which may be sent to a conventional distillation system for further purification, and C_3 acetylenes (propyne) and C_4 acetylenes streams, which may be sent to a selective hydrogenation unit, for example.

[0006] The C_3 and C_4 acetylenes may be selectively hydrogenated downstream of the butadiene recovery process to form useful olefins and dienes. Formation of olefin oligomers (green oil) may result during such hydrogenation processes. Processing of the crude C_4's at elevated temperatures through extractive and conventional distillation may also result in formation of dimers and oligomers, such as vinyl cyclohexane. In other processes for the recovery of butadiene, the totality of a crude C_4 stream may be passed through a selective hydrogenation reactor to selectively hydrogenate acetylenes upstream of extractive distillation. Following such hydrogenation systems, it is typical to separate the oligomeric "green oil" byproducts from the desired hydrocarbon products using a separator commonly referred to as a green oil column.

[0007] In addition to the acetylene streams, 1,2-butadiene and C_{5+} components are also recovered from the butadiene separation processes. Other waste streams may also be produced during the various butadiene recovery processes. For example, butadiene vaporization may require the removal of non-vaporized components from a vaporizer drum.

SUMMARY

[0008] Embodiments disclosed herein provide improved processes for recovering butadiene from mixed C_4 hydrocarbon streams. More specifically, embodiments disclosed herein provide for the recovery of butadiene from a mixed C_4 hydrocarbon stream, integrating post-extraction selective hydrogenation with butadiene extraction unit feed preparation to improve the efficiency and cost effectiveness of processes for the recovery of butadiene. Such integration may provide one or more of the following advantages including decreased 1,2-butadiene rejection, a reduction in the number of waste streams, a reduction in the overall energy requirements, and/or a reduction in the total number of vessels or unit operations required to perform the separations, each of which may improve the efficiency and cost effectiveness of processes for the recovery of butadiene.

[0009] In one ~~aspect~~embodiment, embodiments disclosed herein relate to a process for recovering butadiene from a C_4 fraction. The process may include: 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. In one aspect, there is provided 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.

[0010] In another ~~aspect~~embodiment, embodiments disclosed herein relate to a process for recovering butadiene from a C_4 fraction. The process may include: 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. In another aspect, there is provided 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.

[0011] Other ~~aspects~~ embodiments and advantages of the ~~invention~~ present disclosure will be apparent from the following description and the appended claims.

BRIEF DESCRIPTION OF DRAWINGS

[0012] Figure 1 is a simplified flow diagram of a process for butadiene recovery according to embodiments disclosed herein.

[0013] Figure 2 is a simplified flow diagram of a process for butadiene recovery according to embodiments disclosed herein.

[0014] Figure 3 is a simplified flow diagram of a process for butadiene recovery according to embodiments disclosed herein.

[0015] Figure 4 is a simplified flow diagram of a process for butadiene recovery according to embodiments disclosed herein.

DETAILED DESCRIPTION

[0016] Embodiments disclosed here relate to recovering butadiene from mixed C_4 hydrocarbon streams. More specifically, embodiments disclosed herein relate to improving the operations of butadiene extraction processes coupled to one or more downstream selective hydrogenation units.

[0017] The C_4 fraction to be used as starting mixture in the present processes is a mixture of hydrocarbons having predominantly four carbon atoms per molecule. C_4 fractions are obtained, for example, in the preparation of ethylene and/or propylene by thermal or catalytic cracking of a petroleum fraction, such as liquefied petroleum gas, light naphtha or gas oil. C_4 fractions may also be obtained by the catalytic dehydrogenation (oxidative and/or non-oxidative dehydrogenation) of n-butane and/or n-butene. The resulting C_4 fractions generally include butanes, n-butene, isobutene, 1,3-butadiene and small amounts of C_3 and C_5 hydrocarbons, including methylacetylene, as well as butynes, in particular 1-butyne (ethylacetylene) and butenyne (vinylacetylene). The 1,3-butadiene content is generally from 5 to 80% by weight. For example, a cracker or a CATADIENE unit may contain 15 to 17% butadiene, by weight. Other mixed C_4 feed streams may contain greater or lesser amounts of butadiene. When present in the mixed feed stream, vinylacetylene may be