

# ENVIRONMENTAL HAZARD - PLASTICS 3RD TECHNOLOGIES AGAINST "PLASTIC POLLUTION"

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## Abstract

This article discusses in detail the rapid development of the 3D modeling process, 3D modeling software, and the role of 3D printing technologies and materials in our lives. The wide range of uses of 3D printing, scope of possibilities, benefits and possible dangers are explained.

The "plastic-sand" material obtained from the new, environmentally friendly plastics of the modern era, its components, production technology were explained and the possibility of its use as a 3D printing material was suggested. Advantages and disadvantages of the material, areas of exploitation were investigated, suggestions were made about the already used and to be designed "plastic-sand" products.

The main goal of the article is to protect our countries from "plastic pollution" and to use plastic waste in recycling. One of the steps taken in this direction is the preparation of "plastic-sand" materials obtained from the recycling of plastic waste (containers, packages, boxes, etc.) and their use in 3D printers.

In this regard, since the protection of ecological safety of the environment is a very important issue, the article considers the design of new technologies for collecting and recycling plastics that harm human health and cause pollution of nature. Thus, a new proposal was proposed to produce "plastic-sand" material, to produce eco-friendly and low-cost products, important in our daily life, with an aesthetic appearance, complex shape and construction. The most important thing is to attract investors to open workshops and production facilities for the purpose of developing new technology in this field.

At the same time, the proposed project will protect the ecological safety of nature, and will allow to buy cheaper products.

**Key words:** Three-dimensional graphics, 3D printing, 4D printing, computer modeling, "plastic sand", "plastic pollution".

In modern times, there is almost no area where 3D modeling is not applied. 3D modeling is a computer-generated model of any object. This technology has already found its place in many fields, from games and cinema to medicine. 3D modeling is a method of mathematical transfer of a real object or objects to a computer [2, 3, 4, 6].

With the help of 3D modeling, it is no longer necessary to develop a physical prototype of the product before starting a project. This is an old method and an ineffective one. With 3D modeling technology, manufacturers can create a three-dimensional view of the product on the computer according to the shape and size, material and color, and follow the working principle. By preparing appropriate presentation materials, he can launch the product on the market in a short time.

3D modeling programs - making simple or complex models, two- and three-dimensional forms, giving them color shades is easy.

Three-dimensional graphics - mainly used in the creation of furniture and interiors, new clothing models, hairstyle design, advertising, computer games and video-reel collection, architectural objects and mechanical engineering, and other fields. Printing a 3D model of objects and purchasing them in real form is achieved with the help of 3D printers [2, 4, 5, 7]. The emergence of 3D printers in printing technology is constantly evolving as a revolutionary explosion in this field. Purchase of new materials, modernization of 3D printers leads to this printing process covering wider areas of the industry. Currently, 4D printing technologies are becoming popular.

The simplicity and ease of the process of selecting any product, material, and printing a visual image of any product designed with the help of 3D modeling programs - this technology leads to the spread and "occupation" of many areas of industry.

3D printing technology has been developing since the mid-1980s as a rapid prototyping technology. If we look at the development period of 3D technology, we can say that the invention of the stereolithography apparatus in 1984 sparked interest in these technologies, in 2000, the first 3D kidney print attracted the attention of the media, and since 2013, 3D printing has been widely distributed [ 6].

Currently, 3D printing is not only about prototypes and industrial production. Amateurs and scientists can produce products of any model and design with this technology. So, it can be cheaper and more profitable for the consumer to use this field in everyday life.

### Advantages of the 3D printing process:

- environmental cleanliness, simplicity, easy processing, quick and cheap printing of the product;
- printing time and costs;
- automatic execution of the model transferred to the printer's memory during the printing process;
- almost no material loss;
- recyclability of products from these materials;
- produce complex constructions;
- the possibility of reducing the number of details of complex assembly parts;
- the ability of everyone to easily create objects of various shapes, even at home.

### Areas of use of 3D printing [ 2, 3, 4, 5, 7, 8, 10]:

The main advantage of 3D printing is that anyone can easily create objects of various shapes, even at home. For this, factories, factories and workshops, installed huge machines are not needed. Printing is quite simple with modern cheap and small desktop 3D printers. 3D printing is already developing, so with its help, we can make all kinds of things, objects, tools, etc. that we need in our daily life. can be printed: make the child happy with a new toy, the door refurbishing a broken support, custom designed mugs, ornaments, shoes, etc. print. Why not! Instead

of going to the store for such small things, spending time and extra money - everyone can print the item or clothing they want according to their taste cheaper and faster.

Currently, 3D printing is used in medicine, architectural model printing, shipping, creating costumes and clothing, making maps, obtaining beautiful visual aids for educational institutions, making molds for special jewelry models, etc. widely used in fields.

### Programs used for 3D printing [ 8, 10]:

There are many 3D modeling programs available today. Among them, the most used and highly rated programs are AutoCAD, ZBrush, 3DS Max from Autodesk, Blender.

### The working principle of 3D printing [9, 13, 14]:

working principle of 3D printing is similar to the printing process of a conventional printer. At this time, you need a 3D model, 3D printer and 3D material. 3D printing is based on layer-by-layer assembly technology of various materials:

- First, there is a preparatory period. At this time, the 3D view of the model is either designed on the computer, or it is downloaded to the computer, designed, processed and prepared for printing.

During the print preparation process, the material and color of the model are selected, the 3D view is divided into hundreds or thousands of layers using CAD programs - the "slicing process" is carried out, *i.e.*, model fold It is prepared for 3D printing and the printing parameters are selected. If you need to make any changes to the model during this period, it is possible to easily and quickly make changes to the 3D view on the computer:

- After the model is configured during slicing, the information is sent to print. File transfer to the printer is done via USB, SD or Wi-Fi and the printing process starts. According to the given commands, the printer automatically creates a 3D model of the object by stacking a layer of material.

### Materials used in 3D printing [11]:

The materials used for 3D printing are as varied and colorful as the products being printed. The form of the manufactured product. There are different types of material according to size and texture and operating conditions.

They can be divided into basic materials (plastics of various composition), engineering materials (high temperature resistant, weather resistant, composite, special purpose) and design materials.

3D models can be printed from plastic, concrete, hydrogel, metal, paper, wood, even living cells and chocolate. Let's consider a few of them:

#### **ABS plastic:**

one of the best consumables for 3D printing. It is an odorless, non-toxic, impact-resistant and flexible material with a melting point between 240°C and 248°C, either in the form of powder or thin plastic threads. 3D models made from them are durable, but very sensitive to light rays from direct sunlight.

**Acrylic:**

It is a material used to create transparent models, which cools and hardens very quickly, with a higher melting temperature than ABS plastics. When it is heated, it spoils the visual appearance of the finished product, as a large number of small air bubbles appear in it.

**Concrete:**

Currently, test samples of 3D printers for printing with concrete have been prepared. These are giant printing devices that painstakingly “print” construction details and structures from concrete, layer by layer. Such a 3D printer can “print” a two-story residential house with a total area of 230 m<sup>2</sup> in just 20 hours. In this case, improved concrete is used, which is 95% identical to ordinary concrete.

**Hydrogel:**

5-10 mm long biorobots have already been printed from this material in the USA. In the future, it is planned to inject these robots into the human body and use them to detect and neutralize tumors and toxins, as well as to deliver drugs to their destination. These robots move at a speed of 236 micrometers per second as a result of contraction of heart tissue cells drawn on their surface.

**Nylon:**

A slippery material with high printing temperature (about 320°C), water absorption, longer cooling time, successfully used in 3D printing. Parts made from it are not as rigid as parts made from ABS plastic.

**Other materials:**

Currently, 3D printers designed to print models of various shapes and textures using clay, lime dust, food, living organic cells and many other amazing materials have been developed and are being developed.

The possibilities of 3D printing are diverse, the materials used are numerous. In the near future, the use of new materials for 3D printing will lead to the creation of new printers. One such new material is “sand-containing plastic”.

**Gum-containing plastic [12, 13]:**

Currently, scientists all over the world are working on creating polymers that quickly, safely and naturally break down in a short period of time by changing the structure of plastics and adding various additives. Unfortunately, it has not been possible to buy such functional structural forms yet, and even if they are bought, their production is very limited due to the high cost. The waste is increasing and causing “plastic pollution” of nature. For now, the only way out to reduce the environmental threat remains on the agenda as the issue of collecting and destroying used plastics.

Plastics in general are very convenient as a recycling material. Recycling of single-use plastic containers is already underway in some foreign countries. Industrial use of plastic waste has long been experienced in Europe. Various products can be obtained by mixing these wastes with other materials. Since 2021, in many regions of Russia, the purchase of “plastic-containing plastic” materials and their use in the manufacture of benches, trash cans and tiles.

### **Components of the material and manufacturing technology:**

Plastic materials are durable and reliable. Plastic sand materials are obtained from a mixture of environmentally friendly types of plastic waste with sand. Its composition includes plastic, sand and paint. As raw materials - from plastic waste, different plastic drink containers are used. They do not need to be cleaned during secondary processing, to be cleaned of labels and food residues, as all excess substances are burned without leaving a trace during recycling.

In addition, polyethylene bag to make the material flexible and long-lasting or films, plastic boxes and containers can also be added.

Polyethylene gives the material a special shine, and soft polymers increase the plasticity of the material. Material without soft polymer is brittle.

Plastic In order to ensure the optimal hardness of the material, the amount of plastic and polymers in the raw materials should be in the following ratio:

- soft plastic - 40%, hard polymers - 60%.

The main second component of the material is sand. The sand used must be free of impurities. Sand

drier it is, the less time it takes to prepare the product. The quality of the finished product depends on the mixing of sand and plastic in the form of a completely uniform mass.

The third component is paint. Addition of dyes improves the aesthetic appearance of the product. If no paint is added to the material, the product will be dirty gray in color. Usually, inorganic dyes are used.

components that make up the gum-containing plastic material should be taken mainly in the following proportions:

- sand - 90%, polymers - 9%, paint - 1% (may or may not be added).

Gum-based plastic is an inexpensive, environmentally friendly material. Because the raw materials used are cheap and plentiful, and plastics are environmentally friendly waste.

Therefore, details and parts made from this material will be products that do not harm human health. Collecting the waste used for their preparation and handing it over to specially created workshops will help to protect nature from "plastic pollution".

Currently, tons of plastic containers, packages and boxes are thrown into the garbage in Azerbaijan. Their collection and recycling will be one of the steps taken to protect the beautiful and rich nature of our country.

### **main mechanical indicators of plastic containing gum:**

- high strength and resistance to eating, resistance to moisture, the ability to maintain its properties at extremely low temperatures, relatively low weight, resistance to chemical effects, longevity, ease of mechanical processing, aesthetic beauty, color and shape do not lose due to the influence of sunlight.

### **of gum-containing plastic, range of possibilities:**

As we said, seats for parks, litter boxes, and floor tiles have been made and put into operation from this plastic material.

Taking into account the properties and ecological purity of the material, they can be used in the preparation of garden furniture, decorations, fences and pavements.

suitable for offices, facilities, public buildings' courtyards.

Environmental cleanliness, colorfulness, the possibility of mechanical processing, the ability to obtain complex shapes and designs from these materials can become one of the materials used in the preparation of playgrounds and playgrounds with unusual shapes and constructions for children's kindergartens and entertainment centers.

Their resistance to sunlight and cold makes it possible to use them in the construction of game tables, seats and couches, swimming pools and floors, and construction of bus stops.

### 3D printing technology for gum-containing plastic:

It is becoming a trend to collect, clean, melt and re-form the plastic waste of various industries into wire form (thread-shaped). The capping process for gum-based plastics is similar to the process used to 3D print houses. [9, 11, 14]

The only difference is that printing is done at high temperatures. First of all, a three-dimensional computer model of the product should be designed, the color of the material, and the sequence of the printing process should be determined. Then, in special ovens, plastics should be melted to the required consistency and transferred to the mixing unit together with sand and paint. Here, at 200 °C, the material consisting of plastic, sand and paint should be fully mixed and loaded into the printer's hopper, and then transferred to the printer's head and start the printing process. At this time, the printer will automatically print the given model according to the command received.

### Summary:

3D printing is the new technology of our daily life.

Our daily life cannot be imagined without plastic materials. Every day, people regularly use plastic containers for packaging food, fruits and vegetables, heating food in microwave ovens, and storing solid oils and drinks, regardless of the type of plastic material, whether it is environmentally friendly or harmful. After use, plastic containers are thrown into the trash.

Since most plastics are made from chemicals derived from oil, their structure cannot be broken down naturally. These materials are not subjected to biological decomposition for a long time, and in some cases even for centuries, mixing with the fertile layer of the soil, hindering the development and productivity of plants and causing damage to nature. Recently, the environmental problems caused by plastic waste have caused "alarm bells" to be sounded. Currently, the way out of the situation is only in the collection and destruction of plastic containers. However, at this time, the problem of placing the accumulated waste and how to destroy it arises.

Considering all this, we come to the conclusion that the only way to get rid of plastics is to recycle them.

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