

**FORM 2**

THE PATENTS ACT 1970

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**COMPLETE SPECIFICATION**

(See section 10 & rule 13)

**1. TITLE OF THE INVENTION**

**A METHOD AND APPARATUS FOR TREATING PLASTICS  
USING ROBOTICS**

**2. APPLICANT (S)**

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**3. PREAMBLE TO THE DESCRIPTION**

**COMPLETE**

The following specification particularly describes the invention and the manner in which it is to be performed

# **A METHOD AND APPARATUS FOR TREATING PLASTICS USING ROBOTICS**

## **FIELD**

[0001] The embodiments herein generally relates to treatment of plastics. More particularly, the disclosure relates to a method and apparatus for treating plastics to recycle.

## **BACKGROUND AND PRIOR ART**

[0002] Plastics are one of the most widely used materials for manufacturing products owing to their characteristics of light in weight, inexpensive, durable, and ease of moulding, extruding or pressing into solid objects of various shapes. This widespread use has led to an increase in production of plastic products, wherein consequentially a major portion of the plastic used for making disposable items of packaging or other short-lived products are discarded within a year of manufacture.

[0003] However, the large scale disposal results in substantial quantities of plastics being accumulated in landfills, causing pollution and waste-management issues. Recycling used plastics is an important measure for mitigating the above problems for reducing the amount of plastics being disposed and reducing the oil usage and carbon dioxide emissions associated with the manufacturing of newer plastics.

[0004] Specifically, plastic bottle contribute to the major percentage of plastic consumption and disposal. PET (Polyethylene Terephthalate) bottles are discarded in larger numbers due to their common usage in almost all parts of the world. However, there are no customized apparatus for effectively recycling the PET bottles and transporting the recycled plastics for further processing.

[0005] Therefore, there is a need for a compact, portable and cost-effective apparatus for pre-treatment of plastics before recycling. Moreover, there is a need for an apparatus effectively treating PET (Polyethylene Terephthalate) bottles for recycling.

5 **OBJECTS**

[0006] Some of the objects of the present disclosure are described herein below:

[0007] The main objective of the present disclosure is to provide an apparatus for treating plastics for recycling.

[0008] Another objective of the present disclosure is to provide an apparatus and  
10 method for recycling PET (Polyethylene Terephthalate) bottles.

[0009] Still another objective of the present disclosure is to provide a compact, portable and cost effective apparatus for pre-treating plastics for recycling.

[00010] Yet another objective of the present disclosure is to provide an apparatus for treating plastics for ease of processing during recycling.

15 [00011] The other objectives and advantages of the present disclosure will be apparent from the following description when read in conjunction with the accompanying drawings, which are incorporated for illustration of preferred embodiments of the present disclosure and are not intended to limit the scope thereof.

20 **SUMMARY**

[00012] In view of the foregoing, an embodiment herein provides an apparatus for treating plastics.

[00013] In accordance with an embodiment, the apparatus includes a cleaning assembly, a shredding unit, a transporting unit, a compressing unit and a storage  
25 unit. In an embodiment, the cleaning assembly includes an external drum and an internal drum, wherein the internal drum is placed inside the external drum. The

external drum includes a plurality of holders for holding plastic products and cleaning an interior surface of the plastic products. The cleaned plastic products are transmitted to the shredding unit. In an embodiment, the shredding unit includes an input for receiving the plastic products and a plurality of shredding tools for uniformly shredding the plastic products. The shredded bits of plastics are transported through an outlet to the transporting unit. In an embodiment, the transporting unit is provided for transporting the shredded bits of plastic to the compressing unit. In an embodiment, the compressing unit includes a collector for collecting the shredded bits of plastic. In an embodiment, a compressor is connected to the collector for compressing the shredded bits of plastic into a block. The compressed block is stored in the storage unit.

**[00014]** In accordance with an embodiment, the apparatus for treating plastics using robotics, comprises a cleaning unit including an internal drum placed concentrically inside an external drum, wherein the external drum is rotatable relative to the internal drum. A plurality of holders extends from a circumferential surface of the external drum for accommodating a plastic product, wherein the holders include a plurality of holes for cleaning the plastic product. A proximity sensor is mounted on the holders for detecting presence of the plastic product and transmitting a signal to the microcontroller on detection. The microcontroller controls a pump for facilitating flow of water through the holes for a predetermined duration to clean the plastic products. The microcontroller controls a dryer for facilitating flow of hot air through the holes for a predetermined duration to dry the plastic products. A Shredding unit is operatively connected to the cleaning unit for receiving and shredding the dried plastic products to obtain shredded pieces of plastic. A transporting unit is connected to the shredding unit for conveying the shredded pieces of plastic to a compressing unit. The

compressing unit compresses the shredded pieces of plastic to obtain a three-dimensional plastic block.

**[00015]** In accordance with an embodiment, the transporting unit includes a conveyor belt for conveying the shredded pieces of plastic, a proximity sensor is  
5 mounted on the conveyor belt for detecting presence of the shredded pieces and transmitting a signal to the microcontroller and the microcontroller actuates the conveyor belt for conveying the shredded pieces of plastic to the compressing unit.

**[00016]** In accordance with an embodiment, a proximity sensor mounted on an  
10 input of the shredding unit for detecting presence of plastic products and transmitting a signal to the microcontroller and the microcontroller is configured for actuating a motor connected to a shredding tool for shredding the plastic product to plastic pieces.

**[00017]** In accordance with an embodiment, a circumferential surface of the  
15 internal drum includes a plurality of holes for facilitating flow of water to the holders and a plurality of slots for receiving water from the plastic products during cleaning and drying.

**[00018]** In accordance with an embodiment, the external drum is rotated relative  
20 to the internal drum for aligning the holders with the holes for facilitating spraying of water and dry air through the holes of the holders for performing cleaning and drying of the plastic products.

**[00019]** In accordance with an embodiment, the microcontroller rotating the  
external drum relative to the internal drum by actuating the motor connected to  
the external drum products for aligning the holders along the shredding unit and  
25 the microcontroller actuating at a predefined duration after performing drying of the plastic for releasing the plastic products into an input of the shredding unit.

[00020] In accordance with an embodiment, a collector is provided in the compressing unit for receiving the plastic pieces from the transporting unit, a proximity sensor is mounted on the collector for detecting presence of the plastic pieces and transmitting a signal to the microcontroller and the microcontroller  
5 controls the compressor including a piston ram assembly (320a) for compressing the plastic pieces to a plastic block.

[00021] In accordance with an embodiment, the predefined duration is set in the microcontroller for facilitating automated treatment of plastics using robotics independent of manual intervention. In an embodiment, the plastic product is a  
10 plastic bottle.

[00022] In accordance with an embodiment, the method for treating plastics using robotics, comprises the following steps. First, detecting presence of a plastic product on a holder, by a proximity sensor, then rotating an external drum, connected to the holders, relative to an internal drum placed concentrically inside  
15 the external drum, on detecting the presence of the plastic product, by a microcontroller. Then, controlling flow of water for a predefined duration through a plurality of holes configured on the holders for cleaning the plastic products during the rotation, by the microcontroller and controlling flow of hot air for a predefined duration through a plurality of holes configured on the holders for  
20 drying the plastic products during the rotation, by the microcontroller. Next, shredding the plastic products received from the holders after cleaning and drying, to obtain plastic pieces, by a shredding tool. Then, actuating a conveyor belt for conveying the plastic pieces to a compressing unit on detecting presence of plastic pieces, by the microcontroller. Finally, compressing the plastic pieces received  
25 from the conveyer belt in a collector unit for obtaining a plastic block, by a compressing unit.

[00023] These and other aspects of the embodiments herein will be better appreciated and understood when considered in conjunction with the following description and the accompanying drawings. It should be understood, however, that the following descriptions, while indicating preferred embodiments and numerous specific details thereof, are given by way of illustration and not of limitation. Many changes and modifications may be made within the scope of the embodiments herein without departing from the spirit thereof, and the embodiments herein include all such modifications.

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#### **BRIEF DESCRIPTION OF DRAWINGS**

[00024] The detailed description is set forth with reference to the accompanying figures. In the figures, the left-most digit(s) of a reference number identifies the figure in which the reference number first appears. The use of the same reference numbers in different figures indicates similar or identical items.

[00025] Fig.1 illustrates a schematic of a perspective view of an external drum of the apparatus for treating plastics, according to an embodiment herein;

[00026] Fig.2 illustrates a schematic of a perspective view of an internal drum of the apparatus for treating plastics, according to an embodiment herein;

[00027] Fig.3 illustrates a schematic of a perspective view of an apparatus for treating plastics, according to an embodiment herein;

[00028] Fig.4 illustrates a schematic of a perspective view of a shredding unit of the apparatus for treating plastics, according to an embodiment herein;

[00029] Fig.5 illustrates a schematic of a perspective view of an transporting unit of the apparatus for treating plastics, according to an embodiment herein;

[00030] Fig.6 illustrates a block diagram of a system in the apparatus for treating plastics, according to an embodiment herein; and

[00031] Fig.7 illustrates a block diagram of a flow chart of a method for treating plastics, according to an embodiment herein.

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### **DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS**

[00032] The embodiments herein and the various features and advantageous details thereof are explained more fully with reference to the non-limiting embodiments and detailed in the following description. Descriptions of well-known components and processing techniques are omitted so as to not unnecessarily obscure the embodiments herein. The examples used herein are intended merely to facilitate an understanding of ways in which the embodiments herein may be practiced and to further enable those of skill in the art to practice the embodiments herein. Accordingly, the examples should not be construed as limiting the scope of the embodiments herein.

[00033] As mentioned above, there is a need for a compact, portable and cost-effective apparatus for pre treatment of plastics before recycling. In particular, there is a need for an apparatus effectively treating plastic products for recycling. The embodiments herein achieve this by providing “A method and apparatus for treating plastics using robotics”. Referring now to the drawings and more particularly to Fig.1 to Fig.7, where similar reference characters denote corresponding features consistently throughout the figures, there are shown preferred embodiments.

[00034] Fig.1 illustrates a schematic of a perspective view of a cleaning assembly for treating plastics. In an embodiment, the cleaning assembly 100 includes an external drum 101 and an internal drum 102. The external drum 101 includes a circumferential surface 101a, a first surface 101b at an axial end of the

circumferential surface 101a and a second surface 101c at another axial end of the circumferential surface 101a.

**[00035]** The internal drum 102 is placed inside the external drum 101. In an embodiment, the external drum 101 and the internal drum 102 are connected  
5 through a rod 103. The rod 103 extends axially through the internal drum 102 and the external drum 101, wherein the rod 103 extends from the first surface 101b and the second surface 101c. The internal drum 102 and the external drum 101 are concentric. In an embodiment, the internal drum 102 is stationary and the external drum 101 is rotatable relative to the internal drum 102.

10 **[00036]** In an embodiment, an enclosure is provided for enclosing the cleaning assembly. The internal drum 102 is fixed to walls of the enclosure.

**[00037]** A plurality of holders 104 are provided on the circumferential surface 101a of the external drum 101 wherein the holders 104 extend radially outward from the circumferential surface 101a. The holder 104 is a pipe for facilitating  
15 flow of fluids. In an embodiment, the holders 104 are fixed on the circumferential surface 101a of the external drum 101, wherein the holders 104 rotate with the external drum 101. A plurality of sensors and a motor are connected to the external drum 101. The sensors are provided for detecting presence of plastic products on the holders and transmitting a signal to a microcontroller. The motor  
20 is provided for rotating the external drum 101 relative to the internal drum 102.

**[00038]** In an exemplary embodiment, specification of the motor including rated current (mA):  $\leq 2000$ , rated power (W) of 5.624, rated torque (N-cm) of 19.83, rated speed of 27 RPM, shaft length of 27mm, shaft diameter 8mm and base motor RPM of 4500.

25 **[00039]** In an embodiment, the holders are separated by a predetermined angle for facilitating space for placement of the plastic products. An opening 106 is provided around the holders 104 for allowing residual fluids drained from the

plastic products. In an embodiment, the opening 106 is connected to a residual fluid storage provided inside the internal drum 102. An edge 107 is provided on the external drum 101 extending radially from the circumferential surface 101a. The edge 107 is provided for directing flow of the fluids into the opening and preventing leakage of the residual fluids into other slots.

**[00040]** In an embodiment, a plurality of holes 105 is provided on a surface of the holders 104. The holders 104 are provided for facilitating placement of plastic products and cleaning an interior surface of the plastic products. The plastic products are placed over the holders 104. In an embodiment, the plastic products including but not limited to bottles, PET bottles.

**[00041]** A cleaning fluid is allowed through the holders 104, wherein the holes 105 spray the cleaning fluid in the bottles for cleaning the bottle before processing. A source of hot air is allowed through the holes, for drying an interior surface of the cleaned bottles.

**[00042]** In an embodiment, a pump, a plurality of fluid storages and a plurality of dryers are provided inside the internal drum 102. A plurality of partitions is provided inside the internal drum 102 for separating the fluid storages, pump, motor and the dryers. The fluid storages are provided for storing cleaning fluids. In an embodiment, cleaning fluids include but not limited to water, disinfectant, and soap water. The pump is provided for transporting the cleaning fluids from the fluid storages to the holders 104. The cleaning fluids are sprayed at a force through the holes 105 into the bottles, for cleaning the residual wastes present inside the bottles.

**[00043]** In an exemplary embodiment, specifications of the pump including operating voltage of 12V, operating range of 9V to 14V, flow rate of 4.5 LPM and cut-off pressure at 110 PSI / 6.8 Bar.

**[00044]** In an embodiment, the dryers are provided for drying the cleaned bottles. The dryers force air into the holders 104, wherein the holes 105 convey the air to the interior surface of the bottles for drying the bottles thoroughly. In an embodiment, the dryers blow hot air for faster drying of the bottles.

5 **[00045]** In an embodiment, a plurality of sensors are provided in the holders 104 for detecting a condition of the plastic products and activating and/or deactivating the pump for spraying the fluids, activating and/or deactivating the motor and activating and/or deactivating the dryers. In an embodiment, the condition including but not limited to presence of a plastic product, cleaned plastic product,  
10 dried plastic product.

**[00046]** The motor controls the external drum 101 for positioning the holders 104 in a horizontal position. The sensors are provided for detecting a presence of the plastic products on the holders and transmitting a signal to a microcontroller. The microcontroller is connected to the motor, pump and the dryers. The motor rotates  
15 the external drum 101 for rotating the holders 104 and aligning the holders 104 to the slots corresponding to outlet of the fluid storages. The microcontroller activates the pump for spraying cleaning fluids from the fluid storages into the plastic product for cleaning. A predefined duration of time is set in the microcontroller for cleaning the plastic products. On completion of the predefined  
20 duration of time, the microcontroller stops the pump. The motor rotates the external drum 101 for aligning the holders 104 vertically upwards, thereby draining excess fluid from the plastic products into the opening 106.

**[00047]** Next, the microcontroller activates the motor for rotating the external drum 101 relative to the internal drum 102 for aligning the holders 104 to the slots  
25 corresponding to the dryers. The sensors detect the position of the holders 104 in the external drum 101 relative to the slots of the dryer and transmit a signal to the microcontroller. Based on the detection, the microcontroller activates the dryer for

drying the cleaned plastic products for a predefined duration of time. On completion of the predefined duration of time, the microcontroller stops the dryer and activates the motor for rotating the external drum 101. The motor rotates the external drum 101 for aligning the holders 104 vertically downwards, thereby  
5 facilitating falling of the plastic products to a shredding unit.

**[00048]** Fig. 2 illustrates a schematic of a perspective view of an internal drum of the apparatus for treating plastics. In an embodiment, the internal drum 102 includes a circumferential surface 201. A plurality of holes 202 and a plurality of slots 203 are configured on the circumferential surface 201. The holes 202 are  
10 provided for facilitating flow of cleaning fluids from the fluid storage and hot air from the dryers to the holders 104. In an embodiment, the holes 202 are aligned to an outlet of the fluid storages and an outlet of the dryers. The slots 202 are provided for receiving residue water from the plastic products on the holders 104.

**[00049]** In an embodiment, the external drum 101 is rotated relative to the internal  
15 drum 102 for aligning an end of the holders 104 to the holes, for facilitating flow of the fluids from the pump and/or the dryer to the bottles.

**[00050]** Fig. 3 illustrates a schematic of a perspective view of a shredding and compressing assembly of the apparatus for treating plastics. In an embodiment, the assembly includes a cleaning unit 301, shredding unit 303, a transporting unit  
20 305, a compressing unit 307 and a storage unit 309.

**[00051]** In an embodiment, the cleaning unit 301 includes the plurality of holders 104, wherein a set of the holders 104 is aligned relative to the shredding unit 303 for releasing the cleaned and dried plastic bottles into the shredding unit 303.

**[00052]** In an embodiment, the shredding unit 301 includes an inlet 309, an  
25 aligning portion 310, a motor 311 and outlet 316.

**[00053]** The inlet 309 is operatively connected to the cleaning assembly for receiving the cleaned and dried plastic products. The plastic products from the

inlet 309 are transferred to the aligning portion 310. The aligning portion 310 is provided for aligning the plastic products for uniform shredding. Shredding tools (not shown in figure) are provided for shredding the plastic products into smaller bits of plastic pieces. In an embodiment, the shredding tools including but not limited to sharp-edged circular cutting blades. The motor 311 is connected to the shredding tools for controlling movement and speed of cutting.

**[00054]** In an exemplary embodiment, specifications of the motor including speed of 6 RPM for controlling speed of the shredding tools, input electrical supply of 230 VAC, 50 Hz Single Phase, motor rating of 1 HP and current rating of 10 Amperes.

**[00055]** In an embodiment, a proximity sensor is provided in the inlet 309 for detecting presence of plastic products. The proximity sensor transmits a signal to the microcontroller, wherein the microcontroller activates the shredding tool. In an embodiment, the shredding tool is deactivated based on a predefined duration set in the microcontroller.

**[00056]** The shredded plastic pieces are transported through the outlet 316 to the transporting unit 305.

**[00057]** The transporting unit 305 is operatively connected to the shredding unit 301 for receiving the shredded plastic pieces from the outlet 316. The transporting unit 305 transports the shredded plastic pieces to the compressing unit 305. In an embodiment, the transporting unit 305 including but not limited to a conveyer belt. In an embodiment, the microcontroller is connected to the transporting unit 305. The microcontroller activates the transporting unit 305 based on the signal received from the proximity sensor detecting presence of the plastic product in the input 309.

**[00058]** In an embodiment, the transporting unit 305 is deactivated based on a predefined duration set in the microcontroller, after the deactivation of the

shredding tool. In an embodiment, a motor is connected to the transporting unit for controlling movement. In an exemplary embodiment, the motor including but not limited to AC induction motors wherein the motor is operated continuously in one direction. Input electrical supply for the motor in a range of 200 - 240 VA and single phase. The motor rating : 1/750 HP with parallel shaft orientation.

**[00059]** The compressing unit 307 is operatively connected to the transporting unit 305 for receiving the shredded bits of plastic from the shredding unit 301. In an embodiment, the compressing unit 307 includes a collector 324. The collector 324 is provided for receiving the shredded pieces of plastic.

**[00060]** In an embodiment, a plurality of sensors is connected to the collector 324. In an embodiment, the sensor can include a weight sensor and a proximity sensor. The weight sensor is configured for measuring weight of the plastic pieces and the proximity sensor is configured for detecting a presence of the plastic pieces in the collector 324. The sensors are provided for measuring and monitoring weight of the shredded plastic pieces in the collector 324. The sensors are connected to a microcontroller for transmitting the weight of the shredded plastic pieces.

**[00061]** A compressor 320 is operatively connected to the collector 324. In an embodiment, the compressor 320 including but not limited to a piston, ram. A motor 322 is connected to the compressor 320 for controlling the movement of the compressor. In an embodiment, the compressor 320 compresses the shredded bits of plastic for creating a block. In an embodiment, shape and dimensions of the block variable based on requirement.

**[00062]** In an embodiment, a motor is connected to the compressor 320 for compressing the plastic pieces stored in the collector 324. The microcontroller is connected to the motor for controlling movement of the ram 320a for compressing the plastic pieces. In an embodiment, the plastic pieces are compressed to a plastic block on compression of the ram 320a.

[00063] Fig. 4 illustrates a schematic of a perspective view of a shredding unit of the apparatus for treating plastics. In an embodiment, the shredding unit 301 includes a shredding tool 401. The shredding tool 401 is an assembly of blades for shredding the plastic bottles to obtain plastic pieces. In an embodiment, the motor is connected to the shredding tool 401 for rotating the shredding tool 401, thereby actuating shredding of the plastic bottle.

[00064] In an embodiment, the proximity sensor is mounted at the input 309 for detecting presence of plastic bottles. The proximity sensor transmits a signal to the microcontroller on detecting presence of the plastic bottle, wherein the microcontroller actuates the motor connected to the shredding tool 401.

[00065] Fig. 5 illustrates a schematic of a perspective view of a transporting unit of the apparatus for treating plastics. In an embodiment, the transporting unit 305 is provided for conveying the shredded plastic pieces to the compressing unit. In an embodiment, the transporting unit 305 includes a conveyor belt 501 for transporting the shredded plastic pieces received from the shredding unit 301 for conveying to the compressing unit.

[00066] In an embodiment, a proximity sensor is mounted near an input 502 of the transporting unit 305 for detecting a presence of shredded plastic pieces. The proximity sensor transmits a signal to the microcontroller on detecting the presence of the shredded plastic pieces. The microcontroller is configured for actuating a motor connected to the conveyor belt for conveying the shredded plastic pieces to the compressing unit.

[00067] Fig. 6 illustrates a system in the apparatus for treating plastics. The system includes but not limited to a sensor module 301 and a microcontroller 602, connected to the apparatus. The sensor module 401 includes a plurality of sensors provided for detecting a plurality of parameters of components of the apparatus. In an embodiment, the sensors include proximity sensors. The sensors are

connected to the components including but not limited to holder 104, inlet 309 of the shredding unit, input 502 of the transporting unit 305 and the collector 324. In an embodiment, the parameters including but not limited to presence of bottle on the holder, presence of bottle in the inlet of the shredding unit, presence of shredded pieces of plastic on the collector and weight of the shredded pieces of plastic in the collector 324.

**[00068]** In an embodiment, the detected parameters by the sensors are transmitted to the microcontroller 602. The microcontroller 602 is connected to the sensor system 601 and the apparatus. The microcontroller 602 controls the apparatus based on the parameters detected by the sensor system. The microcontroller 602 is provided for controlling the components including but not limited to the motor, pump, transporting unit 305, shredding tool 401, compressor 320, motor 322 collector 324.

**[00069]** Fig. 7 illustrates a flowchart of a method for treating plastics using robotics. In an embodiment, the method includes the following steps. First, detecting 701 presence of a plastic product on a holder, by a proximity sensor. Then, rotating 702 an external drum, connected to the holders, relative to an internal drum placed concentrically inside the external drum on detecting the presence of the plastic product based on actuation of a motor, by a microcontroller. Next, controlling 703 flow of water for a predefined duration through a plurality of holes configured on the holders for cleaning the plastic products during rotation, by the microcontroller. Then, controlling 704 flow of hot air for a predefined duration through a plurality of holes configured on the holders for drying the plastic products during rotation, by the microcontroller. Then, shredding 705 the plastic products received from the holders after cleaning and drying to obtain plastic pieces, by a shredding tool. Next, actuating 706 a conveyor belt for conveying the plastic pieces to a compressing unit on detecting

presence of plastic pieces, by the microcontroller. Finally, compressing 707 the plastic pieces received from the conveyer belt in a collector unit for obtaining a plastic block, by a compressing unit. The plastic block is obtained as a rigid block capable of being used in various applications.

5 [00070] A main advantage of the present disclosure is that the apparatus provides an apparatus for effectively treating plastics for recycling

[00071] Another advantage of the present disclosure is that the apparatus for treating plastics is portable and compact.

[00072] Yet another advantage of the present disclosure is that the apparatus  
10 provides treatment of plastics for facilitating further processing during recycling.

[00073] Still another advantage of the present disclosure is that the apparatus provides treatment of plastics for usage in various applications.

[00074] The foregoing description of the specific embodiments will so fully reveal the general nature of the embodiments herein that others can, by applying  
15 current knowledge, readily modify and/or adapt for various applications such specific embodiments without departing from the generic concept, and, therefore, such adaptations and modifications should and are intended to be comprehended within the meaning and range of equivalents of the disclosed embodiments. It is to be understood that the phraseology or terminology employed herein is for the  
20 purpose of description and not of limitation. Therefore, while the embodiments herein have been described in terms of preferred embodiments, those skilled in the art will recognize that the embodiments herein can be practiced with modification within the spirit and scope of the embodiments as described herein

Dated this 10<sup>th</sup> January 2023

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I Claim:

1. An apparatus for treating plastics using robotics, comprising:
  - a cleaning unit (301) including an internal drum (102) placed concentrically inside an external drum (101), wherein the external drum (101) rotatable relative to the internal drum (102);
  - a plurality of holders (104) extending from a circumferential surface of the external drum (101) for accommodating a plastic product, wherein the holders (104) including a plurality of holes (105) for cleaning the plastic product;
  - a proximity sensor mounted on the holders (104) for detecting presence of the plastic product and transmitting a signal to the microcontroller (402) on detection;
  - wherein the microcontroller (402) controlling a pump for facilitating flow of water through the holes (105) for a predetermined duration to clean the plastic products;
  - wherein the microcontroller (402) controlling a dryer for facilitating flow of hot air through the holes (105) for a predetermined duration to dry the plastic products;
  - a shredding unit (303) operatively connected to the cleaning unit (301) configured for receiving and shredding the dried plastic products to obtain shredded pieces of plastic;
  - a transporting unit (305) operatively connected to the shredding unit (303) for conveying the shredded pieces of plastic to a compressing unit (307);
  - wherein the compressing unit (307) configured for compressing the shredded pieces of plastic to obtain a three-dimensional plastic block.
2. The apparatus as claimed in claim 1, wherein the transporting unit (305) including a conveyor belt for conveying the shredded pieces of plastic;

a proximity sensor mounted on the conveyor belt for detecting presence of the shredded pieces and transmitting a signal to the microcontroller; and wherein the microcontroller (602) configured for actuating the conveyer belt for conveying the shredded pieces of plastic to the compressing unit.

- 5 3. The apparatus as claimed in claim 1, wherein a proximity sensor mounted on an input (309) of the shredding unit (303) for detecting presence of plastic products and transmitting a signal to the microcontroller; and wherein the microcontroller (602) configured for actuating a motor connected to a shredding tool (401) for shredding the plastic product to plastic pieces.
- 10 4. The apparatus as claimed in claim 1, wherein a circumferential surface (201) of the internal drum (102) including a plurality of holes (202) for facilitating flow of water to the holders (104) and a plurality of slots (203) for receiving water from the plastic products during cleaning and drying.
- 15 5. The apparatus as claimed in claim 4, wherein the external drum (101) rotated relative to the internal drum (102) for aligning the holders (104) with the holes (202) for facilitating spraying of water and dry air through the holes (105) of the holders (105) for performing cleaning and drying of the plastic products.
- 20 6. The apparatus as claimed in claim 1, wherein the microcontroller (602) the rotating the external drum (101) relative to the internal drum (101) by actuating the motor connected to the external drum products for aligning the holders (104) along the shredding unit (303); and wherein the microcontroller (602) actuating at a predefined duration after performing drying of the plastic for releasing the plastic products into an input (309) of the shredding unit (303).
- 25 7. The apparatus as claimed in claim 1, wherein a collector (324) provided in the compressing unit (307) for receiving the plastic pieces from the transporting unit (305);

- a proximity sensor mounted on the collector (324) for detecting presence of the plastic pieces and transmitting a signal to the microcontroller (602); and wherein the microcontroller (602) controlling the compressor (320) including a piston ram assembly (320a) for compressing the plastic pieces to a plastic block.
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8. The apparatus as claimed in claim 1, wherein the predefined duration set in the microcontroller (602) for facilitating automated treatment of plastics using robotics independent of manual intervention.
9. The apparatus as claimed in claim 1, wherein the plastic product is a plastic bottle.
- 10
10. A method for treating plastics using robotics, comprising the steps of:
- detecting (701) presence of a plastic product on a holder, by a proximity sensor;
- rotating (702) an external drum, connected to the holders, relative to an internal drum placed concentrically inside the external drum, on detecting the presence of the plastic product, by a microcontroller;
- 15
- controlling (703) flow of water for a predefined duration through a plurality of holes configured on the holders for cleaning the plastic products during the rotation, by the microcontroller;
- controlling (704) flow of hot air for a predefined duration through a plurality of holes configured on the holders for drying the plastic products during the rotation, by the microcontroller;
- 20
- shredding (705) the plastic products received from the holders after cleaning and drying, to obtain plastic pieces, by a shredding tool;
- actuating (706) a conveyor belt for conveying the plastic pieces to a compressing unit on detecting presence of plastic pieces, by the microcontroller; and
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compressing (707) the plastic pieces received from the conveyer belt in a collector unit for obtaining a plastic block, by a compressing unit.

5 Dated this 10<sup>th</sup> January 2023



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## **ABSTRACT**

### **A METHOD AND APPARATUS FOR TREATING PLASTICS USING ROBOTICS**

The present disclosure provides a method and apparatus for treating plastics for  
5 recycling. The apparatus includes a cleaning unit (301) including an internal drum  
(102) placed concentrically inside an external drum (101), holders (104) for  
accommodating a plastic product and cleaning the plastic product, a proximity  
sensor for detecting presence of the product and transmitting signal to a  
microcontroller. The microcontroller (402) controls a pump for facilitating flow of  
10 water through the holes (105) and controls a dryer for facilitating flow of hot air  
through the holes. A shredding unit (303) is connected to the cleaning unit (301)  
for receiving and shredding the dried plastic products to obtain shredded pieces of  
plastic. A transporting unit (305) is connected to the shredding unit (303) for  
conveying the shredded pieces of plastic to a compressing unit (307). The  
15 compressing unit (307) compresses the shredded pieces of plastic to obtain a  
plastic block.

Fig. 3