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(54) **PLASTIC ROAD PLATE AND THE METHOD OF ITS MANUFACTURE**

(57) Plastic road plate of a cuboidal shape containing four transport through-holes with rectangular longitudinal-section, located near the corners of the plate; its thickness varies from 100 mm to 250 mm, and the plastic used is heterogeneous plastic waste - light and heavy plastics, a combination of lightweight and heavy plastics, PVC or rubber from used tyres. Method of manufacture of the plastic road plate, characterised by the fact that the plastic used is plastic waste; the method consists of the following stages: a) shredding of plastic waste; b) pre-washing of plastic waste; c) production of plastic mass by melting plastic waste chosen from the group composed of lightweight and heavy plastics, their combination, PVC, or rubber from used tyres in a temperature varying from 150 to 280°C and injecting the aforementioned plastic mass to a previously prepared mould tilted at angle α towards the ground, where α equals 15-35°; d) solidification of the moulded plastic plate.

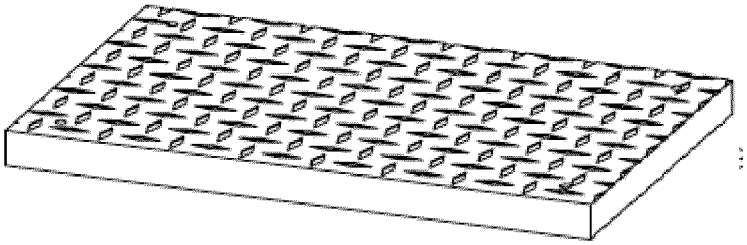

Fig. 1

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Description

[0001] The subject of the invention is a plastic road plate and the method of its manufacture.

[0002] Various methods of manufacturing road surfaces with the use of waste materials are known from the prior art.

[0003] Document KR102306757 B1 concerns the use of waste plastics to manufacture pavement blocks and construction materials. The disclosed plate is made out of waste plastics shredded by grinding them to the form of particles and of a waste plastics binder. The particles are created by grinding waste plastics and a binder of undefined composition, which includes silica, which creates a homogeneous binder mass with visible particles. The road plate might be made up of two layers, where the first layer consists of particles of the first waste material and the binder (or a binder with cement and/or calcium carbonate), and the second layer consists of particles of the second waste material and the binder. Whereas the disclosed method of manufacture of the aforementioned plate consists in rinsing plastic and shredding it to the form of particles by grinding, which then are mixed with a binder in the form of waste plastics with an agitator. All of the above components were mixed uniformly at the temperature of 30°C. Then, the mixture is moulded by injecting it into a mould. The last stage consists in drying the moulded product for 15 minutes in a far infrared dryer in order to prepare pavement bricks.

[0004] Report KR20070039711 A discloses the method of manufacturing pavement bricks out of synthetic resin waste with the use of urethane rubber waste and waste plastics from the synthetic resin waste. After the selection, the waste is divided and crushed with a grinding machine and then pulverised with a pulveriser. The pulverised waste is dried at a temperature ranging from 30 to 50°C for 10-20 minutes with a hot air blower. The product of that process is a primary mixture containing 10-20% wt. of polyurethane and 1-10% of sun protection preparation and 70-89% wt. of waste powder of urethane rubber and a secondary mixture containing 10-20% wt. of polyurethane, 70-84% wt. of waste powder from plastic, 1-10% wt. of flame retardant and 5-10% wt. of dye. The primary mixture is moulded into the main plate and the secondary mixture is moulded into the bottom plate. Then, at a temperature ranging from 150 to 180°C, the block press is moulded by hot pressing for 20 minutes. After an inspection, the manufactured blocks are packed.

[0005] Report CN111688064 A discloses the method of manufacturing block material from waste plastics of any origin. The sources of used waste materials include: different types of plastic materials/nylons/clothing containing plastics/packaging made of plastic/medical waste from protective plastic (disinfected), various toys, plexiglass and any mixed waste made of plastic. In accordance with the disclosed method, the waste is categorised and cleaned, and materials of high heat resistance are shredded into 50 cm pieces. Pre-processed block plastic is chosen from the inside out in accordance with the principle of thermal expansion and contraction of plastic. A controllable mechanical compressor compresses and processes plastic material similar to a block with an integrally connected block structure and a complete structure. The possible products of the process are rectangular/square, cylindrical and trapezoidal plastic block materials with block structures integrally connected in accordance with road traffic conditions.

[0006] Report CN107794820A discloses a surface composed of plates, which is made out of numerous waste plastics. Whereas each of the aforementioned plates is essentially rectangular and fitted with holes located at the bottom part of the plate, which is where construction pipes are to be inserted. Moreover, the left and the right side of the mounting plate is fitted with protrusions and grooves for connecting with the adjacent mounting plates in such way that the two adjacent mounting blocks are connected. Additionally, the top and the bottom sides of the plate are fitted with holes, through which steel rods or other fixtures are introduced. Moreover, the report in question discloses the method of manufacturing of the aforementioned road plates, which consists in physical crushing, separating and cleaning the waste from plastic in order to obtain the necessary plastic particles. Next, the plastic particles are melted in high temperatures and injected to a previously prepared pressing, moulding and cooling mould in order to obtain the desired assembled road surface panel. Alternatively, after shredding and cleaning, the moulding can also involve injecting the material to a previously prepared mould using an injection moulding machine and then cooling in order to obtain the desired assembled road surface panel.

[0007] The aim of the invention is to provide road plates that are lightweight, cheap and of a high load capacity and the method of their manufacture.

[0008] The subject of the invention is a plastic road plate of a cuboidal shape, characterised by the fact that it contains four transport thru-holes with rectangular longitudinal-section, located near the corners of the plate; its thickness varies from 100 mm to 250 mm, and the plastic used is heterogeneous plastic waste - lightweight and heavy plastics, combination of lightweight and heavy plastics, PVC or rubber from used tyres.

[0009] Preferably, the transport holes are cylinders with a diameter of 45-85 mm.

[0010] Preferably, there is an anti-slip pattern on the upper surface of the plate.

[0011] A subsequent essence of the invention is the method of manufacturing plastic road plates in accordance with the invention, characterised in that the plastic used is plastic waste and the method of manufacture consists of the following stages:

a) Shredding of plastic waste;

b) Pre-washing of plastic waste;
c) Production of plastic mass by melting plastic waste chosen from the group composed of lightweight and heavy plastics, their combination, PVC, or rubber from used tyres at a temperature ranging from 150 to 280°C and injecting the aforementioned plastic mass to a previously prepared mould tilted at angle α towards the ground, where α equals 15-35°
d) Solidification of the moulded plastic plate.

[0012] Preferably, the plate is cooled during stage d).

[0013] Preferably, during stage a), the plastic waste is shredded to pieces of sizes ranging from 5x5 mm to 50x50 mm.

[0014] Preferably, stage b') consisting in pre-drying of the pre-cleaned plastic waste follows stage b).

[0015] Preferably, the drying lasts 20-90 minutes in a rotary drum dryer with air blowing at a temperature ranging from 120 to 130°C.

[0016] Preferably, the drying lasts 20-90 minutes and involves rubbing plastic against plastic and heating up the plastic particles until they reach a temperature ranging from110 to 130°C.

[0017] Preferably, the plastic waste used is composed of lightweight plastics, whereas in stage c) melting plastic waste takes place at a temperature ranging from 200 to 250°C, and injecting the aforementioned plastic mass to a previously prepared mould tilted at angle α towards the ground, where α equals 15-35°.

[0018] Preferably, the plastic waste used is composed of heavy plastics, whereas in stage c) melting plastic waste takes place at a temperature ranging from 220 to 280°C, and injecting the aforementioned plastic mass to a previously prepared mould tilted at angle α towards the ground, where α equals 25-35°.

[0019] Preferably, the plastic waste used is composed of a combination of lightweight and heavy plastics, whereas in stage c) melting plastic waste takes place at a temperature ranging from 220 to 260°C, and injecting the aforementioned plastic mass to a previously prepared mould tilted at angle α towards the ground, where α equals 20-30°.

[0020] Preferably, the plastic waste used is composed of PVC or rubber from used tyres, whereas in stage c) melting plastic waste takes place at a temperature ranging from 150 to 180 °C, and injecting the aforementioned plastic mass to a previously prepared mould tilted at angle α towards the ground, where α equals 35°.

[0021] Whereas, within the meaning of the invention, plastic waste is a mixture of plastics in the form of processed plastic, which is not useful for plastic recyclers. It is a so-called plastic waste (dirty and heterogeneous), which contains a mixture of various types of plastic (e.g. lightweight materials such as PE, PP (Olefin), PE, PET, PP; heavy plastics, PVC, rubber from used tyres) of various colours and therefore impossible to be used (from a commercial point of view) by plastic recyclers.

[0022] The invention offers the following advantages:

- the invention provides for a way of utilising plastic waste which is not suitable for recycling, therefore reducing the problem of storing this type of waste;
- in accordance with the invention, the road plates can be used in temporary outdoor transport;
- in accordance with the invention, the plates exhibit high durability;
- in accordance with the invention, the weight of the plates is an essentially lower (i.e. approximately 5 times lower) compared to the concrete plates available on the market;
- in accordance with the invention, lower price of the plates;
- in accordance with the invention, the plate is fitted with transport holes which facilitates securing the plates during transport;
- in accordance with the invention, the plates can be mounted on uneven surfaces unprepared in any way;
- tilting of the mould at angle α, where α equals 15-35° ensures that the plate is poured out in whole while the dunnage bag is simultaneously removed;
- in accordance with the invention, the method does not generate waste, on the contrary - it ensures managing the waste produced by other market participants.

[0023] An example of the execution of the invention is presented in figures, where fig. 1 presents the plate in accordance with the invention with an exemplary anti-slip pattern in the pictorial view; fig. 2 presents the plate in accordance with the invention with an exemplary anti-slip pattern in the pictorial view, in an overhead plan and section A-A view showing the transport holes in detail B.

[0024] Machines known from the prior art used for the moulding were previously used for a different purpose. The machines in question are used by recyclers for granulate production (the so-called regranulate). The machines used in the method in accordance with the invention involve: (I) single-screw machines with a screw diameter of 90 mm x 110 mm and (ii) twin-screw machines with a diameter of 160 mm; these machines use 80 kW-300 kW motors on vector inverters, for three-phase variable speed motors.

Example 1.

[0025] Exemplary road plates made out of heterogeneous plastic waste in accordance with the invention are shown in fig. 1 and 2. The invention addresses the problem of managing processed plastics unsuitable for further use by utilising them in the production of road plates; the plates can be used in temporary outdoor transport and constitute an alternative to concrete plates which are currently used for this purpose. In accordance with the invention, as shown in fig. 1, the road plate is characterised by the essentially cuboidal shape and an anti-slip pattern on its top surface. Various exemplary anti-slip patters are shown in fig. 1 and fig. 2.

[0026] In accordance with the invention, the plate is fitted with four transport thru-holes located on the corners of the plate. In this example, the aforementioned transport holes have a cylindrical shape. Exemplary diameters of the aforementioned transport holes are 45 mm and 85 mm, respectively, as shown in fig. 2.

[0027] The plate is made out of various types of materials. The invention provides for the use of lightweight materials (e.g. lightweight plastics from the group compromising PE, Olefin, PE, PET, PP); heavy plastics; mixtures of different lightweight and heavy materials; PVC or rubber from waste tyres. In accordance with the invention, the plates are characterised by a high load capacity which can be regulated depending on the thickness of the plate and the mixture of the polymers used. An exemplary list of load capacity of the plates in accordance with the invention depending on their size and thickness is presented in table 1. Whereas the optimal parameters allowing for reaching a high load capacity were achieved with thickness ranging from 100 to 250 mm.

Table 1. Load capacity in accordance with the invention

Plate designation	Length (L)	Width (W)	Height (thickness) (H)	Load capacity of a plate made out of lightweight plastics PE, PP (olefin), PE, PET, PP	Load capacity of a plate made out of heavy plastics	Load capacity of a plate made out of a mixture of lightweight and heavy metals with 50: 50 weight ratio
	[Mm]			Average load capacity [kg/m^2]		
WI/C	1000	400	100	10500	6300	4095
	1000	400	150	21000	12600	8190
	1000	400	200	33000	19800	12870
WII/C	1500	1200	100	6000	3600	2340
	1500	1200	150	9000	5400	3510
	1500	1200	200	13500	8100	5265
WIII/C	2500	1600	100	1500	900	585
	2500	1600	150	3000	1800	1170
	2500	1600	200	6000	3600	2340
WIV/C	3000	2000	100	1560	936	608
	3000	2000	150	2400	1440	936
	3000	2000	200	3600	2160	1404
WV/C	3500	2400	100	1200	720	468
	3500	2400	150	1800	1080	702
	3500	2400	200	2700	1620	1053
WVI/C	4000	2800	150	600	360	234
	4000	2800	200	900	540	351
	4000	2800	250	1350	810	527

(continued)

Plate designation	Length (L)	Width (W)	Height (thickness) (H)	Load capacity of a plate made out of lightweight plastics PE, PP (olefin), PE, PET, PP	Load capacity of a plate made out of heavy plastics	Load capacity of a plate made out of a mixture of lightweight and heavy metals with 50: 50 weight ratio
	[Mm]			Average load capacity [kg/m^2]		
WVII/C	4500	3200	150	300	180	117
	4500	3200	200	450	270	176
	4500	3200	250	675	405	263

Example 2.

[0028] In this example of execution, the WI/C plate with the following dimensions: L=1000 mm, W=400 mm and H=100 mm was made. Moreover, in this example of execution, a single-screw machine with a screw diameter of 90 mm x 110 mm and 80 kW motor was used.

[0029] In this example of execution, the method in accordance with the invention involves the following stages:

Stage a) shredding of plastic waste

[0030] During the first stage, the plastic waste is shredded. Whereas the shredding depends on the size of the plate to be created and the machine used in the method in accordance with the invention. Essentially, the bigger the machine, the bigger its stokehole and the deeper the grooves of the screws and the bigger the pieces of plastic can be sucked in by the machine.

[0031] In this example of execution, the plastic waste is shredded until it reaches 5 mm-granulation.

Stage b) pre-washing of plastic waste

[0032] The next stage of the method in accordance with the invention is pre-washing of plastic waste. Washing of plastic waste does not involve detergents, only clean water. During this stage, the initial amount of sand and silica is removed to avoid damaging the machines used in the stage of moulding and the friction devices in the aforementioned machines. Pre-washing is done in dedicated cleaning machines known from the prior art; they separate plastic waste into two chambers and segregate it into heavy plastics (non-floating) and lightweight plastics (floating), Then, all heavy elements (containing sand or other contamination) sink and are moved from the bottom using the screw conveyor.

[0033] The essence of this process is not to interfere with the remaining composition of the plastics but to separate them into two main groups, heavy and lightweight plastics.

Stage b') pre-drying of the pre-cleaned plastic waste

[0034] Then, the segregated plastics are dried. In this example of execution, the drying lasted 20 minutes in a rotary drum dryer with air blowing at the temperature of 130°C.

Stage c)

[0035] In this example of execution, for further stages only the mixture of lightweight plastics was used, which were melted at the temperature of 200 °C and injected to a previously prepared mould with the following dimensions: 1000mm x400 mm x 100 mm. tilted at angle α towards the ground, where α equals 15°. Such tilting of the mould allows for pouring out the plate in whole while simultaneously removing the dunnage bag.

Stage d) solidification of the moulded road plate

[0036] In this example of execution, the road plate solidifies in room temperature.

[0037] A plate made out of lightweight plastics type WI/C was obtained with the following dimensions: L=1000 mm, W=400 mm, H=100 mm, and with load capacity of 10500 kg/m^2.

Example 3.

[0038] In this example of execution, the WVII/C plate with the following dimensions: L=4500 mm, W=3200 mm and H=250 mm was made. Moreover, in this example of execution, a twin-screw machine with a screw diameter of 160 mm and 200 kW motor was used.

[0039] In this example of execution, the method in accordance with the invention involves the following stages:

Stage a) shredding of plastic waste

[0040] During the first stage, the plastic waste is shredded. In this example of execution, the plastic waste is shredded until it reaches 50mm granulation.

Stage b) pre-washing of plastic waste

[0041] The next stage of the method in accordance with the invention is pre-washing of plastic waste. Washing of plastic waste does not involve detergents, only clean water. During this stage, the initial amount of sand and silica is removed to avoid damaging the machines used in the stage of moulding and the friction devices in the aforementioned machines. Pre-washing is done in dedicated cleaning machines known from the prior art; they separate plastic waste into two chambers and segregate it into heavy plastics (non-floating) and lightweight plastics (floating), Then, all heavy elements (containing sand or other contamination) sink and are moved from the bottom using the screw conveyor.

[0042] The essence of this process is not to interfere with the remaining composition of the plastics but to separate them into two main groups, heavy and lightweight plastics.

Stage b') pre-drying of the pre-cleaned plastic waste

[0043] Then, the segregated plastics are dried. In this example of execution, the drying lasted 20 minutes in a rotary drum dryer with air blowing at the temperature of 130°C.

Stage c)

[0044] In this example of execution, for further stages only the mixture of lightweight plastics was used, which were melted at the temperature of 250 °C and injected to a previously prepared mould with the following dimensions: 4500mm x 3200 mm x 250 mm, tilted at angle α towards the ground, where α equals 20°. Such tilting of the mould allows for pouring out the plate in whole while simultaneously removing the dunnage bag.

Stage d) solidification of the moulded road plate

[0045] In this example of execution, the road plate was subjected to cooling.

[0046] A plate made out of lightweight plastics type WVII/C was obtained with the following dimensions: L=4500 mm, W=3200 mm, H=250 mm and with load capacity of 675 kg/m^2.

Example 4.

[0047] In this example of execution, the WI/C plate with the following dimensions: L=1000 mm, W=400 mm and H=100 mm was made. Moreover, in this example of execution, a twin-screw machine with a screw diameter of 160 mm and 200 kW motor was used.

[0048] In this example of execution, in accordance with the invention, the method involves the following stages:

Stage a) shredding of plastic waste

[0049] During the first stage the plastic waste is shredded. In this example of execution, the plastic waste is shredded until it reaches 5 mm granulation.

Stage b) pre-washing of plastic waste

[0050] The next stage of the method in accordance with the invention is pre-washing of plastic waste. Washing of plastic waste does not involve detergents, only clean water. During this stage, the initial amount of sand and silica is removed to avoid damaging the machines used in the stage of moulding and the friction devices in the aforementioned

machines. Pre-washing is done in dedicated cleaning machines known from the prior art, they separate plastic waste into two chambers and segregate it into heavy plastics (non-floating) and lightweight plastics (floating), Then, all heavy elements (containing sand or other contamination) sink and are moved from the bottom using the screw conveyor.

Stage b') pre-drying of the pre-cleaned plastic waste

[0051] Then, the segregated plastics are dried. In this example of execution, the drying lasts 20 minutes and involves rubbing plastic against plastic and heating up the plastic particles to the temperature of 130°C.

Stage c)

[0052] In this example of execution, for further stages only the mixture of heavy plastics was used, which were melted at the temperature of 200 °C and injected to a previously prepared mould with the following dimensions: 1000mm x400 mm x 100 mm, tilted at angle α towards the ground, where α equals 25°. Such tilting of the mould allows for pouring out the plate in whole while simultaneously removing the dunnage bag.

Stage d) solidification of the moulded road plate

[0053] In this example of execution, the road plate solidifies in room temperature.

[0054] A plate made out of heavy plastics type WI/C was obtained with the following dimensions: L=1000 mm, W=400 mm, H=100 mm, and with load capacity of 6300 kg/m^2.

Example 5.

[0055] In this example of execution, the WVII/C plate with the following dimensions: L=4500 mm, W=3200 mm and H=250 mm was made. Moreover, in this example of execution, a single-screw machine with a screw diameter of 160 mm and 200 kW motor was used.

[0056] In this example of execution, in accordance with the invention, the method involves the following stages:

Stage a) shredding of plastic waste

[0057] During the first stage the plastic waste is shredded. In this example of execution, the plastic waste is shredded until it reaches 50mm granulation.

Stage b) pre-washing of plastic waste

[0058] The next stage of the method in accordance with the invention is pre-washing of plastic waste. Washing of plastic waste does not involve detergents, only clean water. During this stage, the initial amount of sand and silica is removed to avoid damaging the machines used in the stage of moulding and the friction devices in the aforementioned machines. Pre-washing is done in dedicated cleaning machines known from the prior art, they separate plastic waste into two chambers and segregate it into heavy plastics (non-floating) and lightweight plastics (floating), Then, all heavy elements (containing sand or other contamination) sink and are moved from the bottom using the screw conveyor.

Stage b') pre-drying of the pre-cleaned plastic waste

[0059] Then, the segregated plastics are dried. In this example of execution, the drying lasts 20-90 minutes and involves rubbing plastic against plastic and heating up the plastic particles to the temperature of 110-130°C.

Stage c)

[0060] In this example of execution, for further stages only the mixture of heavy plastics was used, which were melted at the temperature of 280 °C and injected to a previously prepared mould with the following dimensions: 4500mm x 3200 mm x 250 mm, tilted at angle α towards the ground, where α equals 35°. Such tilting of the mould allows for pouring out the plate in whole while simultaneously removing the dunnage bag.

Stage d) solidification of the moulded road plate

[0061] In this example of execution, the road plate solidifies in room temperature.

[0062] A plate made out of heavy plastics type WVII/C was obtained with the following dimensions: L=4500 mm, W=3200 mm, H=250 mm, and with load capacity of 405 kg/m^2.

Example 6.

[0063] In this example of execution, the WI/C plate with the following dimensions: L=1000 mm, W=400 mm and H=100 mm was made. Moreover, in this example of execution, a twin-screw machine with a screw diameter of 160 mm and 200 kW motor was used.

[0064] In this example of execution, the method in accordance with the invention involves the following stages:

Stage a) shredding of plastic waste

[0065] During the first stage the plastic waste is shredded. In this example of execution, the plastic waste is shredded until it reaches 5 mm granulation.

Stage b) pre-washing of plastic waste

[0066] The next stage of the method in accordance with the invention is pre-washing of plastic waste. Washing of plastic waste does not involve detergents, only clean water. During this stage, the initial amount of sand and silica is removed to avoid damaging the machines used in the stage of moulding and the friction devices in the aforementioned machines. Pre-washing is done in dedicated cleaning machines known from the prior art, they separate plastic waste into two chambers and segregate it into heavy plastics (non-floating) and lightweight plastics (floating), Then, all heavy elements (containing sand or other contamination) sink and are moved from the bottom using the screw conveyor.

[0067] In this example of execution, the drying stage was not included. In stage c) a slightly moist plastic was used, and all moisture was wicked away in the air release valve used for melting and moulding.

Stage c) production of plastic mass and injecting it into a mould

[0068] In this example of execution, for further stages a mixture of lightweight and heavy plastics in 50:50 weight ratio was used, which were melted at the temperature of 220 °C and injected to a previously prepared mould with the following dimensions: 1000mm x400 mm x 100 mm, tilted at angle α towards the ground, where α equals 20°. Such tilting of the mould allows for pouring out the plate in whole while simultaneously removing the dunnage bag.

Stage d) solidification of the moulded road plate

[0069] In this example of execution, the road plate solidifies in room temperature.

[0070] A plate made out of lightweight plastics type WI/C was obtained with the following dimensions: L=1000 mm, W=400 mm, H=100 mm, and with load capacity of 4095 kg/m^2.

Example 7.

[0071] In this example of execution, the WVII/C plate with the following dimensions: L=4500 mm, W=3200 mm and H=250 mm was made. Moreover, in this example of execution, a twin-screw machine with a screw diameter of 160 mm and 200 kW motor was used.

[0072] In this example of execution, the method in accordance with the invention involves the following stages:

Stage a) shredding of plastic waste

[0073] During the first stage the plastic waste is shredded. In this example of execution, the plastic waste is shredded until it reaches 50 mm granulation.

Stage b) pre-washing of plastic waste

[0074] The next stage of the method in accordance with the invention is pre-washing of plastic waste. Washing of plastic waste does not involve detergents, only clean water. During this stage, the initial amount of sand and silica is removed to avoid damaging the machines used in the stage of moulding and the friction devices in the aforementioned machines. Pre-washing is done in dedicated cleaning machines known from the prior art, they separate plastic waste into two chambers and segregate it into heavy plastics (non-floating) and lightweight plastics (floating), Then, all heavy

elements (containing sand or other contamination) sink and are moved from the bottom using the screw conveyor.

[0075] The essence of this process is not to interfere with the remaining composition of the plastics but to separate them into two main groups, heavy and lightweight plastics.

Stage b') pre-drying of the pre-cleaned plastic waste

[0076] Then, the segregated plastics are dried. In this example of execution, the drying lasted 90 minutes in a rotary drum dryer with air blowing at the temperature of 130°C.

Stage c)

[0077] In this example of execution, for further stages a mixture of lightweight and heavy plastics in 50:50 weight ratio was used, which was melted at the temperature of 260 °C and injected to a previously prepared mould with the following dimensions: 4500mm x 3200 mm x 250 mm, tilted at angle α towards the ground, where α equals 30°. Tilting the mould in a way that allows for pouring out the plate in whole while simultaneously removing the dunnage bag.

Stage d) solidification of the moulded road plate

[0078] In this example of execution, the road plate solidifies in room temperature.

[0079] A plate made out of lightweight plastics type WVII/C was obtained with the following dimensions: L=4500 mm, W=3200 mm, H=250 mm, and with load capacity of 263 kg/m^2.

Example 8.

[0080] In this example of execution, the WI/C plate with the following dimensions: L=1000 mm, W=400 mm and H=100 mm was made, and PVC was the waste plastics used . Moreover, in this example of execution, a twin-screw machine with a screw diameter of 160 mm and 100 kW motor was used. In this example of execution, the method in accordance with the invention involves the following stages:

Stage a) shredding of plastic waste - In this example of execution, PVC is shredded until it reaches 5 mm granulation.

Stage b) pre-washing of plastic waste - Washing PVC did not involve detergents, only clean water in dedicated cleaning machines known from the prior art.

Stage b') pre-drying of the pre-cleaned plastic waste - In this example of execution, the drying lasted 20 minutes in a rotary drum dryer with air blowing at the temperature of 130°C.

Stage c) production of plastic mass and injecting it into a mould

[0081] In this example of execution, PVC was melted at the temperature of 150 °C and injected to a previously prepared mould with the following dimensions: 1000mm x400 mm x 100 mm, tilted at angle α towards to the ground, where α equals 35°. Such tilting of the mould allows for pouring out the plate in whole while simultaneously removing the dunnage bag.

Stage d) solidification of the moulded road plate

[0082] In this example of execution, the road plate solidifies in room temperature.

[0083] A plate made out of PVC type WI/C was obtained with the following dimensions: L=1000 mm, W=400 mm, H=100 mm, and with load capacity of 4000-10500 kg/m^2.

Example 9.

[0084] In this example of execution, the WI/C plate with the following dimensions: L=1000 mm, W=400 mm and H=100 mm was made, and rubber from used tyres was the material used. Moreover, in this example of execution, a twin-screw machine with a screw diameter of 160 mm and 300 kW motor was used. In this example of execution, the method in accordance with the invention involves the following stages:

Stage a) shredding of plastic waste - In this example of execution, the plastic waste is shredded until it reaches 5 mm granulation.

Stage b) pre-washing of plastic waste - Washing the granulate of the rubber waste from used tyres did not involve detergents, only clean water.

Stage b') pre-drying of the pre-cleaned plastic waste - In this example of execution, the drying lasted 20 minutes in a rotary drum dryer with air blowing at the temperature of 130°C.

Stage c) production of plastic mass and injecting it into a mould

[0085] In this example of execution, granulate of the rubber from used tyres was melted at the temperature of 180 °C and injected to a previously prepared mould with the following dimensions: 1000mm x400 mm x 100 mm, tilted at angle α towards the ground, where α equals 35°. Such tilting of the mould allows for pouring out the plate in whole while simultaneously removing the dunnage bag.

Stage d) solidification of the moulded road plate

[0086] In this example of execution, the road plate solidifies in room temperature.

[0087] A plate made out of rubber granulate type WI/C was obtained with the following dimensions: L=1000 mm, W=400 mm, H=100 mm, and with load capacity of 4000-10500 kg/m^2.

Claims

1. The plastic road plate of a cuboidal shape, **characterised by** the fact that it contains four transport thru-holes with rectangular longitudinal-section, located near the corners of the plate; its thickness varies from 100 mm to 250 mm, and the plastic used is heterogeneous plastic waste - lightweight and heavy plastics, a combination of lightweight and heavy plastics, PVC or rubber from used tyres.

2. In accordance with patent claim 1, the plate is **characterised in that** the transport holes are cylinders with a diameter of 45-85 mm.

3. In accordance with the previous patent claims 1-3, the plate is **characterised in that** there is an anti-slip pattern on its upper surface.

4. The method of manufacturing the plastic road plate in accordance with any of the previous patent claims 1-2, **characterised in that** the plastic used is plastic waste and the method consists of the following stages:

   a) Shredding of plastic waste;
   b) Pre-washing of plastic waste;
   c) Production of plastic mass by melting plastic waste chosen from the group composed of lightweight and heavy plastics, their combination, PVC, or rubber from used tyres in a temperature varying from 150 to 280°C and injecting the aforementioned plastic mass to a previously prepared mould tilted at angle α towards the ground, where α equals 15-35°;
   d) Solidification of the moulded plastic plate.

5. The method in accordance with patent claim 4, **characterised in that** during stage d), the plate is cooled.

6. The method in accordance with patent claim 4 or 5, **characterised in that** during stage a), the plastic waste is shredded to pieces of sizes varying from 5x5 mm to 50x50 mm.

7. The method in accordance with any of the previous patent claims 4-6, **characterised in that** stage b) is followed by stage b') consisting in pre-drying of the pre-cleaned plastic waste.

8. The method in accordance with patent claim 7, **characterised in that** the drying lasts 20-90 minutes in a rotary drum dryer with air blowing at temperature of 120-130°C.

9. The method in accordance with patent claim 7, **characterised in that** the drying lasts 20-90 minutes and involves rubbing plastic against plastic and heating up the plastic particles to the temperature of 110-130°C.

10. The method of any of the previous patent claims 4-9, **characterised in that** the plastic waste used is composed of lightweight plastics, whereas in stage c) melting plastic waste takes place at the temperature of 200-250°C, and injecting the aforementioned plastic mass to a previously prepared mould tilted at angle α towards the ground, where α equals 15-35°.

11. The method of any of the previous patent claim 4-9, **characterised in that** the plastic waste used is composed of heavy plastics, whereas in stage c) melting plastic waste takes place at the temperature of 220-280°C, and injecting the aforementioned plastic mass to a previously prepared mould tilted at α angle to the ground, where α equals 25-35°.

12. The method of any of the previous patent claims 4-9, **characterised in that** the plastic waste used is composed of a combination of lightweight and heavy plastics, whereas in stage c) melting plastic waste takes place at the temperature of 220-260 °C, and injecting the aforementioned plastic mass to previously prepared mould tilted at angle α towards the ground, where α equals 20-30°.

13. The method of any of the previous patent claim 4-9, **characterised in that** the plastic waste used is composed of PVC or rubber from used tyres, whereas in stage c) melting plastic waste takes place at the temperature of 150-180 °C, and injecting the aforementioned plastic mass to previously prepared mould tilted at angle α towards the ground, where α equals 35°.

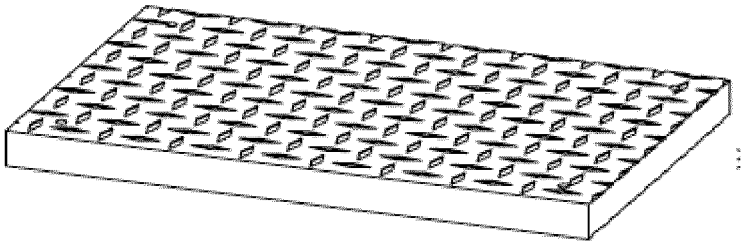

Fig. 1

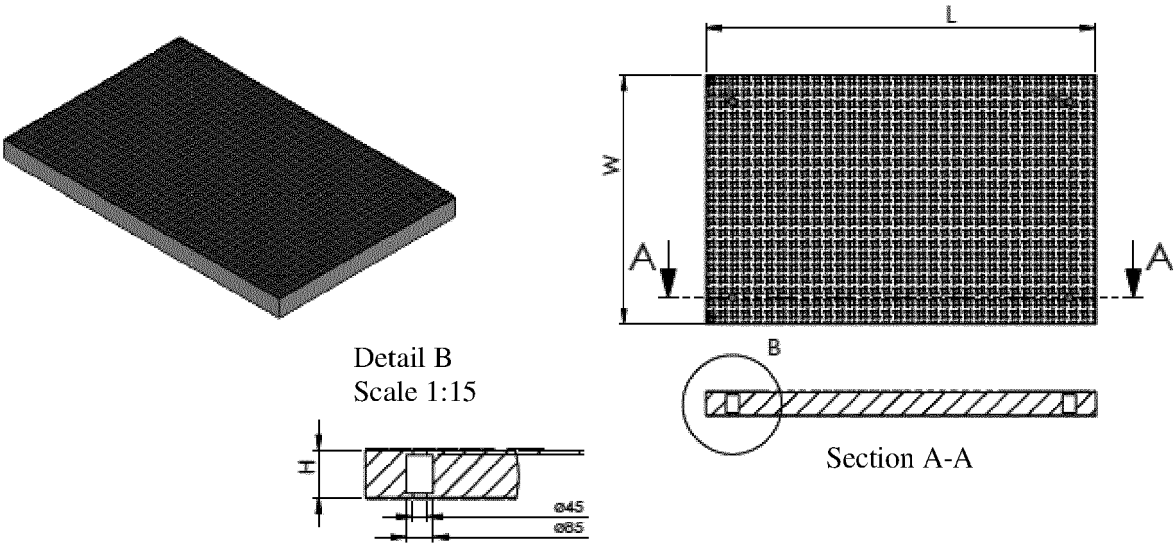

Fig. 2

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EUROPEAN SEARCH REPORT

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Munich	16 March 2023	Beucher, Stefan

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