CLAIMS:

1. A method of processing a renewable bio-based material comprising the step of:

reacting the bio-based material, comprising triglycerides and free fatty acids, with hydrogen in the presence of a catalyst on a support in a reactor to form a treated oil;

(i) passing the treated oil through a distillation unit and an adsorption unit to form green diesel; and/or (ii) passing the treated oil through at least one distillation column to separate the treated oil into at least one component and passing the at least one component through an adsorption column;

wherein the reactor comprises a cooling function for controlling the temperature of the reactor; wherein the cooling function is an internal cooling function comprising adding a cooling substance into the reactor.

2. The method of claim 1, wherein the support is alumina (Al_2O_3), silica (SiO_2) or alumina-silica (Al_2O_3-SiO_2)preferably, wherein the support is Al_2O_3 and the catalyst on Al_2O_3 is selected from the group consisting of $NiMo/Al_2O_3$ and NiW/Al_2O_3 or the support is Al_2O_3 and the catalyst on Al_2O_3 is selected from the group consisting of $NiCoMo/Al_2O_3$, $NiMoP/Al_2O_3$ and $CoMo/Al_2O_3$.

3. The method of claim 1, wherein the temperature in the reactor is 200°C to 400°C and the pressure in the reactor is 25 bar to 40 bar.

4. The method of claim 1 , wherein the space velocity is 0.5 h^{-1} to 2 h^{-1}.

5. The method of any one of the preceding claims, wherein a ratio of hydrogen to the bio-based material is 0.03g hydrogen/g bio-based material to 0.10g hydrogen/g bio-based material, preferably wherein the ratio of hydrogen to the bio-based material is 0.05g hydrogen/g bio-based material to 0.07g hydrogen/g bio-based material.

6. The method of any one of the proceeding claims, further comprising the step of purifying the treated oil, preferably wherein the step of purifying the treated oil comprises the step of passing the treated oil through a high-pressure separator followed by the step of passing through a low-pressure separator wherein the high-pressure separator separates a gaseous component from the treated oil.

7. The method of any one of the preceding claims, wherein the cooling substance is selected from the group consisting of a fresh amount of the bio-based material, a fresh amount of hydrogen, a portion of the treated oil and a combination thereof.

8. The method of any one of the preceding claims,

wherein the adsorption unit comprises at least one adsorbent selected from the group consisting of activated carbon, ion exchange resin, molecular sieve and chemical adsorbent

and/or, wherein the adsorption column comprises at least one adsorbent selected from the group consisting of activated carbon, ion exchange resin, molecular sieve and chemical adsorbent.

9. The method of any one of the preceding claims, wherein the at least one component is selected from the group consisting of n-paraffin having less than 16 carbon atoms, n-hexadecane, n-heptadecane, n-octadecane and n-paraffin having more than 18 carbon atoms.

10. A green diesel obtainable by a method of any one of claims 1 to 9, the green diesel comprising isoparaffin in an amount of 0 to 10 wt% and n-paraffin in an amount of 90 to 100 wt%, wherein the distillation range is 200°C to 350°C and the cetane number is at least 100.

11. The green diesel of claim 10, wherein the distillation range is 260°C to 323°C.

12. The green diesel of any one of claims 10 to 11, wherein the flash point is in the range of 100°C to 130°C.

13. The green diesel of any one of claims 10 to 12, further comprising total glycerides less than 0.05wt%.

14. A phase change material obtainable by a method of any one of claims 1 to 9, the phase change material comprising isoparaffin in an amount of 0 to 1 wt% and n-paraffin in an amount of 99 to 100 wt%, wherein the n-paraffin is a n -paraffin having 16 carbons (n-C16), a n-paraffin having 17 carbons (n-C17) or a n-paraffin having 18 carbons (n-C18), and wherein the phase change material has a heat of melting of at least 200 J/g.

15. An industrial solvent obtainable by a method of any one of claims 1 to 9, the industrial solvent comprising n-paraffin in an amount of at least 99 wt%, and a distillation range of 250°C to 270°C.

16. A system for processing a renewable bio-based material in the method according to anyone of claims 1 – 9 to obtain the green diesel of any one of claims 10 to 13, the phase change material of claim 14 and/or the industrial solvent of claim 15, comprising:

a reactor for reacting the bio-based material, comprising triglycerides and free fatty acids, with hydrogen in the presence of a catalyst on a support to form a treated oil;

(i) a distillation unit for passing the treated oil through to form green diesel and an adsorption unit for passing the green diesel through; and/or

(ii) at least one distillation column to separate the treated oil into at least one component and an adsorption column for passing the at least one component through; and

wherein the reactor comprises a cooling function for controlling the temperature of the reactor; wherein the cooling function is an internal cooling function comprising a cooling substance.

17. The system of claim 16, wherein the cooling substance is selected from the group consisting of a fresh amount of the bio-based material, a fresh amount of hydrogen, a portion of the treated oil and a combination thereof.

18. The system of claims 16 or 17, wherein the temperature in the reactor is 200ºC to 400ºC and the pressure in the reactor is 25 bar to 40 bar.

19. The system of any one of claims 16 to 18, further comprising a high-pressure separator and a low-pressure separator for passing the treated oil through.