CLAIMS

What is claimed:

1. A process for recovering 1,3-butadiene from a C_4 fraction, comprising:

   feeding a hydrocarbon fraction containing butanes, butenes, 1,2-butadiene, 1,3-butadiene, C_4 acetylenes, C_3 acetylenes, and C_{5+} hydrocarbons to a butadiene extraction unit;

   recovering from the butadiene extraction unit a 1,3-butadiene fraction, a C_3 acetylene fraction, a C_4 acetylene fraction, one or more fractions comprising the butanes and butenes, and a fraction comprising the 1,2-butadiene and the C_{5+} hydrocarbons;

   selectively hydrogenating at least one of the C_3 acetylene fraction and the C_4 acetylene fraction to produce a hydrogenated effluent comprising olefins, dienes, and oligomer byproducts;

   feeding the hydrogenated effluent and the fraction comprising the 1,2-butadiene and the C_{5+} hydrocarbons to a separator to recover a heavies fraction comprising the C_{5+} hydrocarbons and the oligomer byproducts and a lights fraction comprising the olefins, dienes, and 1,2-butadiene; and

   feeding the lights fraction to the butadiene extraction unit.

2. The process of claim 1, wherein the C_4 acetylene fraction comprises C_4 acetylenes and 1,2-butadiene.

3. The process of claim 2, wherein an amount of 1,2-butadiene in the C_4 acetylene fraction is approximately equal to an amount of the 1,2-butadiene in the ~~feed~~ hydrocarbon fraction.

4. The process of claim 2, wherein the C_4 acetylene fraction is fed to the selectively hydrogenating step, and wherein an amount of 1,2-butadiene consumed via the selectively hydrogenating is approximately equal to an amount of the 1,2-butadiene in the ~~feed~~ hydrocarbon fraction.

5. The process of claim 1, wherein vinylcyclohexene is produced in the butadiene extraction unit or is present in the ~~feed~~ hydrocarbon fraction, the process further comprising:

recovering a fraction comprising the vinylcyclohexene from the butadiene extraction unit; and

feeding the vinylcyclohexene fraction to the separator, wherein the vinylcyclohexene is recovered from the separator in the heavies fraction.

6. The process of claim 1, further comprising:

feeding at least a portion of the ~~feed~~ hydrocarbon fraction to the separator as a reflux;

vaporizing at least a portion of the ~~feed~~ hydrocarbon fraction fed to the separator;

recovering the vaporized portion with the lights fraction for feed to the butadiene extraction unit.

7. The process of claim 6, wherein the reflux comprises only the ~~feed~~ hydrocarbon fraction or a portion thereof and wherein the lights fraction is recovered as a vapor phase fed to the butadiene extraction unit.

8. The process of claim 1, further comprising:

vaporizing a portion of the ~~feed~~ hydrocarbon fraction in a vaporization system;

recovering a vapor fraction from the vaporization system;

recovering a liquid fraction from the vaporization system;

feeding the recovered liquid fraction to the separator as a reflux.

9. The process of claim 8, further comprising:

vaporizing at least a portion of the liquid fraction fed to the separator; and

recovering the vaporized portion with the lights fraction for feed to the butadiene extraction unit.

10. The process of claim 1, wherein the fraction comprising 1,2-butadiene and C_{5+} hydrocarbons further comprises at least one of N-methylpyrrolidone (NMP) and tertiary butyl catechol (TBC).

11. The process of claim 1, wherein the butadiene extraction unit comprises one or more of the following:

a pre-absorber;

a pre-fractionation column;

a feed scrubber / stripper system

a main wash column;

a rectifier;

an afterwash column;

an acetylene fractionator;

a butadiene fractionator;

an acetylene washer;

a solvent purification system; and

a degasser and cooling column.

12. A process for recovering 1,3-butadiene from a C_4 fraction, comprising:

feeding a hydrocarbon fraction containing butanes, butenes, 1,2-butadiene, 1,3-butadiene, C_4 acetylenes, C_3 acetylenes, and C_{5+} hydrocarbons to a vaporization system;

recovering a vapor fraction from the vaporization system;

recovering a liquid fraction from the vaporization system;

feeding the recovered vapor fraction to a butadiene extraction unit;

recovering from the butadiene extraction unit a 1,3-butadiene fraction, a C_3 acetylene fraction, a C_4 acetylene fraction, one or more fractions comprising the butanes and butenes, and a fraction comprising the 1,2-butadiene and the C_{5+} hydrocarbons;

selectively hydrogenating at least one of the C_3 acetylene fraction and the C_4 acetylene fraction to produce a hydrogenated effluent comprising olefins, dienes, and oligomer byproducts;

feeding the hydrogenated effluent and the fraction comprising the 1,2-butadiene and the C_{5+} hydrocarbons to a separator to recover a heavies fraction comprising the C_{5+} hydrocarbons and the oligomer byproducts and a lights fraction comprising the olefins, dienes, and 1,2-butadiene;

feeding the recovered liquid fraction to the separator as a reflux; and

feeding the lights fraction to the butadiene extraction unit.

13. The process of claim 12, wherein the C_4 acetylene fraction comprises C_4 acetylenes and 1,2-butadiene.

14. The process of claim 13, wherein an amount of 1,2-butadiene in the C_4 acetylene fraction is approximately equal to an amount of the 1,2-butadiene in the ~~feed~~ hydrocarbon fraction.

15. The process of claim 13, wherein an amount of 1,2-butadiene consumed via the selectively hydrogenating is approximately equal to an amount of the 1,2-butadiene in the ~~feed~~ hydrocarbon fraction.

16. The process of claim 12, wherein vinylcyclohexene is produced in the butadiene extraction unit or is present in the ~~feed~~ hydrocarbon fraction, the process further comprising:

    recovering a fraction comprising the vinylcyclohexene from the butadiene extraction unit; and

    feeding the vinylcyclohexene fraction to the separator, wherein the vinylcyclohexene is recovered from the separator in the heavies fraction.