

1 **WHAT IS CLAIMED IS:**

- 2 1. A method for hydrodeoxygenation of a bio-oil over a catalyst bed in a hydrodeoxygenation
3 reactor ("HDO reactor"), the method comprising combining a two-phase diluent
4 having a water dew point and a bio-oil at a bio-oil temperature that is from 50 °F less
5 than to 100 °F more than the water dew point;
6 wherein the two-phase diluent comprises a liquid phase and a vapor phase, the
7 liquid phase comprising a hydrocarbon and the vapor phase comprising
8 hydrogen and water.
- 9 2. The method of Claim 1, wherein the bio-oil temperature is from 20 °F to 0 °F less than the
10 water dew point.
- 11 3. The method of Claim 1 or Claim 2, wherein the bio-oil temperature is from 10 °F to 0 °F
12 less than the water dew point.
- 13 4. The method of Claim 1, wherein the bio-oil temperature from 0 °F to 20 °F more than the
14 water dew point of the two-phase diluent.
- 15 5. The method of Claim 1, the method comprising combining the bio-oil and the two-phase
16 diluent in a mix-tee.
- 17 6. The method of Claim 1, the method comprising combining the bio-oil and the two-phase
18 diluent through a static-mixer.
- 19 7. The method of Claim 1, wherein combining the bio-oil and the two-phase diluent
20 comprises directing the bio-oil through a quill within a pipe, wherein the pipe
21 provides the two-phase diluent.
- 22 8. The method of Claim 1, wherein the bio-oil comprises poultry fats, poultry oil, vegetable
23 fats, rendered fats, rendered oils, restaurant grease, brown grease, yellow grease, used
24 cooking oil, waste industrial frying oils, fish oils, fish fats, algal oils, microbial oils, or
25 a combination of any two or more thereof.
- 26 9. The method of Claim 1, wherein the method produces a renewable diesel, wherein the
27 renewable diesel has a carbon intensity of 30 gCO₂e/MJ or less according to
28 California Air Resource Board CA-GREET3.0 model.

- 1 10. The method of any one of Claims 1-9, wherein fouling of the HDO reactor as evidenced
2 by a pressure drop increase of no more than 10 psi during the service life of the
3 catalyst.
- 4 11. The method of Claim 1, wherein combining the two-phase diluent and the bio-oil
5 provides a diluted bio-oil, and wherein the process further comprises contacting the
6 diluted bio-oil with the catalyst bed to provide a catalyst bed outlet product.
- 7 12. The method of Claim 1, wherein prior to combining the two-phase diluent and the bio-
8 oil, the method comprises adjusting the bio-oil temperature to be from 50 °F less than
9 to 100 °F more than the water dew point.
- 10 13. The method of Claim 1, wherein prior to combining the two-phase diluent and the bio-
11 oil, the process comprises measuring the two-phase diluent to determine the water
12 dew point.

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