Recycling Plastics into Prosthetic Non Invasive Material

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Abstract- *In recent years the issue of plastic recycling has become one of the leading issue of environmental protection and waste management. Plastic is known as non-biodegradable substance which means that it is not possible to break it through natural means the possibility of reusing polymeric materials gives a possibility of valorization and enables the effective waste utilization to obtain the consumable produce. Whereas polymer materials have been found an application in many areas of daily life and various type of industries. The 3D printing market is a well known sector. Printable filaments can be made from a variety of thermoplastic materials, including those from recycling.The process of extruding waste plastic has the potential to create an alternative use for recyclable plastic bottles,cups etc as a more sustainable source material for 3D printing.For good environment by recycling polylacticacid(PLA) type of plastics creates many useful material and creates recycled plastics into 3d printed medical prosthetic non invasive material*

Keywords- 3D printing , Recycling plastics, non invasive material, Polylacticacid ,Fused deposition modelling.

I. INTRODUCTION

The developing recycled plastics into 3d printed filament introduces zero plastic waste solutions. Plastic is a known non-biodegradable substance. Plastics generally have a low melting point, so they can't be used where heat levels are high. which may cause a serious impact on environment and ecosystem. Plastic also contributes to global warming.However, the chemical structure of most plastics renders them resistant to many natural processes of degradation and as a result they are slow to degrade.Thus we have made a recycling plastics into 3d prosthetic non invasive material such as splint.3D printing process is widely adopted in all type of industries includes pharmaceutical industry.3D printing is a process that creates a three dimensional object by building successive layers of raw material.

II. IDENTIFY, RESEARCH AND COLLECT

RESEARCH METHODOLOGY

Methodology used is Fused deposition modeling (FDM) is a material extrusion technique where a print head moves across two different directions in X- and Y-axes while plastic filament is melted and pushed through the nozzle to create a 2D layer. This process is repeated layer-by-layer untill the 3D object is complete.A process that turns recycling plastics into a 3d printing filament that can be used to print splints.This process introduce zero waste solution.

THEORY AND CALCULATION

The theory and calculation of recycled plastics into a prosthetic noninvasive material is a process that turns recycling plastics and 3d prints into a filament that can be used to print splints,braces and other medical devices. This process is a prototype mechanism, that grinds the plastic from the previous prints into semi-uniform pellets and a sifter to ensure that nothing too big comes through. These pellets were then put into an extrusion system, which is the machine that extracts the plastic filaments to be the proper diameter for the print.This prototype consists of materials such as a tractor’s steering wheel, filing cabinets and a blender.Those blended filaments are loaded into the 3d printer,and the desired prophetic non invasive material created.3d printing is a process that creates a three dimensional object by building successive layer of raw materials.The flexibility of 3d printing allows designers to make changes easily without the need to setup additional equipments or tools.It also enables manufacturers to create devices matched to a patient anatomy or devices with very complex structures.

MANUFACTURING STRUCTURES

The 3D-printing techniques have grown in the last decades starting from 1986 when the first stereolithographic (SLA) systems were introduced in practice. Seven are the technical processes related to the 3D printing. All that reported information about the technologies involved, the materials used, and the medical applications related to each process . A comparison among all the seven techniques is proposed in the same table showing the advantages and disadvantages related to all the processes. Each process uses specific materials with specific properties that relate to medical applications, which are also summarized in Table 1. This general information helps the users to better choose the right technology depending on the application needed.

These technologies and the related advantages enable the researchers to improve existing medical applications that use 3D-printing technology and to explore new ones. The medical goal that has been already reached is significant and exciting, but some of the more revolutionary applications, such as bio/organ printing, require more time to evolve .

ROLE OF 3D PRINTING IN MEDICAL FIELD

Used for personalized presurgical/treatment andfor preoperative planning. This will lead to a multistep procedure that, integrating clinical and imaging information, will determine the best therapeutic option. Several studies have demonstrated that patient-specific presurgical planning may potentially reduce time spent in the operating room (OR) and result in fewer complications . Moreover, this may lead to reduced postoperative stays, decreased reintervention rates, and lower healthcare costs. The 3D-printing technology allows to provide to the surgeon a physical 3D model of the desired patient anatomy that could be used to accurately plan the surgical approach along with cross- sectional imaging or, alternatively, modelling custom prosthetics (or surgical tool) based on patient-specific anatomy . In this way, a better understanding of a complex anatomy unique to each case is allowed . Furthermore, the 3D printing gives the possibility to choose before the implantation the size of the prostheses components with very high accuracy .

Customize surgical tools and prostheses: the 3Dprinting can be used to manufacture custom implants or surgical guides and instruments. Therefore, the customization of surgical tools and prostheses means a reduction of cost given by the additive manufacturing technique .

Study of osteoporotic conditions: following a pharmacological treatment, 3D printing is useful in validating the results achieved by the patient. This enables a more accurate estimation of patient’s bone condition and a better decision on the surgical treatment .

Testing different device in specific pathways: a clear example is the reproduction of different vascular patterns to test the effectiveness of a cardiovascular system used to treat peripheral and coronary artery disease . In this way, the 3D printing enables us to quickly produce prototypes of new design concepts or improvements to existing devices.

Improving medical education: 3D-printed patient-specific models have demonstrated that they can increase performance and foster rapid learning while significantly ameliorating the knowledge, management, and confidence of the trainees regardless of the area of expertise . The benefits of 3D printing in education are the reproducibility and safety of the 3D-printed model with respect to the cadaver dissection, the possibility to model different physiologic and pathologic anatomy from a huge dataset of images, and the possibility to share 3D models among different institutions, especially with ones that have fewer resources . 3D printers that have the capability to print with different densities and colours can be used to accentuate the anatomical details .

Patient education: patient-centered cares makespatient education one of the top priorities for most healthcare providers. However, communicating imaging reports verbally or by showing patients their CT or MRI scans may not be effective; the patients may not fully understand 2D images representation of a 3D anatomy. On the contrary, 3D printing may improve the doctor- patient communication by showing the anatomic model directly . Storage of rare cases for educational purposes: thisrole is closely linked to the previous one. This allows the generation of a large dataset composed by datasets of patients affected by rare pathologies, allowing the training of surgeons in specific applications .

Improve the forensic practice: in the courtroom, a3D model could be used to easily demonstrate various anatomic abnormalities that may be difficult to jury members to understand using cross sectional imaging .

Bioprinting: the 3D printing allows also the modelling of implantable tissue. Some examples are the 3D printing of synthetic skin for transplanting to patients, who suffered burn injuries. It may also be used for testing of cosmetic, chemical, and pharmaceutical products. Another example is the replicating of heart valves using a the valve’s stiffness [26] or the replicating of human ears using molds filled with a gel containing bovine cartilage cells suspended in collagen .

Personalized drug 3D printing: the 3D printing of drugs consists of the printing out the powdered drug layer to make it dissolve faster than average PILLS. It allows also personalization of the patient’s needed quantity .

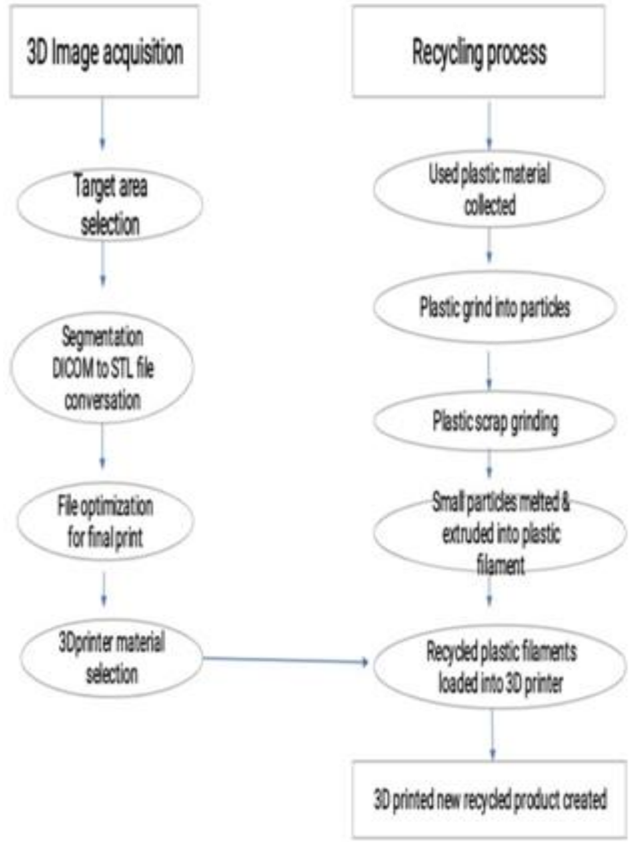
Customizing synthetic organs: the 3D printing may represent an opportunity to save life reducing the waiting list of patients that need transplantation Bioprinted organs may also be used in the future by pharmaceutical industries to replace animal models for analyzing the toxicity of new drugs

Therefore, these examples clearly demonstrated that 3D printing is one of the most disruptive technologies that have the potential to change significantly the clinical field, improving medicine and healthcare, making care affordable, accessible, and personalized. As printers evolve, printing biomaterials get safety regulated and the general public acquires a common sense about how 3D printing works.

III. RECYLED PLASTICS INTO 3D MEDICAL PROSTHETIC MATERIAL

Plastic recycling processes involves collecting, sorting, shredding, washing, melting, and pelletizing. Recycling of PLA plastics invloved in collecting of plastic cups,bottles,etc.Then collected plastics extruded into a plastic filaments and 3D printer is loaded .3D printer have done by FDM. Fused deposition modeling (FDM) is a technology is a melt extrusion method.Fused Deposition method is a material extrusion technique where a print head moves across two different directions in X- and Y-axes while plastic filament is melted and pushed through the nozzle to create a 2D layer.FDM is used to deposit filaments of thermal plastics according to a specific pattern. Similar to 3DP, the layout for FDM consists of a printhead able to build printed materials. And because FDM can print highly detailed objects, it's also commonly used by engineers that need to test parts for fit and form.The polymer is extruded through the heated nozzle and laid down as filaments according to the CAD design.

Finally have Created recycled plastics into 3d prosthetic non invasive material called Splints.



Figures and Tables

FIGURES 1.1 WAIST SPLINT

Formatting Tables

Polymer	Printing temperature	Bed temperature
Polylacticacid	210°C	50°C

IV. PROPERTIES AND USES

a. Engineering 3D printing materials are available with special properties, such as heat resistance,flame resistance, chemical resistance or that are certified as biocompatible or food safe.
b. Flexibility can be defined as either high elongation at break, where thermoplastics such as TPU are available in SLS and FDM, or as low hardness , where materials with a rubber-like feel are available for SLA/DLP and Material Jetting.

USES

a. Hand wrist splint is great for unstable wrist joints or periods of recovery from minor sprains or injury, these wrist splints. Customize to patients need.
b. It is a biodegradable, bio compatible material and Mainly processed from Renewable resources.
c. It is User friendly, also Very low deformation to the environment. Thus we can use in long term

V. RESULT AND DISCUSSION

In this project, finally produced a 3D printed non invasive wrist splint. it shows that 3d printing is a process that creates a three dimensional object by building successive layer of raw materials.The flexibility of 3d printing allows designers to make changes easily without the need to setup additional equipments or tools.It also enables manufacturers to create devices matched to a patient anatomy or devices with very complex structures.Although the plastic used in 3-D printing was biodegradable, it still took about six months to break down.Eventually, the goal is to turn used plastic bottles and cups into usable filament to create biomedical devices in the future.

VI. CONCLUSION

Overall, this project is possible to create medical used material called handwrist splint that can used in wrist joints or periods of recovery from minor sprains or injury .Recycling 3D process can aslo procduce products like plastic clear PPE face shield,face masks,chin trimmer, braces ,etc.It is a biodegradable,bio compatible material and mainly processed from renewable resources.It is a User friendly and also very low deformation to the environment.Thus it can be use in long term.Recycled plastics are also useful for laboratory and industry prototyping research whereas failed prototypes are recycled into filament for future work. In additive manufacturing will be increasingly prevalent to become a leading production tool. 3D printing perfectly fits the conception of the 4.0 Industry and will become unavoidable.As 3D printing solutions will lower production costs, their adoption rate within the industry will increase. It will produce "zero waste" plastic recycling solution for the betterment of environment.

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