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3,434,967

PROCESS FOR SIMULTANEOUS SOLVENT RECOVERY FROM AND GRANULATION OF ASPHALTS

Charles C. Oldenburg, Mill Valley, Calif., assignor to Chevron Research Company, San Francisco, Calif., a corporation of Delaware

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4 Claims

ABSTRACT OF THE DISCLOSURE

A process for simultaneously separating solvent and asphalt from a deasphalting process and dispersing comminuted asphalt in water which comprises injecting a heated, liquefied solution of solvent and asphalt into an agitated water bath maintained at a temperature and pressure at which the solvent will vaporize substantially completely and the asphalt, thus freed of the solvent, will solidify as small particles, while simultaneously withdrawing from said bath a slurry of comminuted asphalt dispersed in water. Temperatures of 32°–225° F. are preferred. Small amounts of surfactants may be added to the bath.

BACKGROUND OF THE INVENTION

This invention relates to a process for producing a dispersion of asphalt in water, and also for recovering solvent for reuse in a solvent deasphalting process.

In a conventional solvent deasphalting process, a raffinate is produced which comprises asphalt and some solvent, although the bulk of the solvent is removed with the extract phase. It is, of course, desirable to recover the solvent from this raffinate for reuse in the deasphalting process. In the past, this has been done by heating the raffinate to a temperature of about 400° F. or greater and then flashing it at a low pressure to separate the volatile solvent from the asphalt. The hot, liquefied asphalt is then recovered. Such processes are disclosed in many patents, typical of which are U.S. Patents 2,943,505 and 3,305,474.

In many cases there is little need for the recovered hot asphalt as a product in its own right. Often it is more desirable to burn the asphalt as fuel or in the presence of a controlled amount of oxygen—e.g., in a partial oxidation reactor—to produce hydrogen to be supplied to the many hydrogen-consuming processes, such as hydrocracking, in a refinery. It is in this context that a serious problem has arisen. It has been found that hot, liquefied asphalt, of the type produced by flashing solvent deasphalting raffinates, cannot easily or economically be transported from the flashing and recovery vessel to the combustion vessel unless the two units are in very close proximity. This is because the asphalt, while being pumped through pipes from one unit to the other, cools quite rapidly and solidifies in the pipeline. Heretofore this problem has been partially solved by using steam jacketing to keep the asphalt in the pipelines hot and liquefied. This, however, is an expensive procedure and works satisfactorily only when the asphalt is to be transported over relatively short distances.

An alternative solvent for the transportation problem has recently been suggested in aforesaid U.S. Patent 3,305,474, wherein a process is disclosed for producing a fine powdered asphalt from hot, liquefied asphalt. The patent discloses that this asphalt may be transported as the dry powder.

All the processes suggested in the prior art for handling and transporting this "SDA asphalt" from a solvent deasphalting process suffer from one major deficiency: all require that the hot asphalt be separated from the solvent

prior to the cooling and comminuting of the asphalt. This is generally accomplished by flashing as referred to above. This additional step obviously adds complexity and expense to the process. It is also stated as—e.g., in aforesaid U.S. Patent 3,305,474—that there must be a second additional step, such as steam stripping, to remove whatever traces of solvent were not separated from the asphalt by the first separation step. This requirement, of course, compounds the expense and operational complexity of a practical process. Further, in some prior art processes, the steps of cooling and comminuting the asphalt after it is freed of all solvent are also separate steps. It would thus be advantageous to have a process in which solvent separation and asphalt cooling and comminution all occurred simultaneously.

Finally, it would be most advantageous if such a process provided means whereby the asphalt was simultaneously put into a form suitable for inexpensive long-distance transportation. It has been known for some time that asphalt can be transported over long distances dispersed in water in the form of a slurry, after the asphalt is cooled, comminuted to small particles (called "crumbs"), and dispersed in the water. If the asphalt crumbs are small enough and the proper proportion of asphalt to water in a "crumb slurry" is maintained, the crumb slurry may be injected directly into furnaces and burned as fuel without the necessity of separating the asphalt and water. Such a slurry may also be burned in a partial oxidation unit to produce hydrogen. This invention provides a process wherein, in a single step, all these desirable events occur simultaneously.

SUMMARY OF THE INVENTION

This invention is a process for simultaneously separating solvent and asphalt from a deasphalting process and dispersing comminuted asphalt in water which comprises injecting a heated, liquefied solution of solvent and asphalt into an agitated water bath maintained at a temperature and pressure at which the solvent will vaporize substantially completely and the asphalt, thus freed of the solvent, will solidify as small particles, while simultaneously withdrawing from said bath a slurry of comminuted asphalt dispersed in water.

DETAILED DESCRIPTION OF THE INVENTION

The process of this invention can best be described by reference to an example. A solvent deasphalting process raffinate consisting of 100,000 lbs./hr. of asphalt and 52,000 lbs./hr. of a mixed propane-butane solvent maintained at 250° F. to liquefy the asphalt is injected into a vessel containing an agitated water bath maintained at 150° F. A small amount of a surfactant described below is also added. Water at 75° F. is added to the bath at the rate of 4,686,400 lbs./hr. The heat balance of the vessel is maintained by injecting 483,000 lbs./hr. of 150 p.s.i.g. steam at 365° F. into the water bath. Residence time for the solvent and asphalt in the 50,000 gallon vessel is five minutes. The solvent, after separation from the asphalt, is removed in a vapor stream at 150° F. and 2 p.s.i.g. along with 167,400 lbs./hr. of water. The asphalt is removed in a crumb slurry containing 2 percent asphalt and 98 percent water maintained at 150° F. This crumb slurry may be transported and utilized as withdrawn from the vessel, partially dehydrated to produce any desired concentration of solids, or totally dehydrated to produce a dry powdered asphalt. Dehydration may be by conventional means. The dry powdered asphalt may be picked up by an air or gas stream and transported by a pneumatic conveyor system.

The process may be carried on in a conventional agitated closed water-bath mixing vessel or in any similar type of vessel. Agitation as used herein and in the appended claims is defined as violent and irregular movement where-

by intimate contact between the asphalt and water occurs and discrete particles of the asphalt undergoing treatment separate. If the asphalt upon contact or mixing is not agitated, or if only mildly stirred, the material undergoing treatment will agglomerate. Agitation may be satisfactorily accomplished by high speed stirring as, for example, with paddle stirrers or impeller stirrers rotating at high speeds or with a turbine mixer, axial flow pump, centrifugal pump, etc. This treatment dissociates the asphaltic material into discrete particles which separate from the remaining aqueous phase in finely divided form. Means are also provided for direct steam injection into the bath, preferably somewhere near the bottom of the vessel. In preferred practice, the raffinate is injected at the bottom of the vessel, the crumb slurry is skimmed off at the top of the water bath, and the solvent-containing vapor stream is removed from vapor space above the surface of the water bath.

The solvents which may be used in this process are any of those conventional solvents used in solvent deasphalting which are immiscible with water and which vaporize substantially completely at temperatures below the melting point of asphalt at conventional pressures. The most common examples of such conventional solvents are the light paraffins: ethane, propane, butane, pentane and hexane, and various mixtures thereof.

Where desired, a minor amount of a suitable surfactant or surface-active agent, such as the sodium alkyl benzene sulfonates, may be added to the water bath. The surface-active agent facilitates separation of the comminuted asphalt material from the aqueous mixture and reduces the quantity of water entrained when it is desired to recover highly concentrated slurries of asphalt or a dry, powdered, asphalt product. The choice of surface active agent is determined largely by the materials employed in the process and may be anionic, cationic or nonionic. About 0.1–0.5 percent by weight of surfactant may be incorporated, preferably by dissolving the agent in the water bath. However, smaller or larger amounts may be used where desired and, if convenient, may be injected into the water supply, the steam supply, or the raffinate itself.

The proper degree of separation of the solvent and asphalt and comminution of the asphalt is accomplished by injecting the raffinate at a high flow rate into the certain portions of the agitated bath, such as the eye of an impeller stirrer. The proper points of injection are well known to those skilled in the art of mixing solids and liquids and may easily be determined by reference to standard texts on mixing.

The degree of comminution of the asphalt obtained depends on several factors, among which are the temperature and pressure differential between the raffinate stream and the bath, the point at which the raffinate enters the bath, the degree of agitation employed, and the concentration of the asphalt in the raffinate. Additional comminution occurs when the vaporizing solvent, in escaping from the cooling and solidifying asphalt, fractures the asphalt. This latter advantageous aid to comminution does not occur in the prior art processes, for in those processes the solvent is vaporized and separated while the asphalt is still molten.

The temperature of the water bath is maintained at that temperature at which the solvent will vaporize substantially completely and the asphalt, thus freed of solvent, will solidify as finely divided particles. Such temperature will be dependent on the particular solvent used. Where the solvent, such as ethane or propane, is relatively volatile at low temperatures, the bath may be maintained at or slightly above room temperature. Where a solvent, such as pentane or hexane, has little volatility at the lower temperatures, higher temperatures must neces-

sarily be used. The particular temperature used is a matter of simple experimentation and one skilled in the art can easily determine the optimum temperature for each solvent. The temperature must, however, be maintained above the freezing point of water and below the temperature—i.e., about 225° F.—above which the asphalt is liquefied. Temperatures slightly above or below this range may be used in some instances if materials are added which lower the freezing point of the water bath or if a particularly high softening point asphalt is being treated. The pressure on the system should be maintained at a level below the vapor pressure of the solvent being separated at whatever temperature is being employed. The optimum pressure and temperature are easily determined within limits known to those skilled in the art.

Steam is supplied, if necessary, to maintain the heat balance in the water bath. The pressure and temperature of the steam will be determined by the requirements of the heat balance, and the most convenient pressure and temperature relationship may be determined by reference to conventional steam tables. Since the steam is injected into a water bath, it is immaterial whether the steam is wet or dry.

The crumb slurry may be removed from the water bath by any conventional means. Overflow weirs may be provided to remove the slurry from the upper portion of the water bath, or the top layer of the water bath may be skimmed by conventional apparatus. Other means of removing the crumb slurry will readily suggest themselves to those skilled in the art.

Residence time of the asphalt and solvent is approximately 2–10 minutes. A properly sized, closed vessel can easily be determined from the residence time chosen. A vapor space should be left above the surface of the water bath in the vessel to facilitate collection of the solvent vapor.

It is apparent that many widely different embodiments of this invention may be made without departing from the scope and spirit thereof; and, therefore, it is not intended to be limited except as indicated in the appended claims.

I claim:

1. A process for the simultaneous separation of asphalt and solvent from a deasphalting process and formation of a dispersion of comminuted asphalt in water which comprises injecting a heated, liquefied solution of solvent and asphalt into an agitated water bath maintained at a temperature and pressure at which the solvent will vaporize substantially completely and the asphalt, thus freed of the solvent, will solidify as small particles, while simultaneously withdrawing from said bath a dispersion of comminuted asphalt in water.

2. The process of claim 1 wherein a surfactant is added to said bath to aid in formation of said slurry.

3. The process of claim 1 wherein the temperature of said bath is maintained in the range of from about 32° F. to about 225° F.

4. The process of claim 1 wherein said solvent is a C₂–C₆ paraffin.

References Cited

UNITED STATES PATENTS

3,235,482	2/1966	Knowles et al.	208—39
3,305,474	2/1967	Knowles et al.	208—39
3,321,394	5/1967	Mills	208—309

HERBERT LEVINE, *Primary Examiner*.

U.S. Cl. X.R.

208—39; 264—9, 14; 302—66

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

March 25, 1969

Patent No. 3,434,967

Charles C. Oldenburg

It is certified that error appears in the above identified patent and that said Letters Patent are hereby corrected as shown below:

Column 1, line 43, "2,943,505" should read -- 2,943,050 --;
line 63, "solvent" should read -- solution --.

Signed and sealed this 7th day of April 1970.

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents