICANTS

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The invention relates to a process for the preparation of articles useful for variety of purposes, particularly for serving/storing food products and a device for making such articles. This invention particularly relates to an improved process for the preparation of articles such as cups, saucers, plates etc. for serving or holding food products. The articles can be made from biodegradable materials such as the parts of the plant like leaves/sheaths.

Traditionally parts of the plant residues such as leaves, areca palm sheaths have been used in India after converting them into different shapes such as plates, cups, saucers etc for serving and / or holding foods products, cups and saucers of this nature are also traditionally used for vending of butter and semi-solid materials. These articles are hitherto prepared by various methods. A few of the very commonly used methods are explained below.

Leaves such as that of Butea or Bauhunia plant are washed and softened. Two or more of the leaves are stitched together at the edges, using small sharp pins made of twigs, steam or coconut ribs as pins into desired shapes. The stitched plates are then dried in shade and are then used for desired purposes. For making small cups the leaves of Butea, Bauhania or any other leaves such as Banana or sheath of areca palm, are washed, softened and folded at the desired shape, the folding providing the depression or cup shape, and the folds fixed by stitching using pins made of plant

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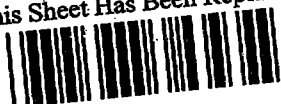


twigs or coconut leaf ribs. The folded stitched cup dried to retain the shape and rigidity.

The articles made from leaves and sheaths according to the methods explained above have enjoyed the advantage of being biodegradable and eco-friendly. However, such articles have the disadvantage of being held together with plant stem pins, stitching, leaves, crevices leading to harboring of micro organisms, due to conditions under which they are prepared, poor physical strength and irregular diamensions flexible nature of the articles resulting in spilling of the products and lack of elegance. These disadvantages have restricted their usage and made them unable to withstand competition from plastic and paper cups and plates.

Presently cups, saucers and plates made from plastics and paper are widely used for serving food as well as carry packs for food articles. Such cups, saucers and plates are not biodegradable and hence not ecofriendly. The cups, saucers and plates made from paper are made using additive and other ingredients including recycled paper, employing undesirable ingredients such as printing inks, colourants which can pose health hazard to the consumers of food served in such containers. Although, the paper material is biodegradable the additives and chemicals used in these products are not always biodegradable or eco friendly. Also, the forest wealth on which the production of paper is dependent is not infinite and progressively getting depleted.

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Also, some of the ingredients and additives used in the process of their manufacture are suspected to migrate or leach or impart flavour into the food product which is not desirable. These containers are also not easily disposable and hence create pollution and littering of environment, as they cannot be incinerated as burning fumes coming therefrom pollute the atmosphere. Also, the plastics being petroleum based products the resources are limited and not renewable. Further these are also very costly.

However, the usage of plates, saucers and cups of disposable nature are fast increasing in view of the convenience, the spread of habit of eating out, fast service and carry home packs of food.

Currently due to the change in the food habits and the demand for fast food the need for the making of articles made from abundantly available biodegradable materials are steadily increasing.

The main objective of the present invention is, therefore, to provide an improved process for making articles from biodegradable materials such as leaves/sheaths of plant, which can be used for serving/holding food. Therefore, it would be appropriate to develop a process for making articles utilising the biodegradable waste materials. Such an use of the waste materials will also add value to the otherwise not useful materials which may also create environmental pollution problems.

Another objective is to provide an improved process for making

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articles such as cups, bowls, saucers, plates for serving or holding food products which are hygienic and ecofriendly.

Yet another objective of the present invention is to provide an improved process for making article having good physical strength.

Still another objective of the present invention is to provide a process for the preparation of articles such as saucers, cups and plates which do not need stitching together using plant pins.

Another objective of the presnt invention is to provide an device for making articles employing the process of the present invention.

The present invention is based on our finding that articles which are biodegradable and eco-friendly such as plant materials such as leaves and leaf sheaths can be achieved by trimming the parts of the plant such as leaves/sheaths after cleaning with water to remove any extraneous matters and subjecting it to pressure and heat simultaneously and then further sterilizing by subjecting to irradiation. The simultaneous application of pressure and heat may be effected by placing biodegradable materials on a die of the shape of the article desired, the die having electrical connection to provide heat during the application of pressure for simultaneous action. The irradiation may be affected ensuring UV and/or radiation.

We have observed that when the biodegradable materials such as

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parts of the plant like leaves, sheaths are moulded by simultaneous application of pressure and heat for a very short period of time followed by immediate sterilisation of the resulting article by exposing the article to irradiation, the resultant article acquires the characteristic of eco friendly and hygienic, at the same time biodegradable. The article produced by the process of the invention does not pose the disadvantages associated with the articles made by the hitherto employed and known processes as explained in the prior art. The shape of the article formed is also irreversible. There is no necessity of using pins made from plant material for joining the leaves together. In addition the article formed looks elegant and attractive compared to the articles presently available .

Accordingly the present invention provides an improved process for making an article useful for variety of purposes, particularly for serving/holding food products which comprises trimming the biodegradable materials such as parts of the plant like leaves/sheaths after cleaning with water to remove any extraneous matters, soaking the trimmed and cleaned parts in water for conditioning, subjecting the conditioned products to pressure for giving the desired shape of the desired final article simultaneously heating the shaped article to effect thermosetting to a temperature in the range of 100°C to 250° C for a period in the range of 2 to 50 seconds so as to make the article stable and irreversible to its original shape, trimming the edges of the resulting article, if required, and subjecting the resulting



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article to further sterilization by subjecting it to irradiation.

In the process of the present invention the plant, such as the parts of Butea, Banana, Sal, Areca, palm may be used. The washing may be done by passing water through a jet.

After soaking the resulting product may be sterilized by heating with steam for further conditioning.

The pressure applied may be in the range of 0.5 to 1 kg/cm².

The temperature employed may be preferably in the range of 100 to 150°C .

The irradiation is effected employing UV and/or gamma radiation.

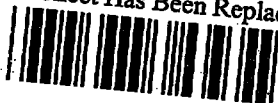
The resultant article may be heated prior to the application of radiation.

The present invention also provides a device for making articles mentioned above. The device of the present invention is useful for the continuous production of bio- plates of different geometrical shapes and sizes using biodegradable raw materials such as areca sheath, bauhunia parts of the plants such as leaves/sheaths.

Attempts to produce automatic machines for large scale production have been met with least success. Manually operated gadgets are available at cottage industrial level.

The device of the present invention would result in reduction in labour and drudgery on the part of Operators and would help in consistent clean and hygienic products, which would pave way for

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adoption of these products, in hotels, industrial canteens, hostels, and they could be exported to different countries.

Hitherto the process of production of such articles are by applying pressure manually. The device for the production shaped articles by manual methods involving stitching and applying pressure manually have the following draw backs.

- a) The production rates are very low, and labour intensive.
- b) The manual drudgery is very high.
- c) Due to repeated manual handling of the raw material and formed plates/cups, the product so obtained is unhygienic.
- d) Consistency in shape and size and production capacity of the product not assured.

The device of the present invention overcomes the drawbacks explained above. Production of articles employing on an automatic device which will effect the application of pressure and heat simultaneously is hitherto not known. Based on electro-pneumatic concept a device to produce articles of uniform quality is developed by us for the first time according to this invention.

The device of the present invention is illustrated in figure 1. of the drawing accompanying this specification.

The device comprises of a die-set (1), press cylinder (2), ejection cylinder (3), discharge cylinder (4), ejector (5)



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heating coil (6), photo sensor (7), the main frame (8), pneumatic solenoid valves (9), air hoses (10), service unit (11), timers (12), counter (13), temperature controller (14), a control panel (15), air compressor (16) and anti-vibration mounts (17).

According to the present invention there is provided a device for making articles useful for variety of purposes, particularly for serving and / or holding food products which comprises a frame (8) to which a die set (1) is fixed, the die set (1) comprising a punch (1a) and a die (1b), defining a gap between them for feeding the material to be shaped, a plurality of solenoid valves (9) and a discharge cylinder (4) being fixed preferably to the sides of the main frame (8), the discharge cylinder (4) being fixed above the solenoid valves (9), the ejector (5) being housed inside the die set (1), and being connected to an ejector cylinder (3) for facilitating the to the punch (1a), the punch (1a) housing the heating coil (6) and provided at its bottom a cutting edge (12), the die (1b) housing a photo sensor (7) for actuating the solenoid valves (9), the control panel (15) comprising of a temperature controller (14) one of the outputs of the temperature controller being connected to the input of a heating coil (6) the other output of the heating coil being connected to the thermocouple of the temperature controller (14), to sense the timer of the punch (1a) and the dieset (1), plurality of electric timers (12), the

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input of the first electric timer being connected in parallel to the other timers, the electric current to this timer being supplied through the input of the said timer, the output of the last timer being connected to the respective solenoid valves (9), the output of the photocensor being connected to the first timer and one of the outputs of the first timer being connected to a counter, the control panel (15) being mounted on the main frame (8).

The working of the device for making articles from biodegradable materials is described below:

The trimmed sheath is placed in between the punch and the die (1) which blocks the sun rays falling on the sensor (7) and the sensor sends the signal to the solenoid valve (9) to allow compressed air into the press cylinder (2), which forms the plant material through a heated punch (1a). The compressor which provides air is attached to the machine and is connected to the service unit (11) to filter the compressed air and to lubricate the same. The pressure of the service unit is set in the range of 0.5 to 1.0 kg/cm². The heating coil (6) is heated to a temperature in the range of 100 to 250°C through a temperature controller set at the beginning of the process. The biodegradable material is held in between the heated punch and the die set for a period in the range of 2 to 50 seconds for thermo setting and the sheath is trimmed after forming. The press cylinder (2) is retracted by the signal of the timer (12), the ejection cylinder

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operates the ejector to bring the form plate to the surface of the die and simultaneously the discharge cylinder pushes the form plate and also the uncut portion of the plant material. The same process described above is continued for producing a continuous batch of formed plates.

The examples given below are illustrations to carry out the invention. Therefore these examples should not be construed as limiting the scope of the invention. For instance depending on the availability of raw material (leaves/sheaths) any leaf/leaf sheath, shapes other than what is mentioned in the examples can be achieved.

Example 1:

The Bauhinia leaves are collected and stored in bulk and sorted on a belt for rejecting the damaged, undersized leaves. The leaves are then trimmed to a uniform size ranging a size say 150 mm x 150 mm. These are passed through a tunnel to which steam is sparged. The sterilised leaves are received in the gap between the punch (male) and die (female) of the device shown in fig 1. The die had the shape frustum of a hexagonal pyramid and the die has a cavity of size A/c 120 mm x A/f 100 mm x 30 mm deep. The die (female) which reciprocates on vertical axis, presses the leaf onto the punch, which is electrically heated to a temperature in the range 100-150°C by an embedded coil and holds it in that position for a time ranging from 2 seconds to 5 seconds. On



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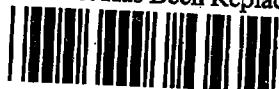
further pressing of the punch, the edges of which are fitted with blade, cut and trim the edges of the undesired projections of the shaped article. The die is lowered and the formed, cut, trimmed article is lifted off by an ejector and discharged manually. The resultant hexagonal shaped article travels through a tunnel kept under UV radiator for a time at the range of 1-3 minutes which is adjustable to achieve surface sterility.

Example 2:

Areca sheaths (the leaf sheath of Areca Catechu) are collected and stored in bulk and sorted on a belt for sizing and grading, rejecting the damaged and undesirable sheaths.

The sheaths are trimmed to a uniform size of say 300 mm x 300 mm. The sheaths are conditioned and moistened in water for 5- 8min. The trimmed sheaths are passed under a water jet spray while on a conveyor belt and collected for conditioning, and further passed through a tunnel to which steam is sprayed at a pressure of 0.5- 1 Kg/cm². The surface sterilised leaves are received in the gap between the die set of the device shown in figure 2. In the die set, the punch shaped like the frustum of a cone which is electrically heated by an embedded coil to a temperature in the range of 150°C-250°C, presses the sheath into the die of similar shape as the punch, and holds it in that position for a time ranging from 5-10 seconds. The pressing of the punch further cuts and trims the edges by the shearing edge fitted to the

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periphery of the punch. The punch moves up and the ejector of the die, ejects out the formed, cut, trimmed article. The formed article is pushed out of the device by the discharge cylinder. The shaped article travels in a tunnel kept under UV radiation for a time at the range of 1-3 min. to achieve surface sterility.

Example 3

The Areca sheaths are collected and stored in bulk and sorted on a belt for sizing, grading and rejecting and damaged, undersized sheaths. The sheaths are then trimmed to a uniform size ranging a size say 250 mm x 250 mm. The sheaths are passed under a water-jet spray while on a conveyor belt and collected. These are passed through a tunnel to which steam is sparged at a pressure of 0.5-1 kg/cm². The sterilized sheaths are received in the gap between the punch (male) and the die (female) of the device shown in fig. 1. The die has the shape of frustrum of a cone and the die has a cavity of size 250 mm x 210 mm x 30 mm deep. The die (female) which reciprocates on vertical axis, presses the sheath on to the punch, which is electrically heated by an embedded coil, and holds it in that position for a time ranging from 20 seconds to 30 seconds. On further pressing of the punch, the edges of which are fitted with blade, cut and trim the edges of the undersized projections of the shaped article. The die is lowered and the formed, cut, trimmed article is lifted off by an ejector and discharged manually. The resultant truncated conical shaped article travels through a tunnel kept under UV radiator



for a time at the range of 1-3 minutes, which is adjustable to achieve surface sterility.

Example 4

The Bauhinia leaves are collected and stored in bulk and sorted on a belt for sizing and grading, rejecting and damaged and undesirable sheaths. The stitched leaves of uniform size of say 300 mm x 300 mm is passed on a conveyor to the forming machine. The surface cleaned leaves are received in the gap between the die set of the device shown in fig. 2. In the die set, the punch shaped like the frustrum of a cone which is electrically heated by an embedded coil to a temperature in the range of 100-150°C, presses the leaves into the die of similar shape as the punch, and holds it in that position for a time ranging from 2-5 seconds. The pressing of the punch further cuts and trims the edges by the shearing edge fitted to the periphery of the punch. The punch moves up and the ejector of the die, ejects out the formed, cut, trimmed article. The formed article is pushed out of the device by the discharge cylinder. The shaped article travels in a tunnel kept under UV radiation for a time at the range of 1-3 min. to achieve surface sterility.

The main advantages of the invention are:

- a) The production capacity is high.
- b) Due to minimal manual handling of the article produced employing the device, the resulting article is hygienic.



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- c) The device does not require application of large human force. The device is used by employing compressed air. The operation of the device needs only one operator.
- d) Consistency in shape, size capacity of the article produced employing the device is assured.
- e) Operation and maintenance of the device is easy and cost effective.
- f) The control system employed for which is not effective, but also ensures safety to operator and the device .

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We Claim

1. A process for making an article useful for variety of purposes, particularly for serving/holding food products which comprises trimming the biodegradable materials such as parts of the plant like leaves/sheaths after cleaning with water to remove any extraneous matters, soaking the trimmed and cleaned parts in water for conditioning, subjecting the conditioned products to pressure for giving the desired shape of the desired final article simultaneoulsy heating the shaped article to effect thermosetting to a temperature in the range of 100 to 250° C for a period in the range of 2 to 50 seconds so as to make the article stable and irreversable to its original shape, trimming the edges of the resulting article, if required, and subjecting the resulting article to further sterilization by subjecting it to irradiation.
2. A process as claimed in claim 1 wherein the parts of the plant, such as the parts of Butea, Banana, Sal, Areca, palm is used.
3. A process as claimed in claims 1 & 2 wherein the washing is done by passing water through a jet.
4. A process as claimed in Claims 1 to 3 wherein after soaking the product is sterilized for further conditioning.
5. A process as claimed in Claims 1 to 4 wherein a pressure in the range of 0.5 to 1.0 kg/cm² is applied.
6. A process as claimed in Claims 1 to 5 wherein a temperature in the range of 150 to 250 °C is applied.
7. A prcess as claimed in claims 1 to 6 wherein the

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irradiation is effected employing UV and/or gamma radiation.

8. A process as claimed in Claims 1 to 7 wherein the resultant article is heated prior to the application of radiation.

9. An article useful for variety of purposes, particularly for or serving food and/or holding food products, prepared by the process as claimed in Claims 1 to 8.

10. A process for making an article useful for variety of purposes particularly for serving and/or holding food products substantially as herein described with reference to the examples.

11. An article useful for variety of purposes particularly for serving/or holding food products, substantially as herein described.

12. A device for making articles useful for variety of purposes, particularly for serving and / or holding food products which comprises a frame (8) to which a die set (1) is fixed, the die set (1) comprising a punch (1a) and a die (1b), defining a gap between them for feeding the material to be shaped, a plurality of solenoid valves (9) and a discharge cylinder (4) being preferably fixed to the sides of the main frame (8), the discharge cylinder (4) being fixed above the solenoid valves (9), the ejector (5) being housed inside the die set (1), and being connected to an ejector cylinder (3) for facilitating the vertical movement of the ejector (5), the punch (1a) being
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to the punch (1a), the punch (1a) housing the heating coil (6) and provided at its bottom a cutting edge (12), the die (1b) housing a photo sensor (7) for actuating the solenoid valves

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(9), the control panel (15) comprising of a temperature controller (14) one of the outputs of the temperature controller being connected to the input of a heating coil (6) the other output of the heating coil being connected to the thermocouple of the temperature controller (14), to sense the timer of the punch (1a) and the diesel (1), plurality of electric timers (12), the input of the first electric timer being connected in parallel to the other timers, the electric current to this timer being supplied through the input of the said timer, the output of the last timer being connected to the respective solenoid valves (9), the output of the photocensor being connected to the first timer and one of the outputs of the first timer being connected to a counter, the control panel (15) being mounted on the main frame (8).

13. A device as claimed in claim 12 wherein the discharge cylinder (4) being fixed above the solenoid valves (9).

14. A device for making an articles useful for variety of purposes, particularly for serving and / or holding food products substantially as hereindescribed with reference to fig 1 of the drawing accompanying this specification.

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