CLAIMS

We claim:

1. A process for converting petroleum based waste oil (PBWO) to light and medium distillate, the process comprising the steps of:

(a) mixing and heating the PBWO, in a pre-boiler containing a mixer, to a temperature and for a period of time sufficient to remove at least 90% of the water in the PBWO;

(b) further mixing and heating the dehydrated PBWO, in a main boiler containing a mixer, to at least 300 °C to produce: (i) a first vapor stream of light end hydrocarbons, the light end hydrocarbons including one or more of naphthalene, gasoline or kerosene; and (ii) a first vapor stream of heavier hydrocarbons including at least 50% C8-C25 hydrocarbon chains;

(c) directing the first vapor stream of heavier hydrocarbons from step (b) to a catalyst tower containing an aluminum silicate catalyst to crack the heavier hydrocarbon chains to shorter hydrocarbon chains; to produce: (i) a second vapor stream of light end hydrocarbons, the light end hydrocarbons including one or more of naphthalene, gasoline or kerosene; and (ii) a mixed vapor and liquid stream of heavier hydrocarbons including at least 50% C10-C15 hydrocarbon chains;

(d) directing the mixed vapor and liquid stream of heavier hydrocarbons from step (c) to a stripper that separates the vapor from the liquid to provide separate vapor and liquid streams, wherein the liquid stream exiting the stripper includes at least 60% C10-C15 hydrocarbon chains.

2. The process of claim 1, wherein the PBWO exiting the pre-boiler of step (a) is at a temperature of 100 to 130 °C.

3. The process of claim 2, wherein the PBWO exiting the main boiler of step (b) is at a temperature of 300 to 375 °C.

4. The process of claim 1, further comprising the step of:

(e) directing the liquid stream exiting the stripper to a heat exchanger.

5. The process of claim 1, wherein the PBWO is maintained at a temperature of 450 °C or lower during the entire process.

6. The process of claim 1, wherein the PBWO is maintained at a temperature of 400°C or lower during the entire process.

7. The process of claim 1, wherein the PBWO is maintained at a temperature of 375° C or lower during the entire process.

8. The process of claim 1, wherein all steps of the process occur at a pressure of no greater than 14.6959 psi (atmospheric pressure).

9. The process of claim 1, wherein the medium distillate exhibits a cetane rating of greater than 50.

10. The process of claim 9, wherein the medium distillate exhibits a cetane rating of 65 to 70.

11. The process of claim 1, wherein the pre-heating boiler in step (a) heats the PBWO from a temperature in the range of 20 to 70 °C, up to a temperature in the range of 100 to 120 °C.

12. The process of claim 1, wherein the main boiler in step (b) heats the PBWO to a temperature of at least 325 °C.

13. The process of claim 1, wherein the main boiler in step (b) heats the PBWO to a temperature of 325 to 400 °C.

14. The process of claim 4, wherein the liquid stream exiting the heat exchanger comprises at least 70% of a medium distillate having C10-C15 hydrocarbon chains.

15. The process of claim 14, wherein the liquid stream exiting the heat exchanger comprises at least 80% of a medium distillate having C10-C15 hydrocarbon chains.

16. The process of claim 1, wherein the mixer in the pre-boiler or the mixer in the main boiler operates at a speed of 30 to 55 RPM, up to 2 to 250 RPM.

17. The process of claim 1, wherein the mixer in the pre-boiler or the mixer in the main boiler agitates the PBWO for at least 50% of the time any PBWO is within the pre-boiler or main boiler.

18. The process of claim 17, wherein the mixer in the pre-boiler or the mixer in the main boiler agitates the PBWO for at least 80% of the time any PBWO is within the pre-boiler or

main boiler.

19. A medium distillate product having at least 80% concentration of hydrocarbons having a chain length of C9-C25, and produced with the process of claim 1.

20. A medium distillate product having at least 80% concentration of hydrocarbons having a chain length of C10-C15, and produced with the process of claim 1.