

METHOD AND APPARATUS TO PRODUCE SYNTHETIC POLYMER ASPHALT

Technical Field Invention

This invention relates to a method for making synthetic polymer asphalt. In particular, this invention relates to a method of making synthetic polymer asphalt as asphalt bitumen substitute by utilization of waste from palm oil refinery (waste spent earth bulk or bleaching earth or sodium bentonite).

Background of the Invention

Asphalt is utilized widely for road construction because of its glue-like nature and good resilience to weather, chemical influence and radiation.

Every year the consumption for paving of road streets around the world exceed 900,000 tons. North America and Europe use around two-thirds of this consumption. In America, more than 4 million miles of street are smoothed down with carpeted asphalt. Asphalt carpets are damaged because of emphasis, effect of asphalts fixative oxidation, heavy traffic burden and condition of fickle climate. Every year, it is a requirement in Indonesia to pave the surface of high roadway. Asphalt used for the surface of roadway is produced by PERTAMINA which comes from residue from process distillation of fossil fuel hydrocarbon. The common asphalt product in Indonesia has two types, i.e., asphalt with penetration of 60/70 and 80/100, and partly from natural asphalt or asbuton. Newest study shows statistically relationship between growths of economics and state and infrastructure.

Asphalt surface of street consists of aggregate and asphalt. Fixative oxidation pave during a period of usage, condition of climate, and usage of surface of street, especially heavy traffic burden, yield surface offstreet. Asphalt is very dependent on the temperature of its environment. For example, if contraction repeatedly occurs on the surface of the street, cool air

way effect change of temperature which yields vertical cracks at concreting, known as "burst chill". Asphalt fixative become soft during hot days which results in permanent damage to the surface of the street under repeatedly heavy traffic burden, in term "rutting". Hereinafter, as mechanism pressure result continues to interpose on the surface of the street, it yields forming of cracks which look like crocodile husk, known as burst gap.

Because of the growth in technology, pave with fast polymer are produced progressively. Asphalt which has been modified with polymer has mechanical nature which is better compared to the basic or bitumen or petroleum-based asphalt.

Meanwhile, developments in various industrial types together with growth of population have yielded fast improvement in the production of various waste types. One of the industrial waste types is spent bleaching earth, waste from vegetable oil refinery which is used for pigment/colorant removal of vegetable oil, such as palm oil. Efforts have been made to find the most worthwhile application of spent bleaching earth besides using it as land filling. This proposal has been made to utilize spent bleaching earth as asphalt material for road paving or construction.

Although assorted asphalt modifications and developments have been recognized, none can be produced cheaply.

This invention provides formula and making process of the synthetic polymer asphalt by utilizing waste from palm oil refinery (spent bleaching earth) and formulated with other raw materials (elastomer, resin polymer, used lube oil, and kerosene).

Summary of Invention

On that account, this invention is concerned with the making of synthetic polymer asphalt using raw material of waste spent bleaching earth or sodium bentonite from palm oil refinery, resin polymer or arpus, renolith polymer, used lube oil and kerosene which consist of the following flow process:

- enter sodium bentonite/spent bleaching earth bulks to hopper (2) via

- belt conveyer (1),
- enter arpus and renolith polymer/glissonite to hopper (2) successively, after which raw material is crushed by a crusher (3),
- conduct the raw material to rotary dryer (4) where dirt released passes through a dust cyclone (5), the mixed raw material is sent to a high rise screw conveyer (6) and then poured into a tank homogenizer (8), additive in the form of used lube oil and kerosene from tank (7) is also conducted to the tank homogenizer (8) via the screw conveyor where the mixture is heated between 120°C to 140°C, the tank is provided with churn appliance with blades level off and hot system steam,
- the homogeneous mixture is done by a mixer with speed of agitation at 150 - 400 rpm during 60 minute,
- release the product (synthetic polymer asphalt) through output spillway to a relocation tank with conic base and a heater system, by using pump gear.

Brief Description of Drawings

Figure 1 is a diagram showing the process of making synthetic polymer asphalt.

Detailed Description

According to Indonesian National Standard (SNI), asphalt is differentiated by its characteristic of penetration and softening point or interaction of both characteristics. Asphalt with high penetration causes the asphalt mixture downwards through free space of aggregates of road materials so that there is no binding between the aggregates. Addition of polymer additive will alter the physical characteristic of asphalt mixture, its brittleness and ductility. Softening point influences stickiness of asphalt mixture. Asphalt with higher softening point will provide a better binding characteristic to the aggregates. The preferred polymer used in this invention is arpus/resin

polymer. To provide elasticity characteristic of this synthetic polymer asphalt mixture, the elastomer renolith is used. Renolith gives the flexibility effect when the asphalt mixture is hit by the heavy traffic burden so it does not burst easily. Solubility of the synthetic polymer asphalt in trichloroethylene is almost 100%, which means no deposit or sediment in the asphalt when heated.

This synthetic polymer asphalt mixture consists of spent bleaching earth (sodium bentonite), arpus, renolith/glisonite, used lube oil, and kerosene, with weight ratio of 50 : 32 : 15 : 2 : 1.

Chemical composition for bleaching earth in weight % is as follows:

SiO ₂	65.00 - 75.00
Al ₂ O ₃	12.00 - 22.00
Fe ₂ O ₃	3.00 - 4.50
CaO	0.20 - 1.00
MgO	1.50 - 3.00
TiO ₂	less than 0.50
Na ₂ O	0.50 - 1.50
K ₂ O	0.20 - 0.60

The type of bleaching earth used is natural bentonite which is classified as clay formed by decomposition of volcanic ash or montmorillonite clay. Hydration of the bentonite forms a suspension with gel-like structure. In this case sodium bentonite clay functions as glue or binder for the aggregates.

With reference to Figure 1, spent earth or bleaching earth obtained from palm oil refinery discard (which has been collected in a place of) is transported by using Belt Conveyer (1) to Hopper (2). Arpus and additive renolith are also entered into Hopper (2). Arpus should be crushed by using Crusher (3) until the size of particle is less than 200 mesh. The raw material is passed through a Rotary Dryer where it is dried and dust released passes through a dust cyclone [5]. The rotary dryer is provided with a sensor Indicator Control for controlling the volume at Screw Conveyer (6) and tank

Homogenizer (8). After drying, the raw material is sent to a high rise Screw Conveyor (6). Used lube oil and kerosene from tank (7) are also conducted into the Screw Conveyor [6]. The Tank Homogenizer (8) is provided with churn appliance with blades level off and heater system consisting of a double steam jacket and activator motor, blower (9) and also boiler [10] for generating steam. The mixture is heated between 120°C to 140°C and stirred with agitation at 150 - 400 rpm for 60 minute.

Synthetic polymer asphalt product passes through the outlet to a relocation tank with conic base and a heater by using pump gear (11).

Analysis result of the synthetic polymer asphalt product at an independent laboratory in Indonesia is as follows.

Table 1

No.	PARAMETER	ANALYSIS RESULT	PERTAMINA SPECIFICATION FOR ASPHALT		
			Min	Max	Method
1.	Penetration at 25°C, 100 gram, 5 second (0.1 mm)	60.25	60	79	SN106-2456-1991
2.	Flash point (cleveland open cup) 30°C	337	200	-	SWN06-2433-1991
3.	Ductility at 25°C, 5cm per minute, cm	132	100	-	SIN06-2432-1991
4.	Solubility in trichloroethylen	99.11	99	-	AASHTO T 44-97

5.	Lost of weight, thin film oven test (TFOT), 163°C, 5 hrs (% weight)	0.18	-	1.4	SIN06-2440-1991
6.	Penetration after TFOT towards the real weight, %	85.06	75	-	SIN06-2455-1991
7.	Specific gravity, 25°C gram/cm	1,034	1	-	SIN062441-1991
8.	Softening Point (ring and ball method) °C	50.25	48	-	SIN06-2434-1991

Specification of asphalt produced by PERTAMINA appears on Table 2, below:

Table 2

Asphalt Penetration 60/70 (60 PEN), Pertamina

No.	Parameter	Specification		Unit
		Min	Max	
1.	Penetration at 25°C, 100 gram, 5 second	60	79	mm
2.	Softening Point (ring and ball method)	48	58	°Celsius
3.	Flash point (cleveland open cup)	200	-	°Celsius
4.	Lost of weight, thin film oven test (TFOT), 163°C, 5 hrs	-	0.4	(% weight)
5.	Solubility in CS ₂ or CCl ₄	99	-	(% weight)
6.	Ductility at 25°C, 5cm per minute	100	-	cm

7.	Penetration after TFOT towards the real weight	75	-	Percentage
8.	Specific gravity, 25°C gram/cm	1	-	-

Asphalt Penetration 80/100 (80 PEN), Pertamina

No.	Parameter	Specification		Unit
		Min	Max	
1.	Penetration at 25°C, 100 gram, 5 second	80	99	mm
2.	Softening Point (ring and ball method)	46	54	°Celsius
3.	Flash point (cleveland open cup)	225	-	°Celsius
4.	Lost of weight, thin film oven test (TFOT), 163°C, 5 hrs	-	0.4	(% weight)
5.	Solubility in CS ₂ or CCl ₄	99	-	(% weight)
6.	Ductility at 25°C, 5cm per minute	100	-	cm
7.	Penetration after TFOT towards the real weight	75	-	Percentage
8.	Specific gravity, 25°C gram/cm	1	-	-

Claims:

1. A method of making synthetic polymer asphalt using raw materials of waste or spent bleaching earth, additive polymer, and elastomer which consist of the following flow process:
 - enter the materials of spent bleaching earth/sodium bentonite to hopper (2) via belt conveyer (1),
 - enter resin polymer and elastomer additive to hopper (2) successively, after which the resin polymer is crushed with a crusher (3),
 - conduct the raw materials to rotary dryer (4), after which the raw materials are sent to a high rise screw conveyer (6) and then poured into a tank homogenizer (8), additive in the form of used lube oil and kerosene from tank (7) is also conducted to the tank homogenizer via the screw conveyor where the mixture of raw materials is heated between 120°C to 140°C, the tank is provided with churn appliance with blades level off and hot system steam,
 - the homogeneous mixture is done by a mixer with speed of agitation at 140 - 400 rpm for 60 minute, and
 - release the synthetic polymer asphalt through output spillway to a relocation tank with conic base and a heater system using pump gear (11).
2. A method of making synthetic polymer asphalt according to claim 1, wherein weight ratio of spent bleaching earth (sodium bentonite) : polymer : elastomer additive : used lube oil : kerosene is 50 : 32 : 15 : 2 : 1.
3. A method of making synthetic polymer asphalt according to claim 1, wherein the polymer used is arpus.
4. A method of making synthetic polymer asphalt according to claim 1,

wherein the elastomer used is renolith.

5. A method of making synthetic polymer asphalt according to claim 1, wherein the materials spent bleaching earth comes from natural bentonite clay or sodium bentonite.