CLAIMS

1. A vehicular propulsion system comprising:

an internal combustion engine comprising a combustion chamber;

a fuel system for converting an onboard fuel into octane-rich and cetane-rich components, the fuel system comprising:

a fuel supply tank for containing the onboard fuel;

fuel conduit in fluid communication with the fuel supply tank;

a separation unit comprising at least one adsorbent-based chamber, the separation unit in fluid communication with the fuel supply tank through the fuel conduit, where the separation unit is configured to selectively receive and separate at least a portion of the onboard fuel into an adsorbate and a remainder;

a heat exchanger cooperative with the separation unit and configured to selectively deliver residual thermal energy that results from operation of the internal combustion engine to the at least one adsorbent-based chamber to heat the adsorbate formed thereon to produce a vaporized desorbate;

a first product tank for selectively receiving and containing the vaporized desorbate; and

a second product tank for selectively receiving and containing the remainder;

a plurality of sensors that are configured to acquire operational parameters associated with the internal combustion engine and the fuel system; and

a controller cooperative with the internal combustion engine, sensors and fuel system and configured to determine whether the internal combustion engine is in a first operational condition or a second operational condition such that when the controller determines that the internal combustion engine is in the first operational condition, the controller is configured to direct the flow of a portion of the onboard fuel to the combustion chamber without first passing through the separation unit, and when the controller determines that the internal combustion engine is in the second operational condition, the controller is configured to direct the flow of a portion of the onboard fuel to the separation unit.

2. The system of claim 1, wherein the at least one adsorbent-based chamber comprises a plurality of adsorbent-based chambers.

3. The system of claim 2, wherein the controller is configured to direct:

the conveyance of the onboard fuel to a first of the adsorbent-based chambers for the creation of one of the adsorbate or the remainder thereon;

the receipt of residual thermal energy from the heat exchanger to a second of the adsorbent-based chambers such that one of the adsorbate or remainder that was created thereon is vaporized;

the conveyance of the vaporized adsorbate or remainder to at least one of the first product tank, the second product tank and the combustion chamber;

followed by:

the conveyance of the onboard fuel to the second of the adsorbent-based chambers for the creation of one of the adsorbate or the remainder thereon;

the receipt of residual thermal energy from the heat exchanger to the first of the adsorbent-based chambers such that one of the adsorbate or remainder that was created thereon is vaporized; and

the conveyance of the vaporized adsorbate or remainder to at least one of the first product tank, the second product tank and the combustion chamber.

4. The system of claim 3, wherein the controller switches adsorption of the onboard fuel from the one of the first and second of the adsorbent-based chambers to the other of the first and second of the adsorbent-based chambers upon:

detection of saturation of one or the other of the adsorbent-based chambers.

5. The system of claim 3, wherein the controller switches adsorption of the onboard fuel from one of the first and second of the adsorbent-based chambers to the other of the first and second of the adsorbent-based chambers after a predetermined amount of time has elapsed.

6. The system of claim 3, wherein the controller switches adsorption of the onboard fuel from one of the first and second of the adsorbent-based chambers to the other of the first and second of the adsorbent-based chambers after a predetermined minimum temperature has been attained.

7. The system of claim 1, wherein the first operational condition of the engine corresponds to:

an engine temperature that is indicative of at least one of a cold start condition and a warm-up condition, and further wherein the second operational condition of the engine corresponds to an engine temperature that exceeds the cold start and warm-up engine temperatures.

8. The system of claim 1, wherein the first operational condition of the engine corresponds to at least one of the first and second product tanks containing an amount of fuel that is below a threshold level of octane-rich fuel or cetane-rich fuel respectively, and further wherein the second operational condition of the engine corresponds to an engine temperature that exceeds a cold start and warm-up engine temperatures.

9. The system of claim 1, wherein the vaporized desorbate is coupled to the fuel supply tank through a portion of the fuel conduit such that upon thermal communication between the vaporized desorbate and the fuel supply tank, at least a portion of the vaporized desorbate is condensed.

10. A vehicular fuel system for converting an onboard fuel into octane-rich and cetane-rich components, the fuel system comprising:

a fuel supply tank for containing the onboard fuel;

fuel conduit in fluid communication with the fuel supply tank;

a separation unit comprising at least one adsorbent-based chamber, the separation unit in fluid communication with the fuel supply tank through the fuel conduit, where the separation unit is configured to selectively receive and separate at least a portion of the onboard fuel into an adsorbate and a remainder;

a heat exchanger cooperative with the separation unit and configured to selectively deliver residual thermal energy that results from operation of an internal combustion engine to at least one adsorbent-based chamber to vaporize the adsorbate or remainder formed thereon;

a first product tank for selectively receiving and containing either the vaporized adsorbate or a condensed form of the vaporized adsorbate;

a second product tank for selectively receiving and containing condensed remainder;

a plurality of sensors configured to acquire operational parameters associated with the operation of the fuel system and of an internal combustion engine; and

a controller cooperative with at least one of the fuel supply tank, fuel conduit, separation unit, heat exchanger, first and second product tanks and sensor and configured to determine an internal combustion engine operational condition such that when the controller determines a first operational condition, the controller is configured to direct the flow of a portion of the onboard fuel to such an engine without first passing through the separation unit, and when the controller determines a second operational condition, the controller is configured to direct the flow of a portion of the onboard fuel to the separation unit.

11. A method of operating an internal combustion engine, the method comprising:

configuring a fuel system to comprise a fuel supply tank for containing an onboard fuel, a separation unit, a heat exchanger, a first product tank and a second product tank cooperative with one another through fuel conduit and responsive to directions provided by a controller;

using the controller to ascertain an operational condition of the internal combustion engine;

using the controller to direct the flow of a portion of the onboard fuel to the combustion chamber without first passing through the separation unit when the internal combustion engine is in a first operational condition; and

using the controller to direct the flow of a portion of the onboard fuel to the separation unit when the internal combustion engine is in a second operational condition

such that an adsorbate collects on a surface of at least one chamber of the separation unit.

12. The method of claim 11, wherein the at least one chamber comprises a plurality of chambers such that while the adsorbate collects on a surface of a first chamber, heat from the heat exchanger is provided to a second chamber to desorb a previously adsorbed adsorbate that is situated thereon.

13. The method of claim 12, wherein the controller instructs the heat exchanger to alternate which of the first and second chambers receives a quantity of heat sufficient to desorb a previously adsorbed adsorbate that is situated thereon.

14. The method of claim 11, wherein the first operational condition of the engine corresponds to an engine temperature that is indicative of at least one of a cold start and a warm-up, and further wherein the second operational condition of the engine corresponds to an engine temperature that exceeds the cold start and warm-up engine temperatures.

15. The method of claim 11, wherein the first operational condition of the engine corresponds to a situation where at least one of the first and second product tanks is empty, and further wherein the second operational condition of the engine corresponds to an engine temperature that exceeds a cold start and warm-up engine temperatures.

16. The method of claim 11, further comprising conveying to the combustion chamber during a compression ignition mode of engine operation a fuel portion that includes the adsorbate independently of a fuel portion that includes a remainder.

17. The method of claim 16, wherein the fuel portion that includes the adsorbate is introduced to the combustion chamber via direct injection during a portion of the compression stroke.

18. The method of claim 16, wherein the fuel portion that includes the remainder is introduced to the combustion chamber via direct injection during a portion of the compression stroke.

19. The method of claim 16, wherein the fuel portion that includes the adsorbate is introduced to the combustion chamber via port fuel injection fully mixed with an air charge during a portion of an intake stroke, further wherein the fuel portion that includes the remainder is introduced to the combustion chamber via direct injection during a portion of a compression stroke.

20. The method of claim 16, wherein the fuel portion that includes the adsorbate is introduced via direct injection during a portion of a compression stroke, further wherein the fuel portion that includes the remainder is introduced via direct injection near top dead center movement of a piston that reciprocates within the combustion chamber.