Technology of production of environmentally safe road pavements with new content by recycling tires

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Abstract: This scientific article proposes the technology of recycling tires and obtaining an environmentally safe finished product. In this, the technology of creating road pavements with a new composition through the composition of secondary tire shreds and interactive phosphogypsum components has been developed. Technological processes, new methods, ingredients are studied in the article. Researched in chemical methods.

1 Introduction

Today, in the world, powdery carbon materials are used in the production of many high-strength high-molecular compounds and products, and are used in chemistry, food, mechanical engineering, aviation, electrical equipment, and military equipment. It is important to create powdery carbon materials that form the structure of the products obtained on the basis of high molecular compounds based on the technological, physical-mechanical and dynamic properties according to the given requirements. In order to improve the technological, technical and specific properties of products based on high molecular compounds in the world, it is necessary to create carbon materials, to modify the ingredients of compositions based on high molecular compounds, and to use them in various conditions, with high resistance to organic acids and solvents, radiation, heat, cold. and scientific researches are being conducted to create the scientific basis of production of friction-resistant technical products, composition composition and production technologies. In recent years, in order to supply the chemical and food industry, land, air, water transport and agricultural machinery with technical products based on high molecular compounds (rubber-technical products, transpartition tapes and tires, polymer products), increasing production products, technological process several works are being carried out in terms of improvement, increasing the quality and quantity of manufactured products, creating new reserves of raw materials. In the "Strategy of Actions" for the further development of the Republic of Uzbekistan, the task of "creating import-substituting technologies from local raw materials and secondary resources" is defined. In this regard, in order to improve the technological, technical and specific properties of products made on the basis of high molecular compounds, it is important to carry out scientific research on the technologies of obtaining powdered

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carbon materials based on local raw materials and the creation of composites with pre-planned properties by adding them in the works [1, 2].

Sawdust from recycled tires is widely used. We will consider the following main areas of use of this material. The number of cars moving on the roads of our country is increasing day by day, and as a result, the amount of used tires is also increasing. At this point, a natural question arises: what to do with these tires? So how do you recycle tires? Most people simply throw tires in the garbage, which in turn creates huge waste piles and poses a threat to the environment. With the help of a mobile plant for the processing of automobile tires, it is possible not only to empty large areas of tires, but also to obtain the necessary raw materials (rubber flakes, metal) from them. Tire recycling is also important because even a very old tire can be used as a good polymer raw material. During the construction and reconstruction of highways, it is necessary to take environmental protection measures. When adopting technological solutions in production, it is necessary to take into account not to harm the environment, not to disturb the balance of nature, and not to create a risk of changing ecological, geological, hydrological and other natural conditions. It is forbidden to carry out drainage, drying and leveling works that damage the layer of grass growth outside the area allocated for road construction in the works [3].

In the works [4-7], the influence of the properties of materials on the motions of nonlinear mechanical systems was studied. Expressions of modal mass and modal stiffness were used to solve the problems of reducing harmful vibrations at low and high frequencies. Conclusions were obtained as a result of numerical calculations.

2 Methodology

Environmental damage caused by the construction of temporary structures and construction transport roads in the area designated for road construction, as well as in places where cars are parked, materials are stored, and other lands designated for similar purposes must be eliminated before the road is put into use. When choosing production methods and mechanisms, it is necessary to completely eliminate or reduce as much as possible other damages to the environment and land, causing pollution, in compliance with the relevant sanitary norms, the permissible norms of waste polluting the environment and water bodies. Warehouses where organic binding materials are stored must be provided with heating devices to heat and maintain the same temperature of binding materials and oils stored in bitumen pipes and taps, bitumen pumps and bitumen boilers in the works [8, 9]. Stone materials (pebble, gravel) should be unloaded as much as possible into hopper (semi-bunker) devices around the rail or closed warehouses.

Asphaltobeton, cement concrete (ABZ, TsBZ) plants, in the yards of mixing plants, in railway and coastal warehouses, the surface of the areas where mineral materials are stored should be covered with a hard coating, ensuring water drainage. Construction of the road surface layers should be done only on a properly accepted, ready, moisture-free and solid road base layer. When the base and cover of the road surface is prepared by processing with binding materials, it is laid on the surface of a dry and clean layer, when processing with organic binders, the sublayer must be unfrozen. Before laying each layer of the road surface, it is necessary to measure their border and height mark and tie them in place with piles in the works [10, 11]. When machines equipped with automated tracking parts are used, the height and boundary are determined by means of wires stretched taut from one or two sides of the layer being laid. Placement of signs and control of their correct execution is carried out with geodetic instruments. In the winter season, it is allowed to carry out the construction of road surface layers only on the base of the road, which has been fully completed and accepted before the onset of cold weather in the works [12, 13].

3 Results

It is necessary to use the method of continuous construction in the entire length of the roads, or in its parts, as well as in the execution of certain types of road construction works. If the construction objects are scattered, short in length, and the performed work is the same, specialized continuous working groups should be organized, which alternately move from one object to another, and they should usually be in the complex of the unified organizational system of the road construction organization in the works [14, 15]. The speed of successive construction, the size of organizational and technological breaks between certain stages of work, is accepted as a result of comparison of technical and economic options, taking into account extremely complex and labor-intensive construction processes and other organizational and economic factors (readiness of technical resources and the level of their use, to be able to use resources quickly and wisely, to use devices and materials that mechanize the construction process as much as possible, to use existing materials on the premises, etc.) in the works.

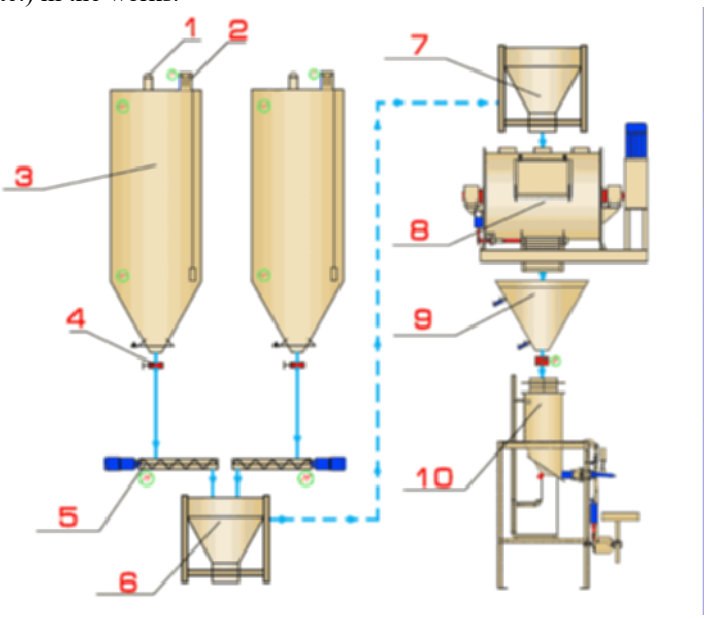

Fig. 1. Obtaining a finished product from secondary tire shavings.

The total moisture content of phosphogypsum is up to 45%, therefore phosphogypsum was heated at a temperature of 1500 C for 1 hour before use, crushed and reduced to a powder state and then used. As an additive, sand with a particle size of 0.2-0.25 mm is used. We made KM by mixing PPK and fillers together and sampled them by pouring them into molds. Because it helps them to study their chemical and physical-mechanical properties.
Before laying the road surface in winter conditions, it is necessary to clean the surface of the intermediate work area of the road base or the lower layer of the pavement from snow and ice. It is forbidden to carry out the specified works when it is snowing and during a blizzard, as well as when the ice begins to melt (Table 1).

Table 1. Line characteristics.

The standard composition of the line:
1- Main shredder hole

2- Reactor vibrating separator,
3- Thermal reactor, rotor magnetic separator
4- Measuring transmitter, flywheel
5- A magnetic separator that separates the metal part of tires
6- Shredder for hard cutting (Conversion to dispersed phase)
7- Double Roller Grinder (Making Ingredients Blend)
8- A device for ensuring the interconnection of solid mass substances
9- Sampling tape
10- Rotary Vibration Separator (Ensures Component Bonding)
Technical parameters:
Production capacity: 10,000 tons per year, 6,000 hours
Building: 500 m^2 and 5 meters high
Raw ash or: tires with a diameter of 1200 mm and a width of up to 380 mm
Finished product type: 40 mesh (0.98mm) rubber powder
Management: up to 6 people in one shift.
The following is required for the line:
1) A set of air compressors
2) 220 m^3 pool and multiple pumps or two sets of 10 m^3 air-cooled stand.
* Sample indicators of technical parameters are given. They can be changed based on customer requirement.

One of the ways to improve the complex properties of interpolymer materials (IM) is their modification by adding various additives to their composition. This, in turn, improves the strength, hardness, heat resistance, water resistance and a number of other important properties of the material. One of the ways to improve the complex properties of interpolymer materials (IMs) is physical modification by adding various fillers to their composition. This results in improved IM strength, hardness, heat resistance, water resistance, and a number of other important properties.

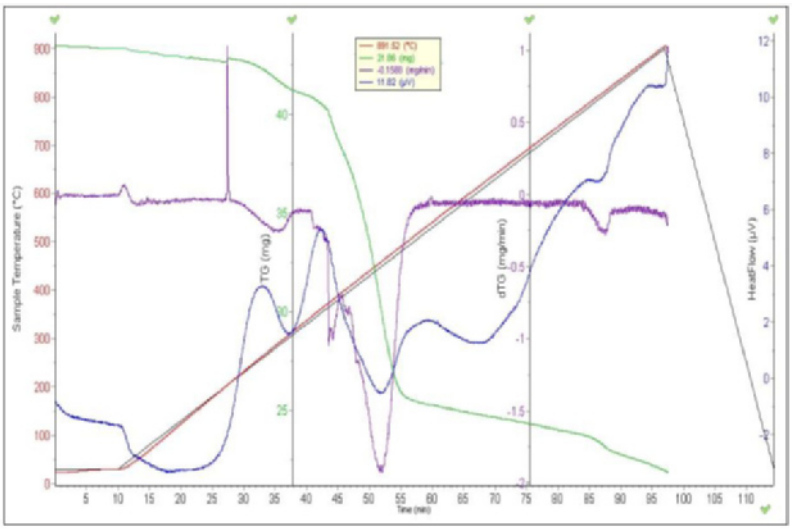

Figure 2. Differential thermal analysis of tire sawdust

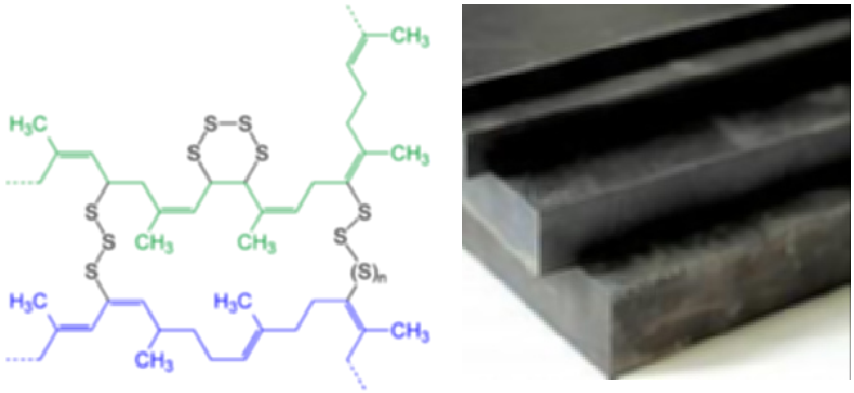

Figure 3. Road tile obtained from chemical composition and experimental testing of rubber compound

Modification methods are used to improve the properties of polymer-polymer complexes and to expand the directions of their use. In order to improve the complex properties of composite materials (CMs) made from PPKs, various components are included in them. Complements are modified by insertion. In this case, the physical and mechanical properties of KM: strength, hardness, heat resistance, resistance to the effects of water and aggressive substances in it, and a number of other important properties change in a positive direction. It has been mentioned in the literature that it is possible to control the properties of polymer-polymer complexes (PPKs) by changing the nature of the intermolecular bonds of the interacting components. As a result of the reaction of starting materials in equimolar equality, PPKs are formed, and non-stoichiometric complexes (NIPKs) are formed by increasing the amount of one of the starting materials.

4 Discussion

The apparatus used to determine the flash and ignition temperature of compositions in an open crucible (Brenken method) consists of: 1) a metal or porcelain crucible with a height of 46 mm and a diameter of 58 mm; 2) sand bath; 3) 250-360°C thermometer divided into 1°C degrees; 4) fire extinguisher. Oil to be tested is placed in the crucible 12 mm (if the flash temperature is lower than 210 °C) or 18 mm (if it is higher than 210 °C) from the lower edge of the crucible. The crucible was heated on an electric plate, connected to a rheostat. At the beginning, the temperature rate was 10°C in 1 minute, and then, when adding 40°C to the estimated temperature, the heating was reduced and the rate of increase was 4°C in one minute. Using a flamethrower, each 2°C increase in temperature was checked for 5 seconds until a blue flame was formed on the surface of the oil, and the flash temperature was determined from this.

The instruments used to determine the flash point of compositions in a closed crucible are: a closed metal crucible located in a cast iron bath with a brass jacket. Consists of two-hole crucible lid, thermometer hole, burner, spring-loaded handle and stirrer.

For this purpose, the oil in the tool was heated at a temperature rate of 5-8°C per minute for oils with a flash temperature of 50-150°C, and 10-12°C per minute for oils with a temperature above 150°C. It is heated at a temperature of 2°C/min when it is 30°C before the ignition temperature, and 1°C/min at 10°C, and turning the knob to 1°C, the sinking flame is observed until the formation of a flame, and the resulting temperature is determined. When the test is carried out at barometric pressure, if it differs from 0.1 MPa (760 mm.s.g.) to 0.01 MPa (15 mm.s.g.), the flash temperature T,°C is calculated using the following formula (1) :

$$T=t+0.25(101.3-P) \quad (1)$$

where, R is the barometric pressure when determining the flash temperature, kPa; t is the observed flash temperature at R-pressure, °C.

The method of determining the amount of sulfur in the composition is carried out on the POST-2M instrument in accordance with State Standards (GOST 1437-75). The test oil is drawn with an accuracy of 0.0002 g and placed in a special porcelain container, and in relation to the amount of sulfur obtained, it is obtained:

sulfur content, % 0-2 2-5

extractable oil, g 0.2-0.1 0.1 - 0.05

The tire composition in the container is sprinkled with crushed and pre-dried clay, placed in a quartz tube and burned in an oven at a temperature of 900-950°C for 30-40 minutes and heated in the heated part (center) of the oven for 15 minutes. The quartz ring is then washed with 25 ml of distilled water, placed in a receiver and titrated with 0.02 sodium caustic solution in the presence of 8 drops of mixed indicator until it changes from an inky solution to light green. The amount of sulfur (S) in percent is calculated by the following formula (2):

$$S=(0.00032(V_1-V_0)100)/V_1 \quad (2)$$

in which, the amount of 0.00032-sulfur, 1 ml. 0.02 caustic sodium solution, V_0 is the volume of 0.02 N caustic sodium solution used for titration in the control experiment, ml; V_1 is the volume of exactly 0.02 N caustic sodium solution used in the titration, ml; ml is amount of oil, g.

Control of the quality of works: When the foundation and coverings are built from reinforced soils, the following are additionally controlled:

- at least once per shift: - the granulometric composition of coarse and sandy soils according to GOST 12536;
- plastic number of clay primers according to GOST 5180;
- degree of crushing of clay soils, when sifted in a sieve with a hole of 5 and 10 mm;
- previous temperature when using organic binders;
- appearance of emulsions in one place, without layers;
- the quality of the mixtures obtained by the method of testing the compressive strength of the sample;
- the temperature of the mixtures stored in the stack at an additional depth of 0.2-0.5 m, at least every 200 m;
- the moisture content of the treated soils and ready-made mixtures before compaction and the cross-section of the compacted material at 3 points (axis and at a distance of 0.5 m from the edge of the layer) density and their compliance with the requirements of paragraph 4.79: At least 1 time in 5 shifts;
- the mass of soluble salts in saline soils according to GOST 25100;
- suitability of fly ash and fly ash mixtures;
- maintenance requirements were constantly checked.

5 Conclusion

Gas is supplied to the pyrolysis device and nozzle, and about 800 kg of wood waste is burned with gas mixed with air. The air mixture allows to maintain the working temperature up to 550 C°. Pyrolysis gases (formed from the decomposition of tires) exit through the tube (crucible) for heating the raw material. The process of thermal decomposition of raw materials (used car tires) is carried out without the introduction of air. After the raw material is heated and brought to working temperature, a large amount of gas is released as a result of

thermal decomposition. The released gases are sent to the heat exchanger for condensation through the connecting pipe. The hydrocarbon fractions separated (formed) when the rubber is heated are sent from the retort to the heat exchanger (condensation of pyrolysis gases), then the hydrocarbon fractions are cooled, condensed, and as a result, liquid pyrolysis turns into fuel.

There is a constant accumulation of old used tires. Only 20% of their total number is processed. Used tires are the largest production of waste products containing polymers that do not undergo natural decomposition. Therefore, recycling and recycling end-of-life tires are of great economic and environmental importance. It is also a profitable business.

Old tires are a valuable polymer raw material: 1 ton of tires contains about 700 kg of rubber, which can be reused in the production of fuel, rubber products and construction materials, and many other purposes. The problem of tire recycling is very acute and old tire recyclers are often asked to accept tires for recycling. There is a constant accumulation of old used tires. Only 20% of their total number is processed. Used tires are the largest production of waste products containing polymers that do not undergo natural decomposition. Therefore, recycling and recycling end-of-life tires are of great economic and environmental importance. It is also a profitable business.

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