

Consumable Bitumen Film For Packaging Bitumen

Field of Invention

[0001] The present invention relates to a consumable bitumen compound film for packaging bituminous products. In particular, the invention relates to encapsulating or packing of bitumen with a bitumen compound film that is consumable or meltable and compatible with the bituminous products.

Background

[0002] Bitumen (in some countries is also known as asphalt) is used mainly as a binder in road construction with a small percentage being used in roofing/waterproofing and vibration/anti-corrosion materials. Bitumen, including naturally occurring and refined bitumen obtained from distillation of crude oil, is usually semi-solid at room temperature and liquid when heated up. Conventionally, bitumen is stored and transported in bulk via tanks, pipes, trucks and ships that are maintained at elevated temperature of around 120 to 160°C, or at normal ambient temperature in steel drums or in polyethylene, polypropylene or paper bags.

[0003] Storing bitumen in heated tanks and vessels consumes energy, thus making it expensive, whilst storing bitumen cold in drums leads to wastage as bitumen is very viscous and leaves behind residues. For example, the residues in steel drums may amount to about 3%. Packing of bituminous products in polyethylene, polypropylene or paper bags often leads to leakages during handling and transporting. With greater environmental concern, there is therefore a need for another method of packing, storing and transporting bitumen and bituminous materials.

[0004] Further, handling and transporting of bituminous products in, for example 200 litres, steel drums can be difficult and hazardous if specialized drum handling equipment is not available at the transporter or end-user site.

[0005] US patent publication no. 2007/0027235, by Albert Marchal describes a consumable bitumen packaging material. The packaging material is made of a mouldable composition composed of 60.1-99.9 weight % of polymer, with 0.1-39.9% of said proportion is bitumen, and 0.1-39.9 weight % of a metallic charge. A packing container is moulded and after cooling it is filled with bitumen in a separate operation. The density of the packaging material is adjusted so as to prevent the packaging material from floating to the surface of the molten bitumen. The packaging material also has the required toughness, impact resistance and temperature stability for storage and transport.

[0006] Despite development in consumable bitumen packaging, there is still a need for another way of packaging bituminous materials.

Summary

[0007] The following presents a simplified summary to provide a basic understanding of the present invention. This summary is not an extensive overview of the invention, and is not intended to identify key features of the invention. Rather, it is to present some of the inventive concepts of this invention in a generalised form as a prelude to the detailed description that is to follow.

[0008] In this document, bitumen and bituminous materials include the semi-solid hydrocarbon product produced by refining of crude oil, petroleum pitches produced by cracking of petroleum fractions, tar produced from coal and natural occurring bitumen. In North America, asphalt is synonymous to bitumen; outside North America, asphalt refers to a mixture of bitumen and aggregates for road construction.

[0009] In one embodiment, the present invention provides a new way of packaging bitumen. Accordingly, a bitumen package comprises: a bituminous material being formed into a block; and a bitumen compound film operable to encase the bituminous block; wherein said bitumen compound film comprises 10 to 30% by weight of natural

bitumen, 5 to 25% by weight of synthetic rubber polymer and the balance being the bituminous material of said block.

[0010] In another embodiment, the present invention provides a system for extruding and packaging bitumen. The system comprises: an extrusion head having a die, said die has a core output channel and a film output channel surrounding the core output channel; wherein: a bituminous material is operable to be extruded through the core output channel whilst a bitumen compound film is operable to be extruded through the film output channel so that the bitumen compound film is formed around a core of the bituminous material. In one embodiment, the bitumen compound film comprises 10 to 30% by weight of natural bitumen, 5 to 25% by weight of synthetic rubber polymer and the balance being the bituminous material of the core.

Brief Description of the Drawings

[0011] This invention will be described by way of non-limiting embodiments of the present invention, with reference to the accompanying drawings, in which:

[0012] FIG. 1A illustrates a system for extruding bitumen into blocks and encapsulating each block in a bitumen film according to an embodiment of the present invention; FIG. 1B is a schematic of the system 100 shown in FIG. 1A;

[0013] FIG. 2A1 illustrates a bitumen pack according to another embodiment of the present invention, whilst FIG. 2A 2 illustrates an end view and FIG. 2A3 illustrates a sectional view; and

FIG. 2B illustrates a bitumen pack with all sides of the bitumen compound film being sealed up;

[0014] FIG. 3A illustrates a pallet with stacks of bitumen packs shown in FIG. 2A; FIG. 3B1 illustrates a shipping container with pallets of bitumen packs; FIG. 3B2 illustrates a shipping container loaded with bitumen packs without using pallets; FIG. 3C illustrates a lifting bag with stacks of bitumen packs; and

FIG. 3D illustrates stacks of bitumen packs in storage.

Detailed Description

[0015] One or more specific and alternative embodiments of the present invention will now be described with reference to the attached drawings. It shall be apparent to one skilled in the art, however, that this invention may be practised without such specific details. Some of the details may not be described at length so as not to obscure the invention. For ease of reference, common reference numerals or series of numerals will be used throughout the figures when referring to the same or similar features common to the figures.

[0016] FIG. 1A shows a system 100 for co-extruding bitumen and bitumen compound film according to an embodiment of the present invention, whilst FIG. 1B shows a schematic of the system 100. As shown in FIGs. 1A and 1B, the system 100 includes a bitumen extruder 110, a bitumen compound film extruder 130, an extrusion head 150, a weld press 170 and a cooling unit 180. In the system 100, a bitumen product is extruded or dispensed into blocks 200 and each block is encapsulated or encased in a bitumen compound film 160 in one operation.

[0017] In one embodiment, the bitumen extruder 110 is a rotary screw extruder. In another embodiment, the bitumen extruder is a piston-type injection extruder. The bitumen extruder 110 has an inlet hopper 114 and an output end 116. Similarly, the bitumen compound film extruder 130 may be a rotary screw or piston-type extruder, which has an inlet hopper 134 and an output end 136. For example, road paving grade bitumen at about 50°C is fed into the inlet hopper 114 of the bitumen extruder 110, whilst the bitumen compound film 160 composition at about 160°C to about 200°C is fed into the inlet hopper 134.

[0018] As shown in FIGs. 1A and 1B, the output ends 116, 136 of the bitumen and bitumen compound film extruders are connected to the extrusion head 150 such that bitumen is extruded through a centre core 154 of a die 152 whilst a tube of bitumen

compound film 160 is extruded through a channel 156 surrounding the centre core 154. In use, a bitumen compound film 160 is co-extruded to surround a block of extruded bitumen. At the discharge end of the die 152 is a weld press 170 for sealing the bitumen compound film 160 separately at a front end and rear end of each block of extruded bitumen. Each extruded bitumen pack 200 is then transferred through the cooling unit 180 before the bitumen pack 200 is removed for storage or delivery.

[0019] In another embodiment of the extruder, be it the bitumen extruder 110 or bitumen compound film extruder 130, the extruder may include a high pressure pump system. The high pressure pump system, for example, in the range from about 10 bar to 100bar is to provide sufficient force to extrude the bitumen through the centre core 154 of the die 152 or the bitumen compound film through the channel 156 surrounding the centre core 154 of the die 152.

[0020] In one embodiment of the present invention, the bitumen compound film 160 is made up of 10-30% by weight of natural bitumen (sometimes known as Gilsonite or asphaltene) and 5-25% by weight of synthetic rubber polymer. (Gilsonite is a trade name of American Gilsonite Co., Ltd.). For example, to pack road paving bitumen, such as penetration grades 30 to 100, the bitumen compound film 160 may be made up of 10-30% by weight of natural bitumen, 50-80% by weight of bitumen and 5-25% by weight of synthetic rubber polymer. In another example, to pack polymer modified bitumen and roofing/sealing grade bitumen, the bitumen compound film 160 may be made up of 10-30% by weight of natural bitumen and 50-80% by weight of polymer modified bitumen. In one embodiment, the synthetic rubber polymer and polymer modifier may include styrene-butadiene-styrene (SBS), styrene-butadiene rubber (SBR) and similar rubber grafted polymers and copolymers.

[0021] As one will appreciate, the bitumen compound film 160 comprises primarily of the bitumen product that is being packed. With the core of the bitumen product representing about 75% to about 98% of the total material extruded, the bitumen compound film 160 is fully miscible with a melt of the bitumen product. In addition, the relatively small amount of rubber polymer enhances the properties of the bitumen product without significantly increasing the cost of the packed bitumen blocks 200.

[0022] Preferably, the bitumen blocks are extruded in different sizes and weights. For example, for easy manual handling by a person, a packed bitumen block 200 may range from about 1 kg to about 25 kg, whereas a bitumen block of 25-50 kg may be manageable by two persons. For mechanized handling, a packed bitumen block 200 may range from about 50 kg to about 200 kg. These packed bitumen blocks 200 may be stacked on pallets (as shown in FIG.3A) and in cartoons for delivery by a lorry or in a shipping container (as shown in FIGs. 3B1 and 3B2) for delivery by road, sea or rail; and so on. These packed bitumen 200 may also be packed in lifting bags (as shown in FIG.3C) for loading into general dry cargo ships. In storage (as shown in FIG. 3D), powder of calcium carbonate, for example, may be sprinkled on surfaces of the packed bitumen blocks 200 to minimize or prevent them from sticking to adjacent bitumen packages. In another alternative, sheets of paper or plastics are used between bitumen packages to minimize them from sticking to each other.

[0023] In one embodiment, each block of bitumen package 200 is formed into a slab 200a. Preferably, the bitumen slab 200a has length, width and thickness dimensions, in which the width/length to thickness aspect ratio is two times or more. FIG. 2A1 shows a bitumen package 200,200a after it is formed by the co-extrusion system 100. These slabs 200,200a of bitumen, therefore, has a large surface area to volume ratio and thus allows a packaged bitumen slab 200a to melt quickly when heated up in a cauldron. In addition, a vessel of molten bitumen, obtained by melting many of these packed slabs 200a, is homogenous and therefore any required agitation/mixing is minimal. In contrast, the melt down of conventional polyethylene and polypropylene bags results in these polymers floating on the surface of the molten bitumen and it is difficult to disperse these polymers into the molten bitumen.

[0024] Depending on the grade of bitumen to be packed and size of each package 200, 200a, the bitumen compound film 160 may range from a thickness of about 200 microns to about 5 mm. For example, for a 5-kg pack of 60-70 or 80-100 penetration grade bitumen, a bitumen compound film 160 thickness of about 200 microns is found to be sufficient; for a 200-kg pack of similar grade of bitumen, the thickness of the bitumen compound film 160 is about 5 mm.

[0025] At the enduser site, the packed bitumen 200,200a is heated to a temperature of about 150°C to about 200°C to melt both the bitumen and the bitumen compound film 160. An advantage of the present invention is that the bitumen compound film 160 is totally compatible and miscible with a melt of the bitumen product. The composition of the bitumen compound film 160 goes into the bitumen content and there is no residue, material wastage or environmental waste. In addition, the natural bitumen and the synthetic rubber polymers/copolymers in the bitumen compound film 160 enhance the physical properties of the bitumen, possibly due to the high molecular mass and long chain polymers of the natural bitumen creating crosslinks in the resultant bitumen mix. For example, the composition of the bitumen compound film 160 may increase the softening temperature of the bitumen mix; bitumen with a higher softening point is advantageous because of its reduced rutting on road surfaces, especially in regions of hot climates.

[0026] The method of dispensing and packing bitumen according to the present invention is also safer than conventional methods. For example, this method of dispensing and packaging bitumen poses a lesser occupational hazard to an operator. For example, when extruding road paving grade bitumen, the extruded bitumen is about 40°C to about 60°C, whereas in conventional methods, bitumen is packed at about 100-160°C. When extruding polymer modified bitumen, the extruded bitumen is about 90°C to about 110°C, compared to temperatures of about 160-180°C for conventional methods.

[0027] The other advantage according to the present invention is that dispensing of the bituminous product and encapsulating it in a bitumen compound film are carried out simultaneously, i.e., in one operation. In contrast, the conventional filling of bitumen products in drums, polyethylene, polypropylene or paper bags involves several steps and these lead to unnecessary multiple handling. Hence, the present method is faster and operates at a higher volume than convention methods. This method of dispensing and packing bitumen according to the present invention is, therefore, superior and more economical than known methods.

[0028] While specific embodiments have been described and illustrated, it is understood that many changes, modifications, variations and combinations thereof could be made to the present invention without departing from the scope of the present invention. Whilst the bitumen blocks 200,200a are described broadly to contain paving, roofing and waterproofing materials, the bitumen products are not so restricted but include other bituminous compounds, such as: tars; pitches obtained from bottom residues of petroleum refineries; asphalts; industrial bitumen; and bitumen emulsions. In the above description, the bitumen blocks/slabs 200,200a and bitumen compound film 160 are co-extruded; it is possible that the bitumen product is dispensed into moulds, allowed to cast into shape and cooled down before each bitumen block or slab is encased by the above bitumen compound film 160. It is also possible that the above bitumen compound film is extruded into separate sheets; for example, two sheets of bitumen compound films 160 are extruded to cover a bitumen block/slab and all the edges of the bitumen compound film are heat sealed to encase the bitumen block/slab 200b, as shown in FIG. 2B. It is also possible to coat each bitumen block with the above bitumen compound film, for example, by dipping or spraying. In another example, a pair of weld presses 170 may be used to simultaneously heat seal the front and rear edges of a bitumen pack; it is also possible to employ a weld press to simultaneously heat seal all the edges of a bitumen pack in one operation.

CLAIMS:

1. A bitumen package comprising:
a bituminous material being formed into a block; and
a bitumen compound film operable to encase the bituminous block;
wherein said bitumen compound film comprises 10 to 30% by weight of natural bitumen, 5 to 25% by weight of synthetic rubber polymer and the balance being the bituminous material of said block.
2. A bitumen package according to claim 1, wherein the bituminous material is any one of the following: road paving grade bitumen or asphalt; polymer modified bitumen; roofing grade bitumen; sealant and waterproofing grade bitumen; emulsion bitumen; tar; and refinery bottom residual pitches.
3. A bitumen package according to claim 1 or 2, wherein said bitumen block is formed into a slab, whose width/length to thickness aspect ratio is two times or more.
4. A bitumen package according to any one of the preceding claims, wherein said synthetic rubber polymer comprises its copolymer and similar rubber grafted polymer.
5. A system for dispensing and packaging bitumen in one operation, said system comprising:
an extrusion head having a die, said die has a core output channel and a film output channel surrounding the core output channel;
wherein a bituminous material is operable to be extruded through the core output channel whilst a bitumen compound film is operable to be extruded through the film output channel so that the bitumen compound film is formed simultaneously around a core of the bituminous material.
6. A system according to claim 5, wherein the bitumen compound film comprises 10 to 30% by weight of natural bitumen, 5 to 25% by weight of synthetic rubber polymer and the balance being the bituminous material of the core.

7. A system according to claim 6, wherein the synthetic rubber polymer comprises its copolymer and similar rubber grated polymer.
8. A system according to any one of claims 5-7, further comprising a weld press, which is operable to heat seal the bitumen compound film after the bitumen core and film are extruded.
9. A system according to claim 8, wherein front and rear ends of the bitumen compound film are separately heat sealed.
10. A system according to claim 8, wherein front and rear ends of the bitumen compound film are simultaneously heat sealed.
11. A system according to claim 8, wherein all the edges of the bitumen compound film are simultaneously heat sealed.
12. A system according to any one of claims 5-11, further comprising a water bath cooling unit, which is disposed after the weld press.
13. A composition of a bitumen compound film for wrapping a block of bituminous material, said composition comprising:
 - 10 to 30% by weight of natural bitumen;
 - 5 to 25% by weight of synthetic rubber polymer; and
 - the balance being the bituminous material of said block.