

Claims:

1. An integrated solvent deasphalting and steam pyrolysis process for the direct processing of a crude oil to produce olefinic and aromatic petrochemicals, the process comprising:
 - a. charging the crude oil to a solvent deasphalting zone with an effective amount of solvent to produce a deasphalted and demetalized oil stream and a bottom asphalt phase;
 - b. thermally cracking the deasphalted and demetalized oil stream in the presence of steam to produce a mixed product stream;
 - c. separating the thermally cracked mixed product stream;
 - d. recovering olefins and aromatics from the separated mixed product stream; and
 - e. recovering pyrolysis fuel oil from the separated mixed product stream.
2. The integrated process of claim 1, wherein step (c) comprises
 - compressing the thermally cracked mixed product stream with plural compression stages;
 - subjecting the compressed thermally cracked mixed product stream to caustic treatment to produce a thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide;
 - compressing the thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide;
 - dehydrating the compressed thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide;
 - recovering hydrogen from the dehydrated compressed thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide; and

obtaining olefins and aromatics as in step (d) and pyrolysis fuel oil as in step (e) from the remainder of the dehydrated compressed thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide.

3. The integrated process of claim 2, further comprising separately recovering methane from the dehydrated compressed thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide for use as fuel for burners and/or heaters in the thermal cracking step.
4. The integrated process of claim 1 wherein the thermal cracking step comprises heating hydroprocessed effluent in a convection section of a steam pyrolysis zone, separating the heated hydroprocessed effluent into a vapor fraction and a liquid fraction, passing the vapor fraction to a pyrolysis section of a steam pyrolysis zone, and discharging the liquid fraction.
5. The integrated process of claim 4 wherein the discharged liquid fraction is blended with pyrolysis fuel oil recovered in step (e).
6. The integrated process of claim 4 wherein separating the heated hydroprocessed effluent into a vapor fraction and a liquid fraction is with a vapor-liquid separation device based on physical and mechanical separation.

7. The integrated process of claim 6 wherein the vapor-liquid separation device includes
- a pre-rotational element having an entry portion and a transition portion, the entry portion having an inlet for receiving the flowing fluid mixture and a curvilinear conduit,
 - a controlled cyclonic section having
 - an inlet adjoined to the pre-rotational element through convergence of the curvilinear conduit and the cyclonic section,
 - a riser section at an upper end of the cyclonic member through which vapors pass;
 - and
 - a liquid collector/settling section through which liquid passes.
8. The integrated process of claim 1, wherein step (a) comprises
- mixing the crude oil feedstock with make-up solvent and optionally fresh solvent;
 - transferring the mixture to a primary settler in which a primary deasphalted and demetalized oil phase and a primary asphalt phase are formed;
 - transferring the primary deasphalted and demetalized oil phase to a secondary settler in which a secondary deasphalted and demetalized oil phase and a secondary asphalt phase are formed;
 - recycling the secondary asphalt phase to the primary settler to recover additional deasphalted and demetalized oil;
 - conveying the secondary deasphalted and demetalized oil phase to a deasphalted and demetalized oil separation zone to obtain a recycle solvent stream and a substantially solvent-free deasphalted and demetalized oil stream;

conveying the primary asphalt phase is conveyed to a separator vessel for flash separation of an additional recycle solvent stream and a bottom asphalt phase,

wherein the substantially solvent-free deasphalted and demetalized oil stream is the feed to the steam pyrolysis zone.

9. The integrated process as in claim 8, wherein the bottom asphalt phase is blended with pyrolysis fuel oil recovered in step (e).

CLAIMS

1. An integrated solvent deasphalting and steam pyrolysis process for the direct processing of a crude oil to produce olefinic and aromatic petrochemicals, the process comprising:
 - a. charging the crude oil to a solvent deasphalting zone with an effective amount of solvent to produce a deasphalted and demetalized oil stream and a bottom asphalt phase;
 - b. thermally cracking at least a portion of the deasphalted and demetalized oil stream in the presence of steam in a steam pyrolysis zone to produce a mixed product stream, wherein
 - at least a portion of the deasphalted and demetalized oil stream is heated in a convection section of the steam pyrolysis zone;
 - the heated deasphalted and demetalized oil stream is separated into a vapor phase and a liquid phase with a vapor-liquid separation device that includes
 - a pre-rotational element having an entry portion and a transition portion, the entry portion having an inlet for receiving a flowing fluid mixture and a curvilinear conduit,
 - a controlled cyclonic section having an inlet adjoined to the pre-rotational element through convergence of the curvilinear conduit and the cyclonic section and a riser section at an upper end of the cyclonic member through which the vapor phase passes, and
 - a liquid collector/settling section through which the liquid passes;
 - the vapor phase is passed to a pyrolysis section of the steam pyrolysis zone; and
 - the liquid phase is discharged ;
 - c. separating the thermally cracked mixed product stream;
 - d. recovering olefins and aromatics from the separated mixed product stream; and

- e. recovering pyrolysis fuel oil from the separated mixed product stream.
2. The integrated process of claim 1, wherein step (c) comprises
- compressing the thermally cracked mixed product stream with plural compression stages;
 - subjecting the compressed thermally cracked mixed product stream to caustic treatment to produce a thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide;
 - compressing the thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide;
 - dehydrating the compressed thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide;
 - recovering hydrogen from the dehydrated compressed thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide; and
 - obtaining olefins and aromatics as in step (d) and pyrolysis fuel oil as in step (e) from the remainder of the dehydrated compressed thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide.
3. The integrated process of claim 2, further comprising separately recovering methane from the dehydrated compressed thermally cracked mixed product stream with a reduced content of hydrogen sulfide and carbon dioxide for use as fuel for burners and/or heaters in the thermal cracking step.
4. The integrated process of claim 1 wherein the discharged liquid fraction is blended with pyrolysis fuel oil recovered in step (e).

5. The integrated process of claim 1, wherein step (a) comprises
- mixing the crude oil feedstock with make-up solvent and optionally fresh solvent;
 - transferring the mixture to a primary settler in which a primary deasphalted and demetalized oil phase and a primary asphalt phase are formed;
 - transferring the primary deasphalted and demetalized oil phase to a secondary settler in which a secondary deasphalted and demetalized oil phase and a secondary asphalt phase are formed;
 - recycling the secondary asphalt phase to the primary settler to recover additional deasphalted and demetalized oil;
 - conveying the secondary deasphalted and demetalized oil phase to a deasphalted and demetalized oil separation zone to obtain a recycle solvent stream and a substantially solvent-free deasphalted and demetalized oil stream; and
 - conveying the primary asphalt phase to a separator vessel for flash separation of an additional recycle solvent stream and a bottom asphalt phase,
- wherein the substantially solvent-free deasphalted and demetalized oil stream is the feed to the steam pyrolysis zone.
6. The integrated process as in claim 5, wherein the bottom asphalt phase is blended with pyrolysis fuel oil recovered in step (e).