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DESCRIPTION

FIELD OF THE INVENTION

The present invention relates to toy building-blocks.

BACKGROUND OF THE INVENTION

The prior art discloses toy building-blocks which are produced from a synthetic polymer, a particular material used being ABS (acrylic-butadiene-styrene) or PC (polycarbonate). These synthetic polymers are mostly produced from petroleum-based fossil feedstocks.

The German Utility Model DE 20 2008 011 326 U1 discloses a toy building-block intended to be amenable to connection to other toy building-blocks by pressure, where the building-block is composed of biodegradable material.

SUMMARY OF THE INVENTION

The cost of petroleum-based feedstocks is constantly increasing because these feedstocks are available only in restricted quantity and the stocks are slowly becoming exhausted and/or the efforts required to produce adequate quantities of petroleum-based feedstocks are constantly increasing.

The toy building-blocks produced entirely from renewable feedstock are moreover not adequately stable and durable.

It is therefore an object of the invention to provide toy building-blocks which are amenable to connection to similar toy building-blocks and are produced from materials which not only represent an alternative to petroleum-based feedstocks but also render the toy building-blocks more durable and more mechanically stable.

A toy building-block according to Claim 1 is provided as first embodiment of the invention.

According to the invention, toy building-blocks intended to be amenable to assembly by pressure and/or to connection to one another by pressure can be produced to some extent from naturally occurring feedstocks, thus permitting conservation of petroleum reserves.

The naturally occurring feedstocks can by way of example be used to produce biopolymers from which, in a mixture with synthetic polymers, it is possible to produce the toy building-blocks. Alternatively it is also possible to use a plurality of different types of biopolymer to produce toy building-blocks, and alternatively it is also possible here to admix synthetic biopolymers.

A mixture of natural polymers with synthetic polymers, for example acrylic-butadiene-styrene (ABS), polymethyl methacrylate (PMMA), polyurethane, polyvinyl alcohol or polycarbonate (PC), can give toy building-blocks which are more durable and/or more mechanically stable than toy building-blocks produced entirely from biopolymers.

Examples of embodiments are described in the dependent claims.

According to another exemplary embodiment of the present invention a toy building-block is provided and is composed of a composite material according to Claim 2.

By using composite materials it is possible to obtain toy building-blocks that have high mechanical stability, the production of composite materials here being simpler and therefore more advantageous than that of polymers.

According to one example of an embodiment of the invention, a toy building-block is provided where the first material is natural fibres.

By virtue of natural fibres the toy building-blocks have greater biodegradability, and are therefore less harmful to the environment.

In another embodiment of the invention a toy building-block is provided where the first material can be provided with the aid of optimized enzymes, cells or microorganisms.

Use of industrial biotechnology, i.e. use of, for example, optimized enzymes, cells or microorganisms, is in a manner of speaking use of nature as a chemical factory. This reduces the cost of technical equipment required for the production process, thus permitting production of polymers, and specifically biopolymers, at lower cost than conventional, i.e. synthetic, polymers.

The processes become especially sustainable and avoid competition with food production when substrates used for the microorganisms can comprise residual biomass from forestry or agriculture or residual materials from the food-and-drink industry.

According to one example of an embodiment of the invention, a toy building-block is provided where the first feedstock is starch, lignin, lactic acid, castor oil, wood flour, chitin, chitosan, casein, gelatin, cereal proteins, rapeseed, straw, whey, shrimp shells or any other vegetable oil.

The feedstocks starch, lignin, lactic acid, castor oil, wood flour, chitin, chitosan, casein, gelatin, cereal proteins, rapeseed, straw, whey, shrimp shells or any other vegetable oil are naturally occurring feedstocks, i.e. non-petroleum-based feedstocks, use of which can lead to biodegradable final products; these final products can therefore be regarded as not harmful to the environment.

In another embodiment of the invention a toy building-block is

provided where the first material is a polyester from natural sources, polyesteramide, polylactide, polyhydroxybutyric acid, polytrimethylene terephthalate or thermoplastic starch.

The materials polyester from natural sources, polyesteramide, polylactide, polyhydroxybutyric acid, polytrimethylene terephthalate or thermoplastic starch are naturally occurring materials which can undergo organic decomposition, and therefore cannot lead to any longlasting pollution of the environment even in the event of incorrect disposal.

In another embodiment of the present invention a toy building-block is provided with: an upper side on which there is at least one projection arranged and an underside on which there is at least one tubular cavity arranged, where the upper side can be connected to the undersides of other similar toy building-blocks by pressure, and where the underside can be connected to the upper sides of other similar toy building-blocks by pressure.

A concept that can be regarded as intrinsic to the invention is provision of toy building-blocks which are intended to be amenable to assembly by pressure or connection to one another by pressure and which are produced to some extent from naturally occurring feedstocks. It is thus possible to conserve the limited reserves of petroleum. Another advantage of the toy building-blocks of the invention is that they are less harmful to the environment, because they are at least to some extent biodegradable.

The individual features can, of course, also be combined with one another, thus also to some extent allowing achievement of advantageous effects which go beyond the sum of the individual effects.

BRIEF DESCRIPTION OF THE DRAWINGS

Further details and advantages of the invention will be clear

from the embodiments depicted in the drawings.

Figure 1 is a perspective view of a toy building-block from above,

Figure 2 is a perspective view of the toy building-block from below, and

Figure 3 is a perspective view of another toy building-block.

DETAILED DESCRIPTION OF EXAMPLES OF EMBODIMENTS

Figure 1 is a perspective view of a toy building-block from above with four projections 101 on the upper side 102 of the toy building-block.

Figure 2 is a perspective view of the same toy building-block from below with projections 202 on the upper side 201 and tubular cavities 203 on the underside 204; by virtue of the complementary structure of respective upper side in relation to underside the upper side 201 of the toy building-block can be connected to an underside of another toy building-block of similar structure by pressure. The underside 204 of the toy building-block can moreover be connected to an upper side of another toy building-block of similar structure by pressure. Reinforcement structures 205 are moreover depicted, and can provide stiffening of the toy building-block, thus allowing the mechanical stability of the toy building-block to be increased. Eight reinforcement structures 205 are depicted, the arrangement here having in each case two on an internal side of a wall of the toy building-block. It is also alternatively possible to arrange only one reinforcement structure, or three, four, five, or any desired number of reinforcement structures, on the internal side of a wall. It is also possible to arrange a different number of reinforcement structures on the individual walls of a toy building-block.

According to the invention toy building-blocks are provided, the material of which can be produced to some extent from renewable, biological feedstocks. Other terms for renewable feedstocks are sustainable feedstocks, biological feedstocks, naturally occurring feedstocks and renewable resource. The material obtained from a feedstock of this type is also termed bioplastic; a bioplastic here can be produced entirely from renewable feedstocks or to some extent from renewable feedstocks and to some extent from fossil, petroleum-based feedstocks. Renewable feedstocks are organic feedstocks which can be produced via agriculture or forestry. If residual products or waste products are used as feedstock for the production of bioplastic, the production of bioplastic not only conserves the finite reserves of petroleum but also avoids competition with the production of food, drinks and animal feed.

Bioplastics can be produced entirely or to some extent from renewable feedstocks. By way of example a bioplastic can be produced to an extent of at least 20% from renewable feedstocks, the residual proportion being derived from petroleum-based polymers. In contrast to this, synthetic polymers are produced to an extent of 100% from petroleum-based feedstocks.

Examples of renewable feedstocks that can be used for the production of bioplastics are starch, lignin, lactic acid, castor oil, wood flour, chitin, chitosan, casein, gelatin, cereal proteins and other vegetable oils.

Starch can be used to produce thermoplastic starch, polylactide (PLA) or polyhydroxybutyric acid (PHB), and these can be used as bioplastics. Starch can in particular be obtained from seeds, tubers, bulbs, or rhizomes of various cereal plants or agricultural crops, e.g. potatoes, wheat, triticale, maize, manioc or rice, or by way of example from wood. When seeds of the castor oil plant are used for the production of bioplastics, an additional consequential

environmental advantage is that large quantities of $CO_2$ can be captured during the growth phase of the castor oil plant.

According to the invention it is possible to use bioplastics for the production of toy building-blocks, and these bioplastics can be produced to a predominant extent, or alternatively to an extent that is not predominant, from biopolymers. The biopolymers and/or their precursors can be subjected here to the processes that are conventional for synthetic polymers.

The production of bioplastics, e.g. via use of PA1010 moulding compositions or PA610 moulding compositions, or the production of partially bio-based amorphous transparent biopolyamide, generally leads to markedly lower $CO_2$ emissions than the production of entirely synthetic polymers, e.g. ABS, PMMA or PC, and the extent of adverse environmental effects can thus be reduced.

In an alternative embodiment the toy building-blocks are produced at least to some extent from composite materials, e.g. wood-plastic composites. In another alternative embodiment of the invention the toy building-blocks are produced from composite materials where the composite materials comprise bio-derived content, e.g. wood flour, and petroleum-based polymers or bioplastics. In another alternative embodiment the composite material comprises natural-fibre-reinforced synthetic polymers or natural-fibre-reinforced bioplastics.

According to the invention the toy building-blocks can comprise any desired mixture of petroleum-based and renewable feedstocks, e.g. wood-flour-filled polymers (WPC - wood-plastic compound), or starch blends composed of water-repellent, biodegradable polymers, e.g. of polyester, of polyesteramides, or of polyurethanes or polyvinyl alcohol.

According to the invention the toy building-blocks can be

produced by way of example from thermoplastic starch, polylactic acid or polytrimethylene terephthalate.

Thermoplastic starch (TPS) is a bioplastic which takes the form of thermoplastic biopolymer, where the starch grains serving as feedstock are destructured. Thermoplastic starch is classified as starch polymer on the basis of the feedstock from which it is derived.

Polylactic acid (polylactide, PLA) is produced by polymerization of lactic acid, which in turn is a product of fermentation of sugar and starch by lactic acid bacteria. The polymerization process includes subsequent mixing of the polymers derived from the different isomers of lactic acid, the D-form and the L-form, in accordance with the desired properties of the resultant polymer. Other properties can be achieved by adding copolymers, such as glycolic acid. The bioplastic obtained here is a transparent material with properties very similar to those of the conventional, synthetic thermoplastics; polylactic acid can therefore be readily used in the conventional systems for the production of final products.

In another embodiment of the invention toy building-blocks are produced entirely or to some extent from polytrimethylene terephthalate (PTT), which is a bioplastic derived from 1,3-propanediol (PDO).

Figure 3 shows a toy building-block with, on the underside and upper side 302, a structure similar to that of the toy building-block of Figures 1 and 2; the toy building-block here has eight projections 301 on the upper side 302.

LIST OF REFERENCE NUMERALS

101 Projection
102 Upper side
201 Upper side
202 Projection
203 Tubular cavity
204 Underside
205 Reinforcement structure
301 Projection
302 Upper side

Patentkrav

1. Byggeklods til sammenklemning med byggeklodser med lignende opbygning, idet byggeklodsen består af en bioplast, idet bioplasten omfatter
et første materiale, idet det første materiale er fremstillet af et første reproducerbart råstof, idet det første materiale er fremstillet ved hjælp af mikroorganismer, idet der som substrat for mikroorganismer anvendes biologisk restmasse fra forst- eller landbrug eller restprodukter fra levnedsmiddelindustrien,
et andet materiale, idet det andet materiale er fremstillet af et råoliebaseret råstof, idet det andet materiale består af syntetiske polymerer, navnlig acryl-butadien-styren (ABS), polymethylmethacrylat (PMMA), polyurethan, polyvinylalkohol eller polycarbonat (PC).

2. Byggeklods ifølge krav 1, idet byggeklodsen består af et laminatmateriale, idet laminatmaterialet omfatter
et tredje materiale, idet det tredje materiale er fremstillet af et råoliebaseret råstof, eller idet det tredje materiale er fremstillet af et tredje reproducerbart råstof, idet det første råstof er forskelligt fra det tredje råstof.

3. Byggeklods ifølge krav 2, idet det første materiale er naturfibre.

4. Byggeklods ifølge et af de foregående krav, idet det første materiale er fremstillet ved hjælp af optimerede enzymer, celler eller mikroorganismer.

5. Byggeklods ifølge et af de foregående krav, idet det første råstof er stivelse, lignin, mælkesyre, ricinusolie, træmel, chitin, chitosan, casein, gelatine, kornproteiner, raps, strå, valle, rejeskaller eller en yderligere planteolie.

6. Byggeklods ifølge et af de foregående krav, idet det første materiale er en naturlig polyester, polyesteramid,

polylactid, polyhydroxysmørsyre, polytrimethylenterephthalat eller termoplastisk stivelse.

7. Byggeklods ifølge et af de foregående krav, idet byggeklodsen omfatter
en overside (102, 201, 302), idet der på oversiden (102, 201, 302) er placeret i det mindste en noppe (101, 202, 301),
en underside (204), idet der på undersiden (204) er placeret i det mindste et rør (203), idet oversiden (102, 201, 302) kan klemmes sammen med undersiderne på yderligere byggeklodser med lignende opbygning, og idet undersiden (204) kan klemmes sammen med oversiderne på yderligere byggeklodser med lignende opbygning.

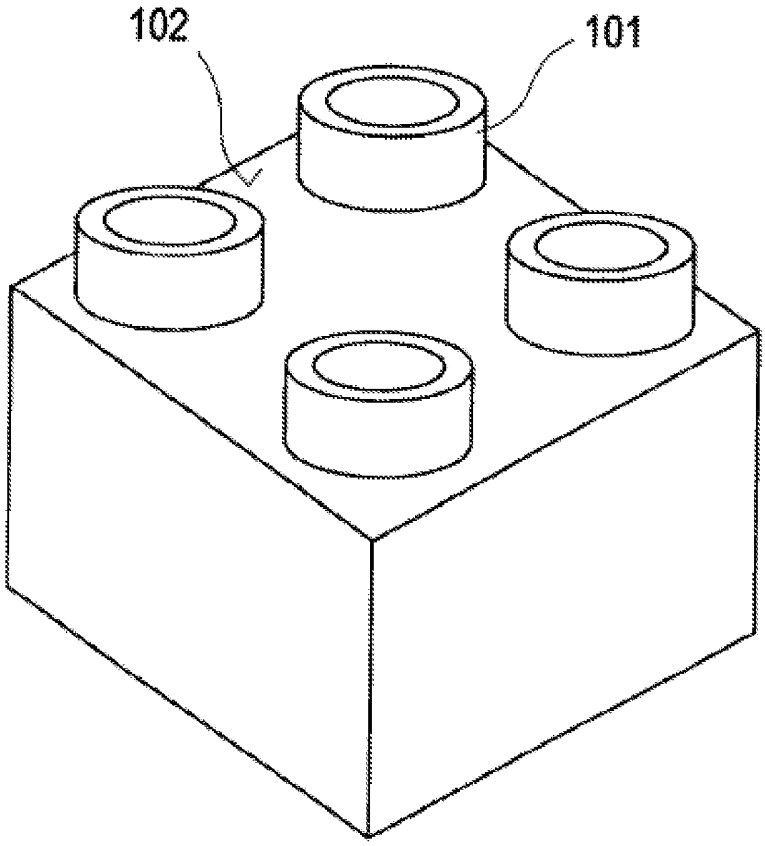


Fig. 1

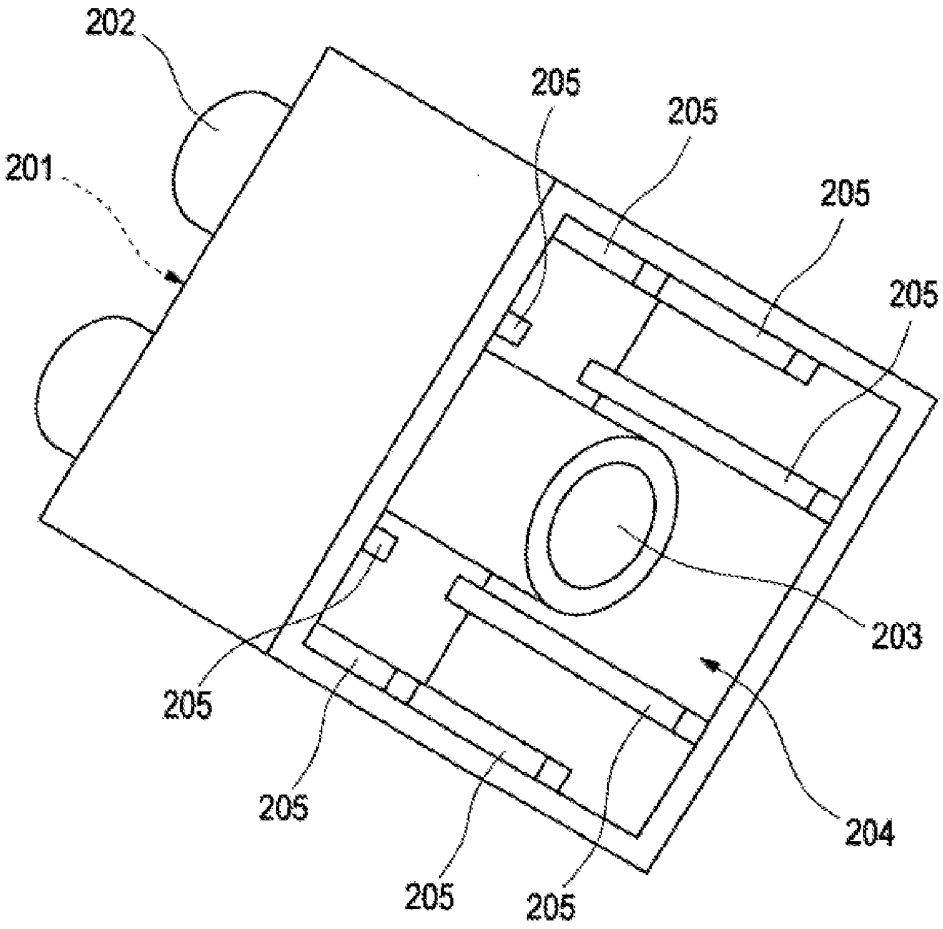


Fig. 2

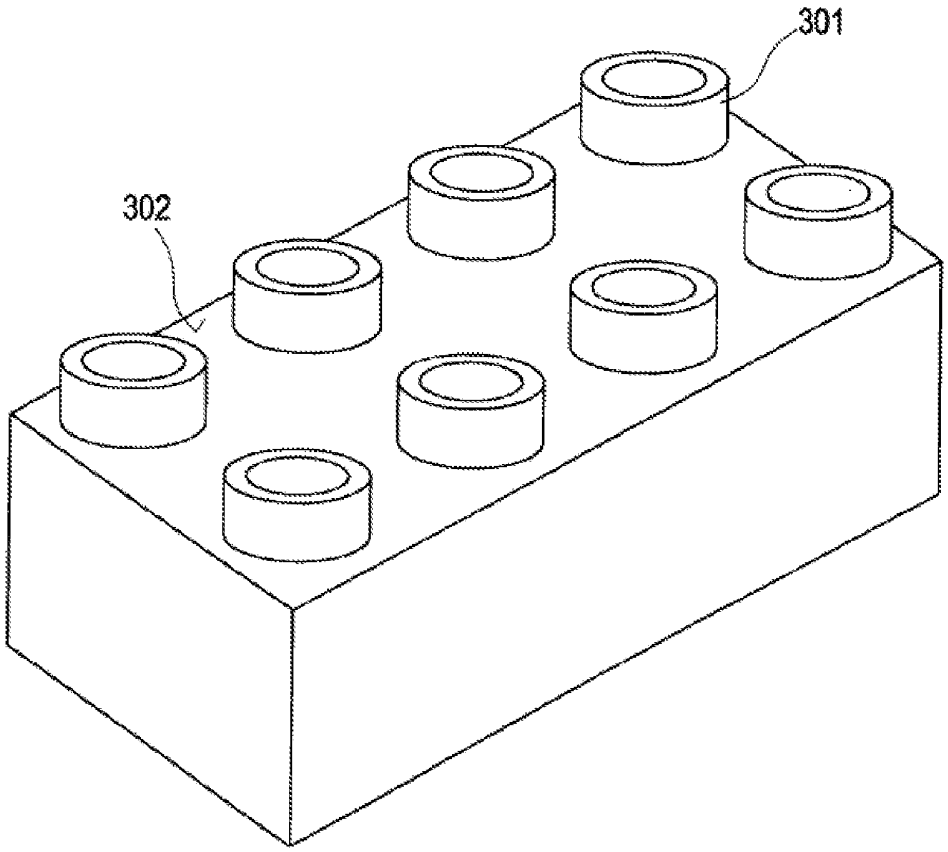


Fig. 3