Nevertheless, correspondingly high yields are desired. Therefore, in such cases, a so-called superfractionation of the 1-butene, the 1-hexene, the 1-octene and/or the 1-decene fraction and a separation of branched olefins must be carried out in particular.

For example, depending on the distribution set, the 1-hexene fraction in the above cases may be contaminated with 0.5 to 2 percent by weight of the somewhat lower boiling component 2-ethyl-1-butene.

The 1-octene and 1-decene fractions are typically each contaminated by lower-boiling components that, however, boil very close to the respective alpha-olefins, namely 2-ethyl-1-hexene and 2-ethyl-1-octene.

Against this background, the present invention has the particular task of creating improved possibilities for the production of pure or specification-compliant alpha-olefin fractions.

Summary

In an aspect of the present disclosure, there is provided a process (100) for the preparation of linear alpha-olefins, wherein

- ethylene in a feed mixture is subjected to catalytic oligomerization (1) to obtain a product mixture containing alpha-olefins with different chain lengths and side compounds,

- a primary fraction is formed in a primary fractionation (2) using at least part of the product mixture, and a secondary fraction is formed in a secondary fractionation (4) using at least part of the primary fraction,

- the primary fractionation (2) and the secondary fractionation (4) are carried out such that the primary fraction and the secondary fraction predominantly contain one of the alpha-olefins and are low in or free of other alpha-olefins, the primary fraction contains one or more of the side compounds, and the secondary fraction is depleted in or free of the one or more side compounds relative to the primary fraction, and

– in an intermediate step (3) between the primary fractionation and the secondary fractionation, to which at least part of the primary fraction is subjected, the one or more side compounds are at least partly converted to one or more secondary compounds and the one or more secondary compounds are at least partly separated in the secondary fractionation,

– wherein the alpha-olefin which the primary fraction and the secondary fraction predominantly contain is 1-hexene, the side compound or one of the side compounds is 2-ethyl-1-butene, and the secondary compound or one of the secondary compounds is 3-methyl-2-pentene, or wherein the alpha-olefin which the primary fraction and the secondary fraction predominantly contain is 1-octene, the side compound or one of the side compounds is 2-ethyl-1-hexene, and the secondary compound or one of the secondary compounds is 3-methyl-1-heptene,

characterized in that

– the intermediate step is carried out in the presence of 20 wt.-ppm to 200 wt.-ppm water as reaction moderator and using a strongly acidic ion exchange resin, so that not more than 0.8% of the alpha-olefin predominantly contained in the primary fraction or the part thereof subjected to the intermediate step is reacted.

Disclosure of the invention

Against this background, a process for the preparation of one of alpha-olefins and a corresponding plant according to the preambles of the independent claims are proposed. Embodiments are the subject of the dependent patent claims and the following description.

Before explaining the features of the invention, further principles of the invention will be explained and terms used will be defined.

Generally, as used herein, a "primary fractionation" of a mixture of alpha-olefins is understood to be the formation of a component mixture that contains a linear alpha-

olefin of a particular carbon number but is low in or free of linear alpha-olefins of other carbon numbers. Such a component mixture is also referred to hereinafter as a "primary fraction" of a corresponding linear alpha-olefin, for example as a 1-butene, 1-hexene, 1-octene or 1-decene primary fraction. The characteristic linear alpha-olefin in each case, since it is contained in the predominant proportion, is also referred to below in each case as the "main component" in a corresponding primary fraction.