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COFFEE GROUNDS AS A RESOURCE: PROSPECTS OF USING WASTE TO CREATE ECOLOGICAL BIOCOMPOSITES

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Many manufacturers today offer a wide selection of products based on composite materials that include fillers of natural origin. Their use became a reaction to the problem of serious plastic pollution of the planet and aimed at improving the environmental situation in general. The development of biocomposite mixtures based on bioplastics, which include secondary raw materials of plant origin, has become an actual direction of modern materials science [1]. This allows for the use of secondary resources and reduces the use of polymers that have a negative impact on the environment and are made on the basis of exhaustible resources such as petroleum products.

Biocomposites based on bioplastics, containing secondary raw materials of plant origin, have a significant advantage, which consists in their high biodegradability. This means that they can be decomposed into safe components over time, which distinguishes them from classic polymers, which require special processing technology. Polymers from petroleum products can decompose in a landfill for several thousand years, contaminating water and soil with harmful substances during the process. In the case of biocomposites with secondary raw materials of natural origin, their disposal is quite simple, because they decompose into environmentally safe components within 5-10 years.

As a binding component in composite materials, PLA (polylactide) can be used, which is obtained from renewable plant resources, such as corn, sugar cane or sugar beet. This material is gaining popularity in 3D printing and packaging due to its environmental friendliness and biodegradability.

There is a wide variety of dispersed fillers that can be used in composite materials containing secondary raw materials of plant origin. These fillers can be obtained by processing plant materials, such as: coffee grounds; coconut coir; crushed mechanically dried leaves of trees or stalks of grain crops, etc.

The daily consumption of coffee around the world results in the generation of a significant amount of coffee grounds waste, which usually ends up in landfills, contributing to environmental pollution (Fig.1). This organic material, which remains after brewing coffee, becomes an unused resource, although its potential can be realized in various environmentally friendly productions, in particular for the creation of biocomposites. Due to the large volume of coffee grounds produced as a by-product, processing them into useful materials could help reduce waste and contribute to the development of a green economy.

Figure 1 - Coffee grounds

Thus, the prospect of using coffee grounds in biocomposites is promising for sustainable development and solving environmental problems. This makes it possible to reduce the dependence on polymers made from petroleum products, reduce the negative impact on the environment and contributes to the transition to a green economy.

Coffee grounds are an affordable material that can be easily processed into composite materials. It is a cheap and renewable resource that allows you to significantly reduce the cost of production of biocomposites. When used in combination with plant-based biopolymer PLA (polylactide), coffee grounds add strength to materials and allow them to decompose naturally. Biocomposites with coffee grounds can be used in 3D printing, packaging and other industries where strength and biodegradability are important [2].

The use of biocomposite mixtures based on biopolymer materials reinforced with natural fibers requires a new generation technique that has high operational characteristics, reliability and durability. Devices that meet these characteristics include 3D printers. Biopolymer materials and natural fibers crushed in special equipment to finely dispersed fractions can be raw materials for for them.

In the future, it is planned to create a 3D printer that prints with biocomposite mixtures based on bioplastics filled with products of processing of secondary raw materials of plant origin, namely coffee grounds. Further improvement and development of printer components (especially the extruder), and research into its optimal operating modes will make it possible to process biocomposite mixtures into finished products.

The proposed 3D printing technology using the specified composite mixtures opens up new prospects for application in many industries and has significant potential for increasing production efficiency.

References

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