Claims

1. Process for preparing an ester mixture in which an n-butene-containing feed mixture having a composition which varies over time is subjected to a first oligomerization to obtain an oligomerizate and at least some of the butene oligomers present in the oligomerizate are hydroformylated to aldehydes, of which at least some are hydrogenated by subsequent hydrogenation to an alcohol mixture which is then converted to the ester mixture, and in which an approximation of the actual viscosity of the ester mixture is determined, wherein
as a function of the approximation of the actual viscosity of the ester mixture determined, ethene oligomers which are obtained by subjecting an n-butene-free, ethene-containing feed mixture to a second oligomerization conducted separately from the first oligomerization are added in a controlled manner to the butene oligomers to be hydroformylated.

2. Process according to Claim 1, wherein the ethene oligomers which are added in a controlled manner to the butene oligomers to be hydroformylated as a function of the approximation of the actual viscosity of the ester mixture determined are obtained by subjecting an n-butene-free, ethene- and hexene-containing feed mixture to the second oligomerization conducted separately from the first oligomerization, such that the second oligomerization is a co-oligomerization of ethene and hexene.

3. Process according to Claim 2, wherein
a) the hexene is sourced from a third oligomerization which is conducted separately from the first and second oligomerizations, in which propene is dimerized,
or
b) the hexene is sourced from a third oligomerization which is conducted separately from the first and second oligomerizations, in which ethene is trimerized;
or
c) the hexene is sourced from the second oligomerization.

4. Process according to Claim 1, 2 or 3, wherein the second oligomerization is effected in the presence of a liquid inert solvent in which the ethene is at least partly dissolved and which is separated from the ethene oligomers after the second oligomerization has been conducted.

5. Process according to any of Claims 1 to 4, wherein the controlled addition of the ethene oligomers to the butene oligomers to be hydroformylated is effected in such a way that a target viscosity of the ester mixture is first fixed, the approximation of the actual viscosity of the ester mixture determined is compared with the target viscosity of the ester mixture, and the amount of the ethene oligomers added to the butene oligomers to be

hydroformylated is increased if the approximation of the actual viscosity is greater than the target viscosity, or the amount of the ethene oligomers added to the butene oligomers to be hydroformylated is reduced if the approximation of the actual viscosity is less than the target viscosity.

6. Process for preparing an ester mixture in which an n-butene-containing feed mixture having a composition which varies over time is subjected to a first oligomerization to obtain an oligomerizate and at least some of the butene oligomers present in the oligomerizate are hydroformylated to aldehydes, of which at least some are hydrogenated by subsequent hydrogenation to an alcohol mixture which is then converted to an ester mixture, and in which an approximation of the actual viscosity of the ester mixture is determined,
wherein
as a function of the approximation of the actual viscosity of the ester mixture determined, ethene is added in a controlled manner to the n-butene-containing feed mixture, such that the first oligomerization is a co-oligomerization of ethene and n-butene.

7. Process according to Claim 6, wherein controlled addition of the ethene to the feed mixture is effected in such a way that a target viscosity of the ester mixture is first fixed, the approximation of the actual viscosity of the ester mixture determined is compared with the target viscosity of the ester mixture, and the amount of the ethene added to the feed mixture is increased if the approximation of the actual viscosity is greater than the target viscosity, or the amount of ethene added to the feed mixture is reduced if the approximation of the actual viscosity is less than the target viscosity.

8. Process according to any of Claims 1 to 7, wherein the approximation of the actual viscosity of the ester mixture is determined by measuring the viscosity of the ester mixture.

9. Process according to any of Claims 1 to 7, wherein the approximation of the actual viscosity of the ester mixture is determined by calculation, the calculation being based on analysis of the alcohol mixture, on an analysis of the aldehydes to be hydrogenated, or on an analysis of the oligomers to be hydroformylated.

10. Process according to any of Claims 1 to 9,
wherein
the n-butene-containing feed mixture is composed of a combination of the following substance mass flow rates which vary within the specified substance mass flow rate ranges with a respective rate of variation within the specified range of rates of variation:

Substance	Substance mass flow rate	Rate of variation
Isobutene:	0 kg/s to 1 kg/s	- 0.05 g/s² to 0.05 g/s²

1-Butene:	0 kg/s to 6 kg/s	- 0.30 g/s² to 0.30 g/s²
2-Butene (cis + trans):	1 kg/s to 13 kg/s	- 0.30 g/s² to 0.30 g/s²
Isobutane:	0 kg/s to 3 kg/s	- 0.15 g/s² to 0.15 g/s²
n-Butane:	1 kg/s to 7 kg/s	- 0.30 g/s² to 0.30 g/s²
Other materials:	0 kg/s to 1 kg/s	- 0.05 g/s² to 0.05 g/s²

11. Process according to Claim 10, wherein the ethene oligomers or ethene used in a controlled manner is/are sourced from an ethene source which delivers a combination of the following substance mass flow rates which vary within the specified substance mass flow rate ranges with a respective rate of variation within the specified range of rates of variation:

Substance	Substance mass flow rate	Rate of variation
Ethene:	0.1 kg/s to 5 kg/s	- 0.01 g/s² to 0.01 g/s²
n-Butene:	0 kg/s to 0.01 kg/s	- 0.01 g/s² to 0.01 g/s²
Other materials:	0 kg/s to 1 kg/s	- 0.05 g/s² to 0.05 g/s²

12. Process according to any of Claims 1 to 11, wherein the first oligomerization and/or the second and/or the third oligomerization is effected in the presence of a heterogeneous catalyst containing nickel, silicon and aluminium.

13. Process according to any of Claims 1 to 12, wherein the hydroformylation is conducted in the presence of a homogeneous catalyst system comprising either cobalt or rhodium.

14. Process according to any of Claims 1 to 13, wherein the conversion of the alcohol mixture to the ester mixture is effected by esterifying the alcohol mixture with a carboxylic acid or carboxylic anhydride, or by obtaining the ester mixture by means of a transesterification of an existing ester with the alcohol mixture.

15. Process according to Claim 14, wherein the alcohol mixture is a mixture of isomeric nonyl alcohols which is reacted with phthalic acid or phthalic anhydride to give diisononyl phthalate.