

THE PROCESS of ASPHALT PURIFICATION

and

THE COMPOSITION of MODIFIED ASPHALT

Technical Field of the Invention.

The present invention is related to the purification process of natural asphalt (in this case, the Buton asphaltic rock), and the utilization of the purified product as a main material to convert oil waste into environmentally friendly materials. The required raw material is not limited to Buton rock asphalt but includes various similar natural asphalt e.g.: Asphaltites (Gilsonite; Grahamite; Trinidad Asphalts), Pyro Bitumen.

The use of the above products in the conversion process of oil waste will generate a new environmentally friendly product which is safe to be concealed as in landfill. Further processing will permit to yield soil stabilizing material with cationic characteristic or anionic modified asphalt. These products are suitable for road construction material.

Background of the invention

Deposits of oil or oil rocks formations in many place in the world generally have asphalt content between 10-40% and several processes to extract hydrocarbon from their deposits have been developed.



In many cases, the most economical extraction process consisted of high temperature steam injection through a drill hole to the geologic formation containing oil. Hot steam forced oil to move from soil particles in the shape of oil-water emulsion which is collected through a different drill hole and brought to the ground surface.

In general this method of extraction would be effective if the bitumen content is higher than 6%, the specific area of the soil particle is low and the steam water film sealing each soil particle is sufficiently thin.

The bitumen extraction process from a natural rock by directly injecting hot steam is effective due to the shape of the bitumen-water-mineral system, as shown in Figure 1, where the position of bitumen (a) is clearly separated from water (b) and mineral (c) in the boulder structure (d). In other words, the direct steam injection process is adequate for this kind of structure.

Another process to extract asphalt from asphaltic rock is by the use of organic solvent. The U.S. Patent No. US-A-4 098 648 for example, explained the extraction of asphalt from asphaltic rock containing certain percentage of asphalt. The extraction of bitumen from hydrocarbon is actuated by centrifugal force in a reactor equipped with a helical screw facing the inner side of the reactor.



A different patent in asphalt extraction process is the patent numbered EP-A-0 173 574. The process involved in this patent is the extraction of asphalt (in a relatively dense form) from crude oil, emulsion of crude oil, residue from distillation, or other heavy oil. The separation is performed by adding hydrocarbon solvent obtained from light paraffin and followed by decantation to draw asphalt fraction. The range of solvent required is between two to four times of the oil volume.

The common process of asphalt separation both from natural resources and from oil residue produced by refineries is by the process of separation and purification through extraction system or hot steam injection. The pure asphalt obtained are then used as road material and for oil drilling purpose.

The shape of natural asphalt mined in Indonesia is very different to those found in other countries as shown in Figure 2, where asphalt (e) is impregnated in a shell (f). Because the unique nature of Buton asphalt, mainly the high porosity of the debris contained, if the process is applied to Buton asphalt, the required organic solvent is very high whilst the produced asphalt is low in quantity, inefficient and uneconomical.

The applications of present Buton asphalt technologies so far is uneconomical. This is because of the confinement of

asphalt particles in Buton asphaltic rock in the organic-carbonate (shell), in other word, the asphalt content is deeply impregnated inside the shell particles. The new invented process described here will fill up the detrimental factors of the previous inventions.

This new invention conceptually is very different (even opposite) to the previous processes. In the previous processes the bitumen purification is performed by dissolving the bitumen, whilst in this invention the process took place by dissolving the bituminous rock. In the former process, bitumen recovery took place by evaporating the solvent followed by drying process. In the new invention, the bitumen recovery is performed by decantation followed by drying.

The product resulted from the purification process may then be used as primary agent for oil waste treatment and converting oil waste to a different material friendly to the environment. The converted product possess new characteristics, i.e.: it does not contain oil and heavy metal nor produce harmful odor and thus it is possible to place it underground and filled safely.

Currently there are two methods of oil waste treatment, i.e.: (a) destruction method, and (b) partial recycling method.



In the first method, the main principle is by burning oil waste in high temperatures to neutralize the emitted toxic gas prior released to the atmosphere. The destruction process necessitate fuel injected (propane, natural gas or burning oil) to the system. The common use of this method is the incineration process.

In the second method, the oil portion is separated from the water solution in the oil waste using physical or chemical methods as in a vertical separator. Oil portion separated from the waste is then returned to the production system whereas the remaining waste, still containing a small portion of oil, is then reprocessed by the destruction method.

The oil waste treatment method in this invention by manipulating pure asphalt and additives materials is beyond both methods mentioned above. This invention is a completely distinct method and is a method capable to convert oil waste to diverse products (reclassifying).

Principally, oil waste is converted to a new product which is environmentally friendly in the form of soil stabilizer or modified asphalt. A diagram of the above mentioned methods of oil waste treatment is shown in Figure 4.

The process of oil waste treatment (conversion) with the said materials consists of the following steps. First, the



dehydration process, a process to separate water from the system, using both physical and or chemical methods. The physical separation process mentioned may consists of heating/vaporizing in atmospheric pressure or in a vacuum setting. Application of chemical separation is by adding water absorbing agent. Second, neutralize organic acids by the addition of Calcium Oxide (CaO). Third, addition of cellulose materials to bind/absorb light hydrocarbon. Fourth, add pure Buton asphalt to form a stable colloid bind to avoid environmental pollution. The above process is made in a temperature ranging from 80 to 175 centigrade. In ambient temperature, this process produce solid or semi solid materials.

Oil waste resulted from oil fields, oil tanks/tankers cleaning and refineries are processed effectively using this method.

In order to expand its use (not only in landfill areas) the converted environmentally friendly product may be further processed to produce soil stabilizer or modified asphalt. The term "modified asphalt" is used to distinguish the product from the commonly known asphalt as a by-product of oil refineries. However, they possess the same characteristic.



Soil stabilizer are obtained by adding certain amount of hydrated lime (5-15%) at temperature ranging from 80-100 centigrade and mixed evenly.

The modified asphalt is derived by adding anti stripping agents with anion characteristic as Tertiary Amine compound or its derivative. To gain the desired penetration grade, Gilsonite or Trinidad asphalt are then added in a measured amount of 1 to 10%

The application of soil stabilizer in road construction is by preparing a hot mix of the existing soil and 11-14% of soil stabilizer. The hot mix is then laid on the prepared surface and compacted by tandem and tire rollers.

The specific application of the above mentioned technology are as follows. First, in the constructions of operating roads or low cost roads in oil fields, plantations, mining, forestry and transmigration areas. Second, in the preparation of sub-base and base in the construction of highways located in areas where aggregate is scarce. Third, to handle disagreeable soil type (usually considered as unwanted materials) such as expansive soil, soft soil and mud, and converting it to a preferable (selected) materials.

The applications of modified asphalt produced by this invention is similar to conventional asphalt produced by oil refineries, i.e. by preparing a hot mix of aggregates and 5-



8% asphalt. Further application techniques are similar to the application of conventional asphalt.

Further application of this technology is in the treatment of oil base mud resulted from oil drilling. The difference to the above mentioned application is that the product obtained from oil base mud cannot subsequently converted to soil stabilizer or modified asphalt due to the high presence of solid.

Summary of the Invention

This invention involves the purification process of natural asphalt impregnated in carbonate rock (e.g. Buton natural asphalt) and its use as primary agent for oil waste treatment to produce an environmentally friendly material. In accordance with the second subject of invention, the natural asphalt utilized as a main material to process oil waste is not limited to Buton asphalt, but is also applicable to other natural asphalt, e.g.: Gilsonite, Trinidad asphalt, Grahamite and other natural asphalt.

The product obtained from application of this waste treatment process is environmentally friendly, and meet the requirement of landfill. Moreover, the product may be processed to derive a soil stabilizer with cationic characteristic, or further processed to produce modified asphalt with anionic characteristic. The two products



derived from supplemental processing is utilized in road constructions. The application of soil stabilizer in road construction is by preparing a hot mix of soil and stabilizer. The hot mix is then laid and compacted. Similarly, modified asphalt is hot mixed with aggregate and spread on a prepared base and then compacted. The application of soil stabilizer is limited to road base and low cost (simple) road surfaces, whilst modified asphalt is applicable to both road base and surface of highways comparable to the application of petroleum asphalt.

Figures short description

Figure 1 shows a microscopic view of a natural asphaltic rock used in previous process.

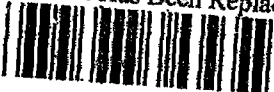
Figure 2 shows a microscopic view of Buton natural asphaltic rock used in the new process invented.

Figure 3 is a flow diagram of the oil waste treatment process and productions of soil stabilizer and modified asphalt in accordance with the invention.

Figure 4 shows the varyous methods of oil waste treatment.

Detailed Description of the Invention

Figure 2 shows the natural asphaltic rock structure found in Indonesia, and is widely known as Buton Asphalt (Asbuton)

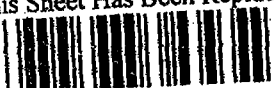


for it is mined in the Island of Buton. The rock forming Asbuton consists of microscopic plankton having a very high specific area. The rock porosity is also very high in opposite to its low permeability. The pure bitumen is impregnated in the porous rock.

The combination of the rock characteristic, i.e.: high specific area and low permeability, caused conventional extraction (using steam or organic solvent) inapplicable to Asbuton. The application of conventional extraction process will only result a very low efficiency and uneconomical production. This process will cause the lost of extracting solvent up to 40% per production cycle.

The principle of this invention is diametrically opposite to the conventional process. While in the conventional process, bitumen extraction took place by the use of solvent, hence the rock boulders is relatively intact. Bitumen is then separated from the solvent and dried to collect the final product.

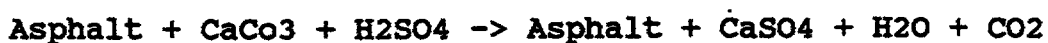
In this invention, rock matrix is dissolved in a solution of water and inorganic acid (Sulfide Acid), with water in the major proportion. Because of the cracking rock matrix, pure bitumen having density $\cdot 1.03$ gr/cc is released and floated since some emitted CO_2 gas are trapped inside. In the contrary, the same chemical reaction caused particles of $\cdot 2$ gr/cc density to sink. Due to the high difference in density



of the expected product and the by-product, separation is easily performed by decantation. The subsequent process is the drying process to collect the final product.

Figure 3 refers to the invented process, where pure asphalt is produced from Asbuton through several processing stages described in the following discussion.

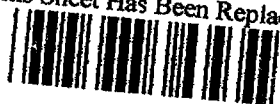
Initially, a certain particle size of Asbuton rock fragments is fed to a mixing vessel, then a certain amount of inorganic solvent such as sulfate acid is added and mixed at a measured revolutions per minute. The chemical reaction taking place in the vessel is an ionic reaction written below:



The CO₂ gas emitted in the mixing vessel is removed from the vessel and asphalt is isolated from the solution by a separator. The asphalt portion is then dried to obtain asphalt with nearly 100% purity.

The high purity produced by the application of this invention is enhanced by the ionic reaction when separating shell which is dissimilar to the previous processes.

Modified asphalt is produced by consistently mixing residual oil and flour in the mixing vessel. By adding various filler and by the process of heating to 90-200 centigrade, the modified asphalt obtained is then ready for packaging.



Modified Asphalt Composition Range

Pure asphalt	= 2-40% by weight
Residual oil	= 60-90% by weight
Cellulose fiber	= 0.5-2%
Lime [$\text{Ca}(\text{OH})_2$ or CaO]	= 7.5-50% by weight

Purification example of Buton Asphaltic Rock (Asbuton),
asphalt content = 40%

In order to produce 1 (one) kilogram of pure asphalt with a purity close to 100%, pour 3.5 liters of water to a 10 liters capacity mixing vessel. Feed 2.5 kg Asbuton having asphalt content of 40% Add 0.5 liter of 96% solution of H_2SO_4 and mix throughly to release all asphalt particles from the Asbuton shell. Using a separator, dissolve asphalt from the solution and dry.





Claims

1. The use of purified natural asphalt, including GILSONITE, as a primary material in the processing (converting) of oil waste treatment to produce an environmentally safe material (environmentally friendly oil).
2. Supplementary treatment of the environmentally friendly oil waste aforementioned in claim 1 to produce soil stabilizer material by adding hydrated lime.
3. Supplementary treatment of the environmentally friendly oil waste aforementioned in claim 1 to produce modified asphalt by adding anti stripping agents, including tertiary amine compounds and/or their derivatives.
4. The purification process of Buton natural asphalt to obtain pure asphalt in accordance with this invention consists of the following steps:
 - Mixing Asbuton and inorganic solvent
 - Separation of asphalt from the solution in the mixing vessel, and
 - Drying of the asphalt accumulated by the separator.

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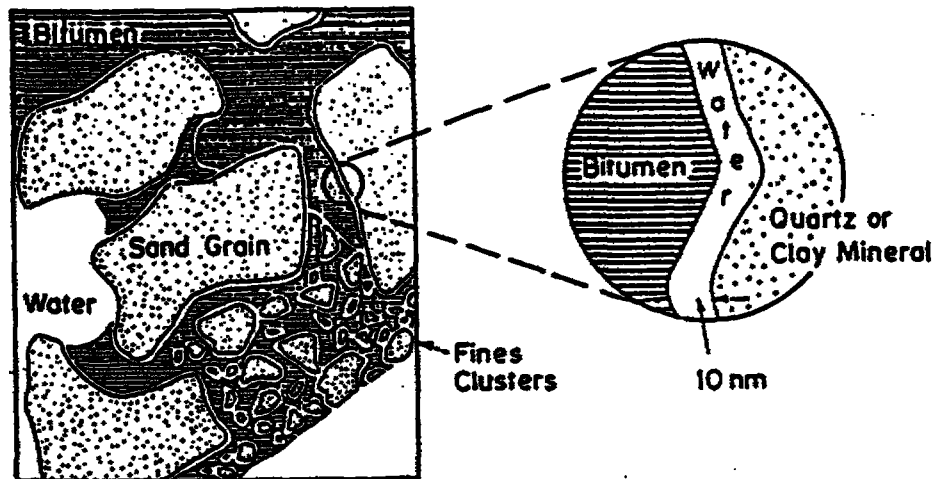


Figure 1. Microscopic Diagram of Natural Asphaltic Rock (In previous processes)

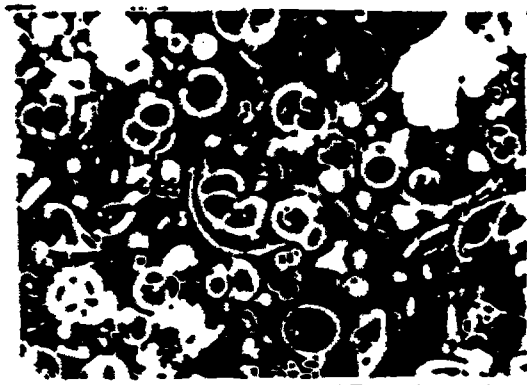
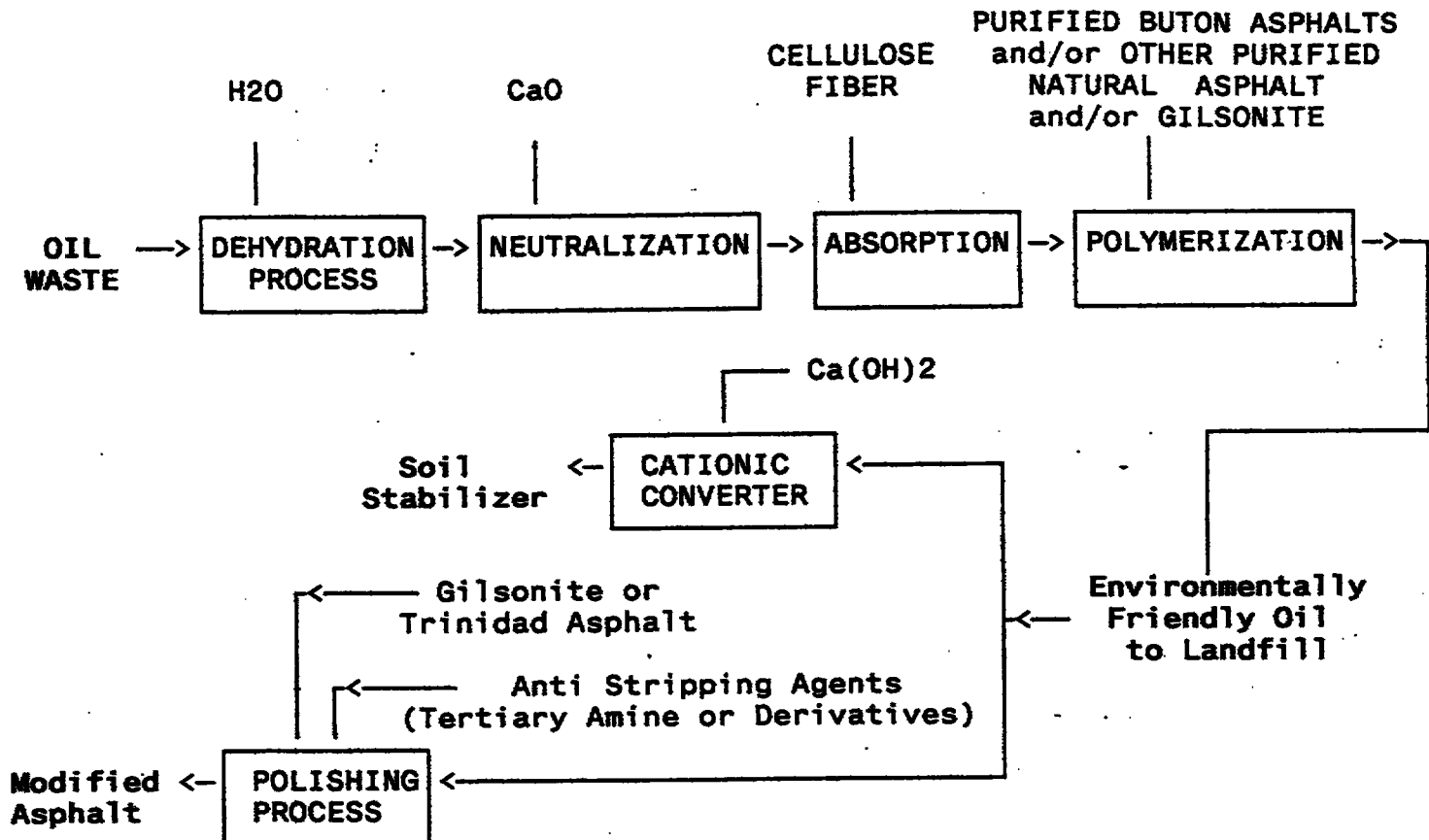


Figure 2. Microscopic cross section of Buton Asphaltic Rock.



Figure 3. Oil Waste Treatment Process

Diagram of the Utilization of Pure Buton Asphalt and Additives



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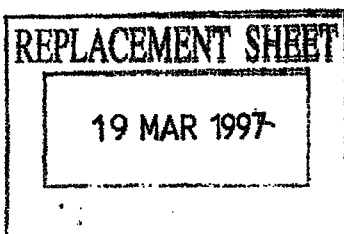
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Background of the invention

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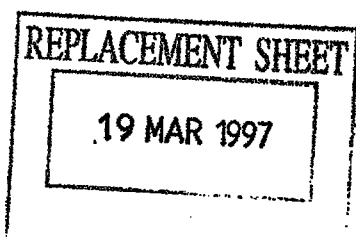
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☒ Claim(s) : paged .13. to paged .14.	
☒ Drawing(s) : paged .15. to paged .16.	
☒ Abstract : paged .17. to paged .18.	
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In many cases, the most economical extraction process consisted of high temperature steam injection through a drill hole to the geologic formation containing oil. Hot steam forced oil to move from soil particles in the shape of oil-water emulsion which is collected through a different drill hole and brought to the ground surface.

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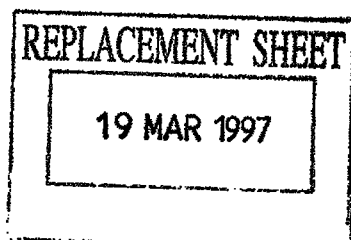


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The shape of natural asphalt mined in Indonesia is very different to those found in other countries as shown in Figure 2, where asphalt (e) is impregnated in a shell (f). Because the unique nature of Buton asphalt, mainly the high porosity of the debris contained, if the process is applied to Buton asphalt, the required organic solvent is very high whilst the produced asphalt is low in quantity, inefficient and uneconomical.

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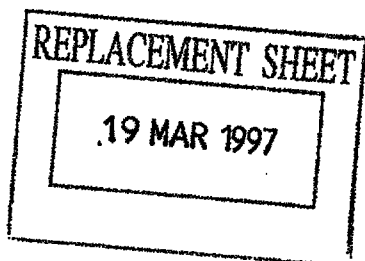


asphalt particles in Buton asphaltic rock in the organic-carbonate (shell), in other word, the asphalt content is deeply impregnated inside the shell particles. The new invented process described here will fill up the detrimental factors of the previous inventions.

This new invention conceptually is very different (even opposite) to the previous processes. In the previous processes the bitumen purification is performed by dissolving the bitumen, whilst in this invention the process took place by dissolving the bituminous rock. In the former process, bitumen recovery took place by evaporating the solvent followed by drying process. In the new invention, the bitumen recovery is performed by decantation followed by drying.

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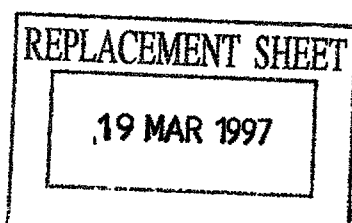
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The oil waste treatment method in this invention by manipulating pure asphalt and additives materials is beyond both methods mentioned above. This invention is a completely distinct method and is a method capable to convert oil waste to diverse products (reclassifying).

Principally, oil waste is converted to a new product which is environmentally friendly in the form of soil stabilizer or modified asphalt. A diagram of the above mentioned methods of oil waste treatment is shown in Figure 4.

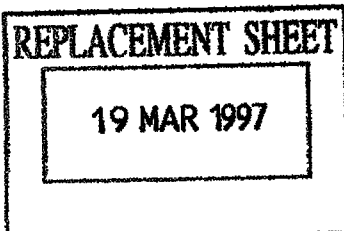
The process of oil waste treatment (conversion) with the said materials consists of the following steps. *First*, the



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Oil waste resulted from oil fields, oil tanks/tankers cleaning and refineries are processed effectively using this method.

In order to expand its use (not only in landfill areas) the converted environmentally friendly product may be further processed to produce soil stabilizer or modified asphalt. The term "modified asphalt" is used to distinguish the product from the commonly known asphalt as a by-product of oil refineries. However, they possess the same characteristic.



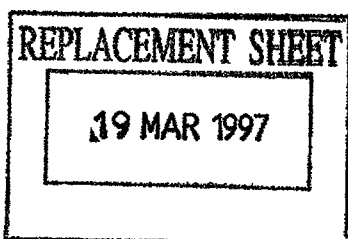
Soil stabilizer are obtained by adding certain amount of hydrated lime (5-15%) at temperature ranging from 80-100 centigrade and mixed evenly.

The modified asphalt is derived by adding anti stripping agents with anion characteristic as Tertiary Amine compound or its derivative. To gain the desired penetration grade, Gilsonite or Trinidad asphalt are then added in a measured amount of 1 to 10%

The application of soil stabilizer in road construction is by preparing a hot mix of the existing soil and 11-14% of soil stabilizer. The hot mix is then laid on the prepared surface and compacted by tandem and tire rollers.

The specific application of the above mentioned technology are as follows. First, in the constructions of operating roads or low cost roads in oil fields, plantations, mining, forestry and transmigration areas. Second, in the preparation of sub-base and base in the construction of highways located in areas where aggregate is scarce. Third, to handle disagreeable soil type (usually considered as unwanted materials) such as expansive soil, soft soil and mud, and converting it to a preferable (selected) materials.

The applications of modified asphalt produced by this invention is similar to conventional asphalt produced by oil refineries, i.e. by preparing a hot mix of aggregates and 5-



8% asphalt. Further application techniques are similar to the application of conventional asphalt.

Further application of this technology is in the treatment of oil base mud resulted from oil drilling. The difference to the above mentioned application is that the product obtained from oil base mud cannot subsequently converted to soil stabilizer or modified asphalt due to the high presence of solid.

Summary of the Invention

This invention involves the purification process of natural asphalt impregnated in carbonate rock (e.g. Buton natural asphalt) and its use as primary agent for oil waste treatment to produce an environmentally friendly material. In accordance with the second subject of invention, the natural asphalt utilized as a main material to process oil waste is not limited to Buton asphalt, but is also applicable to other natural asphalt, e.g.: Gilsonite, Trinidad asphalt, Grahamite and other natural asphalt.

The product obtained from application of this waste treatment process is environmentally friendly, and meet the requirement of landfill. Moreover, the product may be processed to derive a soil stabilizer with cationic characteristic, or further processed to produce modified asphalt with anionic characteristic. The two products

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derived from supplemental processing is utilized in road constructions. The application of soil stabilizer in road construction is by preparing a hot mix of soil and stabilizer. The hot mix is then laid and compacted. Similarly, modified asphalt is hot mixed with aggregate and spread on a prepared base and then compacted. The application of soil stabilizer is limited to road base and low cost (simple) road surfaces, whilst modified asphalt is applicable to both road base and surface of highways comparable to the application of petroleum asphalt.

Figures short description

Figure 1 shows a microscopic view of a natural asphaltic rock used in previous process.

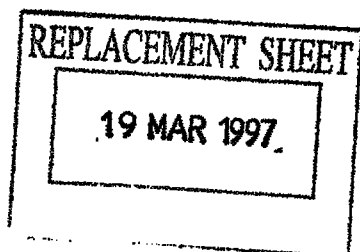
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Figure 3 is a flow diagram of the oil waste treatment process and productions of soil stabilizer and modified asphalt in accordance with the invention.

Figure 4 shows the varyous methods of oil waste treatment.

Detailed Description of the Invention

Figure 2 shows the natural asphaltic rock structure found in Indonesia, and is widely known as Buton Asphalt (Asbuton)

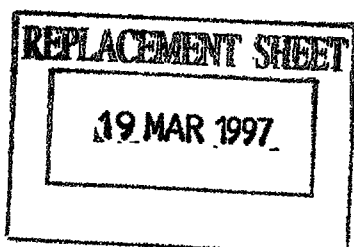


for it is mined in the Island of Buton. The rock forming Asbuton consists of microscopic plankton having a very high specific area. The rock porosity is also very high in opposite to its low permeability. The pure bitumen is impregnated in the porous rock.

The combination of the rock characteristic, i.e.: high specific area and low permeability, caused conventional extraction (using steam or organic solvent) inapplicable to Asbuton. The application of conventional extraction process will only result a very low efficiency and uneconomical production. This process will cause the lost of extracting solvent up to 40% per production cycle.

The principle of this invention is diametrically opposite to the conventional process. While in the conventional process, bitumen extraction took place by the use of solvent, hence the rock boulders is relatively intact. Bitumen is then separated from the solvent and dried to collect the final product.

In this invention, rock matrix is dissolved in a solution of water and inorganic acid (Sulfide Acid), with water in the major proportion. Because of the cracking rock matrix, pure bitumen having density $\cdot 1.03$ gr/cc is released and floated since some emitted CO₂ gas are trapped inside. In the contrary, the same chemical reaction caused particles of $\cdot 2$ gr/cc density to sink. Due to the high difference in density



of the expected product and the by-product, separation is easily performed by decantation. The subsequent process is the drying process to collect the final product.

Figure 3 refers to the invented process, where pure asphalt is produced from Asbuton through several processing stages described in the following discussion.

Initially, a certain particle size of Asbuton rock fragments is fed to a mixing vessel, then a certain amount of inorganic solvent such as sulfate acid is added and mixed at a measured revolutions per minute. The chemical reaction taking place in the vessel is an ionic reaction written below:



The CO₂ gas emitted in the mixing vessel is removed from the vessel and asphalt is isolated from the solution by a separator. The asphalt portion is then dried to obtain asphalt with nearly 100% purity.

The high purity produced by the application of this invention is enhanced by the ionic reaction when separating shell which is dissimilar to the previous processes.

Modified asphalt is produced by consistently mixing residual oil and flour in the mixing vessel. By adding various filler and by the process of heating to 90-200 centigrade, the modified asphalt obtained is then ready for packaging.

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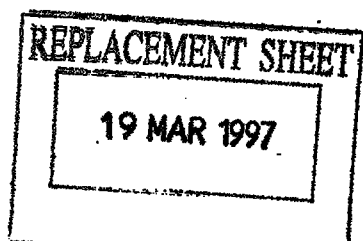
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Modified Asphalt Composition Range

Pure asphalt	= 2-40% by weight
Residual oil	= 60-90% by weight
Cellulose fiber	= 0.5-2%
Lime [Ca(OH)_2 or CaO]	= 7.5-50% by weight

**Purification example of Buton Asphaltic Rock (Asbuton),
asphalt content = 40%**

In order to produce 1 (one) kilogram of pure asphalt with a purity close to 100%, pour 3.5 liters of water to a 10 liters capacity mixing vessel. Feed 2.5 kg Asbuton having asphalt content of 40%. Add 0.5 liter of 96% solution of H_2SO_4 and mix thoroughly to release all asphalt particles from the Asbuton shell. Using a separator, dissolve asphalt from the solution and dry.



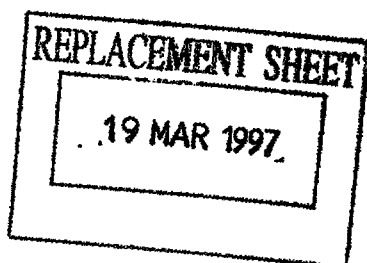


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Claims

1. The use of purified natural asphalt, including GILSONITE, as a primary material in the processing (converting) of oil waste treatment to produce an environmentally safe material (environmentally friendly oil).
2. Supplementary treatment of the environmentally friendly oil waste aforementioned in claim 1 to produce soil stabilizer material by adding hydrated lime.
3. Supplementary treatment of the environmentally friendly oil waste aforementioned in claim 1 to produce modified asphalt by adding anti stripping agents, including tertiary amine compounds and/or their derivatives.
4. The purification process of Buton natural asphalt to obtain pure asphalt in accordance with this invention consists of the following steps:
 - Mixing Asbuton and inorganic solvent
 - Separation of asphalt from the solution in the mixing vessel, and
 - Drying of the asphalt accumulated by the separator.



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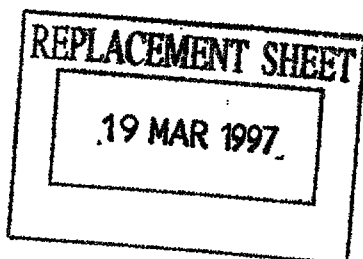
ABSTRACT

THE PROCESS of ASPHALT PURIFICATION
and
THE COMPOSITION of MODIFIED ASPHALT

This invention covers two subjects related to each others. The first subject corresponds with the process of rock asphalt purification, which in most case, their matrices were composed of calcium carbonate rocks. The main chemical reaction of this invention took place between calcium carbonate and inorganic acids e.g.: H_2SO_4 , HCl , etc. Through this chemical reaction, rock matrices are destructed and bitumen extracted by gas developed during the reaction float to the surface whilst mineral are deposited by gravitation force. Bitumen are then separated by decantation and dried:

The second subject is related to the utilization of the product of purification as a main material in the conversion of oil waste materials into environmentally friendly materials. Subsequently the latter may be further processed to produce soil stabilizer material or modified asphalt.

Fig. 3



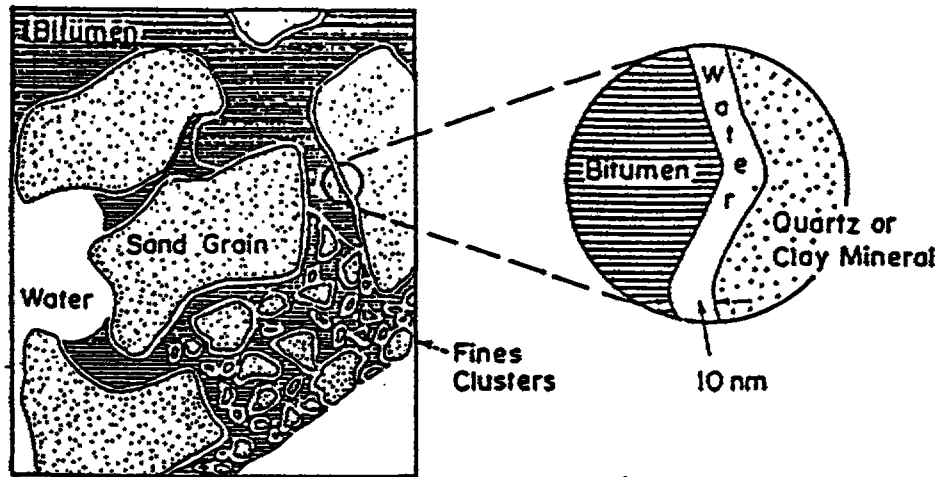


Figure 1. Microscopic Diagram of Natural Asphaltic Rock (In previous processes)

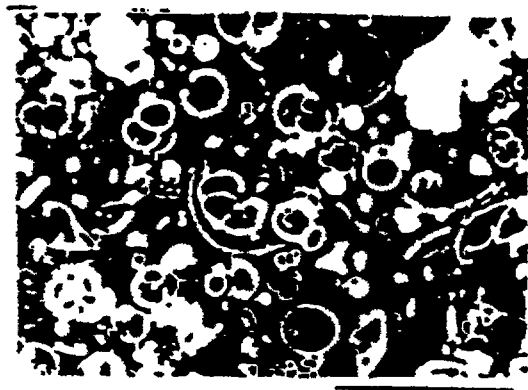


Figure 2. Microscopic cross section of Buton Asphaltic Rock.

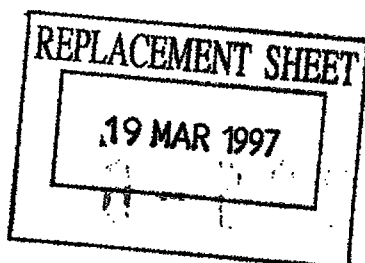
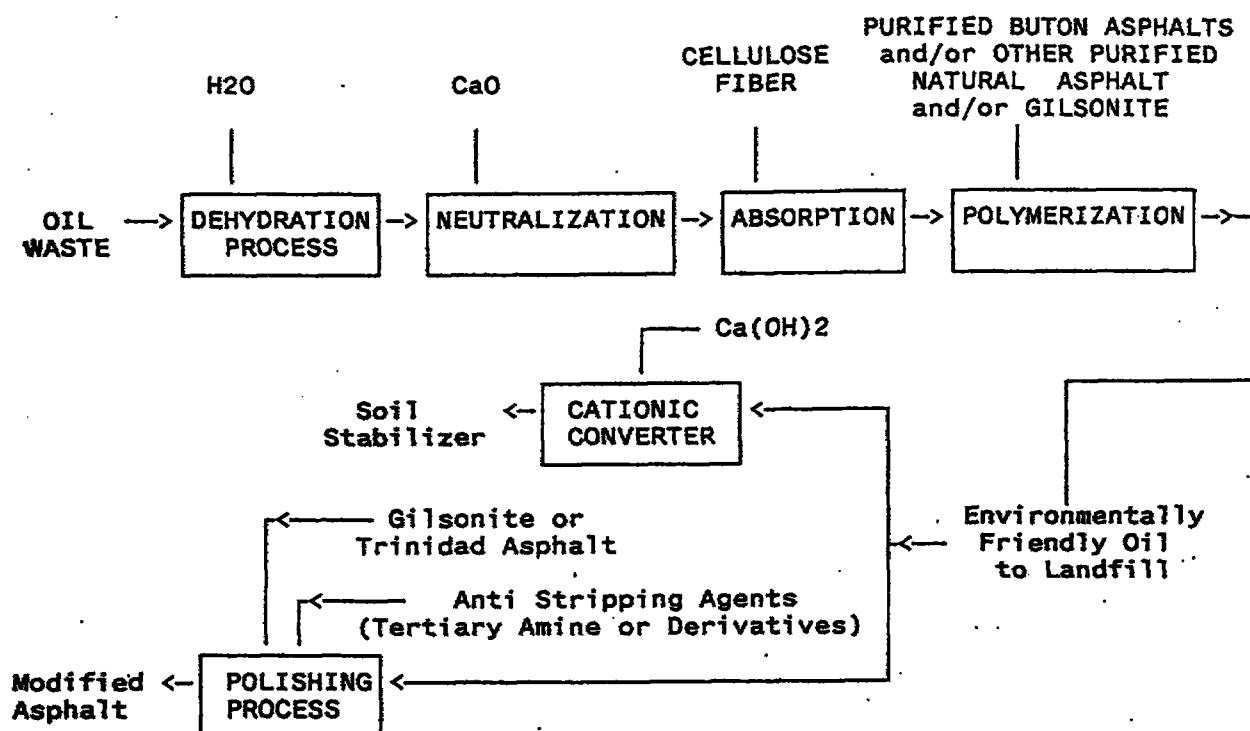


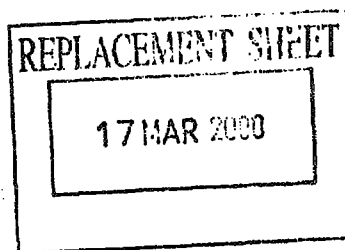
Figure 3. Oil Waste Treatment Process

Diagram of the Utilization of Pure Buton Asphalt and Additives



REPLACEMENT SHEET

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Claims:-

1. The use of purified natural asphalt, including GILSONITE, as a primary material in the processing (converting) of oil waste treatment to produce an environmentally safe material (environmentally friendly oil), wherein the environmentally safe material is further processed by adding hydrated lime to produce soil stabilizer material.
2. The use of purified natural asphalt, including GILSONITE, as a primary material in the processing (converting) of oil waste treatment to produce an environmentally safe material (environmentally friendly oil), wherein the environmentally safe material is further processed by adding anti stripping agents, including tertiary amine compounds and/or their derivatives to produce modified asphalt.
3. The purification process of Buton natural asphalt to obtain pure asphalt in accordance with this invention consists of the following steps:-
 - Mixing Asbuton and inorganic solvent;
 - Separation of asphalt from the solution in the mixing vessel, and
 - Drying of the asphalt accumulated by the separator.

ABSTRACT

THE PROCESS of ASPHALT PURIFICATION
and
THE COMPOSITION of MODIFIED ASPHALT

This invention covers two subjects related to each others. The first subject corresponds with the process of rock asphalt purification, which in most case, their matrices were composed of calcium carbonate rocks. The main chemical reaction of this invention took place between calcium carbonate and inorganic acids e.g.: H_2SO_4 , HCl , etc. Through this chemical reaction, rock matrices are destructed and bitumen extracted by gas developed during the reaction float to the surface whilst mineral are deposited by gravitation force. Bitumen are then separated by decantation and dried:

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☒ Claim(s) : paged ...5... to paged ...7...	
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