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FORMATION, ACCUMULATION AND DISPOSAL OF POLYMER WASTE IN THE REPUBLIC OF BELARUS

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This paper analyses the existing situation in the field of polymer waste management in the Republic of Belarus; and a comparative analysis of recycling processing methods (disposal) in Belarus and Western European countries is given.

Keywords: polymer waste, chlorinated plastic, biodegradation of plastics, bisphenol, polystyrene particles, accumulation, sorting, recycling.

One of the results of anthropogenic activity is the formation of waste, polymer waste occupying a special place. Plastics account for 18-30% of municipal waste in industrialized countries. They form about 260 million tons of waste with an annual increase of 5-6%. Polymer waste consists of 34, 20, and 7 per cent of polyethylene, polystyrene, and polypropylene respectively.

Chlorinated plastic can release harmful chemicals into soil, which can then leak into groundwater or other nearby water sources.

Landfill areas are constantly heaped up with many different types of polymer waste. They have a lot of microorganisms that accelerate plastic biodegradation. Considering biodegradable plastics, decaying process proceeding, methane (a greenhouse gas) is released. This has a significant negative impact on the environment.

A considerable amount of polymers enters the oceans, it has also been estimated that they make up about 10 % of the beach cover worldwide. Plastics in the oceans usually decompose within a year, and the process implies that toxic chemicals such as bisphenol and polystyrene can get into the water. According to 2016 estimates, there are 268,940 tons of plastic on the ocean surface, and the total amount of plastic debris is 5.25 trillion tons.

Polymer waste contamination can cause animal poisoning, which, in turn, can negatively affect the supply of food to humans. Polymer pollution has been described as having very detrimental effects on large marine mammals [1].

In the composition of waste generated in our country, the share of polymers is growing; and only a few types of plastics are actually processed. According to experts, the content of plastic in household waste of the residents of Belarus is 7 % of the total weight. According to some data only 17 to 30 % of total plastic waste is recycled in Belarus.

Food packaging is the main source of plastic waste. The attempts to reduce the amount of packaging when shopping convince us that the bulk of its share falls on food, where the proportion of polymers can reach up to 90 %. It should be noted that recycling of “food” polypropylene and polyethylene; polystyrene; and Tetra Pak packaging is the most problematic.

Polyethylene and polypropylene bag recycling is difficult due to the complexity of sorting. Recycling of "food" polyvinyl chloride (PVC) and polystyrene is also difficult as they crumble during transportation, pressing and washing; they are sensitive to organic impurities, which can provoke their decomposition during the processing. Food containers made of these polymers have difficult-to-separate labels and often heavily contaminated with food residues. No more than 20 % of polypropylene which ends up in recycling bins is recycled.

The analysis of plastic waste recycling methods shows that there are quite a lot of technological solutions of the problem. The recycling can be mechanical, chemical and thermal. Thermal methods include pyrolysis, hydrolysis, glycolysis, methanolysis) [2].

In this regard, in the near future it is necessary to accelerate the analysis of the existing state of polymer waste management in the Republic of Belarus, and the selection of acceptable processing methods (disposal) of these substances.

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SYSTEM OF AUTOMATIC MICROCLIMATE CONTROL AND REGULATION IN A ROOM

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The system of automatic microclimate control and regulation in a room is a system that maintains the necessary air temperature in a room, and regulates temperature changes in a “day-night” and “summer-winter” cycles.

Keywords: automation, microclimate, microcontroller, Arduino, relay.

Nowadays electronic devices play a predominant role in people’s lives. Almost every inhabitant on Earth has a mobile phone in his pocket. What is more, most of them have a smartphone with an Internet access. A person can use a web browser or an app any time to see the weather forecast for today, tomorrow or for the next week. With popularization and intensive development of the Internet and programming technologies people adapted the global network in order to make household routine easier. The examples include smart vacuum cleaners that help to clean a house, waste-picking robots, that simplify the collection of waste in the streets, smart houses with light, curtain, sound system, and TV set controlling systems. All these can be defined by a recently appeared term “ the Internet of Things”. The Internet of Things is a set of things that are connected into one system. The control unit can manage any of the connected nodes. Lessening of our involvement in everyday routine processes has reached such a degree that sometimes we do not take into consideration the radiation emitted by devices. By the way it can be the reason for a person’s feeling bad and for the reduction of life quality. For reducing the negative influence of devices on the people’s health one should follow some basic rules: a room should be regularly ventilated and the recommended air temperature balance should be maintained. Some research were conducted to form the norms of most favorable temperature for a person’s optimal productivity. That’s why there is a need for creating a system that would simplify the microclimate control indoors.

The system components include: a board based on the Arduino Uno microcontroller, a Relay Module with several channels, a resistor of different resistance characteristics. The system control is possible with the help of the Arduino Uno microcontroller. Arduino Uno is a printed circuit board based on the Atmega328P microcontroller (Image 1.). 6 analog inputs, 14 digital outputs, and a 16MHz crystal oscillator are placed on the board. The device can be powered in three ways: via a USB port, via an external power connector, or via a VIN connector.

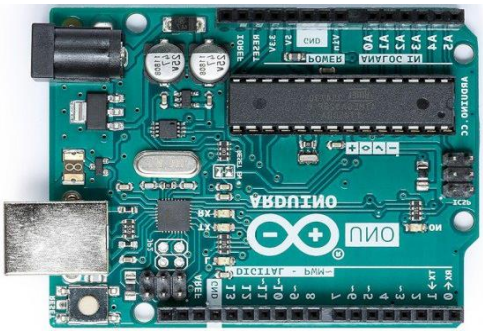

Image 1. – Arduino UNO

A set of DS18B20 sensors is used for measuring air temperature at a particular interval, and the system corrects the work of an air-conditioner using the previously received data.