

CLAIMS

What is claimed is:

1. A method for upgrading a pyrolysis oil stream and a hydrocarbon stream,
5 the method comprising the steps of:
separately introducing the pyrolysis oil stream and the hydrocarbon stream into a
reaction zone to form a mixture of the pyrolysis oil stream and the hydrocarbon stream in
the reaction zone;
catalytically cracking the mixture of the pyrolysis oil stream and the hydrocarbon
10 stream in the presence of a particulate cracking catalyst in the reaction zone; and
maintaining the pyrolysis oil stream at a temperature of less than or equal to 100
°C substantially up to introduction into the reaction zone.
2. The method of claim 1, wherein maintaining the pyrolysis oil stream at the
15 temperature of less than or equal to 100 °C comprises actively cooling the pyrolysis oil
stream.
3. The method of claim 2, wherein the pyrolysis oil stream is actively cooled
substantially up to introducing the pyrolysis oil stream into the reaction zone.
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4. The method of claim 2, wherein actively cooling the pyrolysis oil stream
comprises externally cooling the pyrolysis oil stream with an external cooling medium.
5. The method of claim 1, wherein the hydrocarbon stream is introduced into
25 the reaction zone at a temperature higher than the pyrolysis oil stream.
6. The method of claim 1, wherein the hydrocarbon stream is introduced into
the reaction zone upstream of the pyrolysis oil stream.
- 30 7. The method of claim 1, further comprising pyrolyzing a biomass stream to
produce the pyrolysis oil stream.

8. The method of claim 7, wherein the pyrolysis oil stream produced from pyrolyzing the biomass stream is introduced into the reaction zone in the absence of intervening upgrading processing of the pyrolysis oil stream.

5 9. A method for upgrading a pyrolysis oil stream and a hydrocarbon stream in a fluid catalytic cracking unit including a reaction zone, the method comprising the steps of:

separately introducing the pyrolysis oil stream through a pyrolysis oil feed line and the hydrocarbon stream through a hydrocarbon feed line into a reaction zone to form a mixture of the pyrolysis oil stream and the hydrocarbon stream in the reaction zone, wherein the pyrolysis oil feed line includes a pyrolysis oil outlet into the reaction zone and the hydrocarbon feed line includes a hydrocarbon outlet into the reaction zone;

10 catalytically cracking the mixture of the pyrolysis oil stream and the hydrocarbon stream in the presence of a particulate cracking catalyst in the reaction zone;

15 maintaining the pyrolysis oil stream at a temperature of less than or equal to 100 °C in the pyrolysis oil feed line substantially up to the pyrolysis oil outlet into the reaction zone.

10. A fuel processing apparatus comprising:

20 a pyrolysis reactor for pyrolyzing a biomass stream to produce a pyrolysis oil stream; and

a fluid catalytic cracking unit comprising:

a reaction zone within which particulate cracking catalyst is contacted with a mixture of a hydrocarbon stream and the pyrolysis oil stream;

25 a pyrolysis oil feed line having a pyrolysis oil outlet into the reaction zone for introducing the pyrolysis oil stream into the reaction zone, wherein the pyrolysis oil feed line is adapted to inhibit external heating of the pyrolysis oil stream flowing therethrough; and

a hydrocarbon feed line having a hydrocarbon outlet into the reaction zone for introducing the hydrocarbon stream into the reaction zone separate from the pyrolysis oil stream.

CLAIMS

1. A method for upgrading a pyrolysis oil stream and a hydrocarbon stream, the method comprising the steps of:

separately introducing the pyrolysis oil stream and the hydrocarbon stream into a reaction zone to form a mixture of pyrolysis oil stream and the hydrocarbon stream in the reaction zone;

catalytically cracking the mixture of the pyrolysis oil stream and the hydrocarbon stream in the presence of a particulate cracking catalyst in the reaction zone;

allowing the hydrocarbon stream to first come in contact with the particulate cracking catalyst before introducing the pyrolysis oil stream into the reaction zone; and

actively cooling and maintaining the pyrolysis oil stream at a temperature of less than or equal to 80°C substantially up to introduction into the reaction zone.

2. The method of claim 1, wherein actively cooling the pyrolysis oil stream comprises externally cooling the pyrolysis oil stream with an external cooling medium and internally cooling the pyrolysis oil stream with a supplemental component added to the pyrolysis oil stream.

3. The method of claim 2, wherein the supplemental component added to the pyrolysis oil stream is a carrier gas, and wherein internally cooling the pyrolysis oil stream comprises mixing the carrier gas and the pyrolysis oil stream prior to introducing pyrolysis oil stream into the reaction zone.

4. The method of claim 3, wherein the carrier gas is provided at the temperature of less than or equal to 80°C.

5. The method of claim 3, wherein the carrier gas is provided at the temperature of less than or equal to 10°C.

6. The method of claim 1, wherein the hydrocarbon stream is introduced into the reaction zone at a temperature higher than the pyrolysis oil stream.

7. The method of claim 1, wherein the hydrocarbon stream is introduced into the reaction zone upstream of the pyrolysis oil stream.

8. The method of claim 1, further comprising pyrolyzing a biomass stream to produce the pyrolysis oil stream.

9. The method of claim 8, wherein the pyrolysis oil stream produced from pyrolysis oil stream produced from pyrolysis the biomass stream is introduced into the reaction zone in the absence of intervening upgrading processing of the pyrolysis oil stream.

10. A method for upgrading a pyrolysis oil stream and a hydrocarbon stream in a fluid catalytic cracking unit including a reaction zone, the method comprising the steps of:

separately introducing the pyrolysis oil stream through a pyrolysis oil feed line and the hydrocarbon stream through a hydrocarbon feed line into a reaction zone to form a mixture of the pyrolysis oil stream and the hydrocarbon stream in the reaction zone, wherein the pyrolysis oil feed line includes a pyrolysis oil outlet into the reaction zone and the hydrocarbon feed line includes a hydrocarbon outlet into the reaction zone;

catalytically cracking the mixture of the pyrolysis oil stream and the hydrocarbon stream in the presence of a particulate cracking catalyst in the reaction zone;

allowing the hydrocarbon stream to first come in contact with the particulate cracking catalyst before introducing the pyrolysis oil stream into the reaction zone; and

actively cooling and maintaining the pyrolysis oil stream at a temperature of less than or equal to 80°C in the pyrolysis oil feed line substantially up to the pyrolysis oil outlet into the reaction zone.