the conditions of the MTBE dissociation. No information is given on the recirculation or discharge of TBA or limitation of the water concentration.

It was therefore an object of the embodiments disclosed hereininvention to develop a process for the synthesis and dissociation of MTBE, which makes the isobutene bound in the MTBE synthesis by formation of TBA available to the dissociation and at the same time limits excessive accumulation of TBA and/or water in the synthesis and dissociation.

In one aspect, there is providedThis object was achieved by a process for preparing isobutene by dissociation of MTBE, which comprises the following steps:

a) MTBE synthesis; reaction of isobutene-containing hydrocarbon mixtures (II), with methanol (III), present in one or more methanol-containing streams (VIII, IX), over acidic ion exchangers to give a stream (IV), containing MTBE and TBA,
b) Isolation of MTBE; separation of a stream (V), containing MTBE and TBA, from stream (IV) by distillation,
c) MTBE dissociation; dissociation of stream (V) in the gas phase over a heterogeneous catalyst to give a stream (VI) containing at least isobutene, methanol, MTBE and water and possibly TBA,
d) Isolation of isobutene; separation of the stream (VI) by distillation to give a stream (VII), containing in each case more than 50% by mass of the amounts of methanol, TBA and water present in stream (VI) and a stream (XVII) containing isobutene,
e) Removal of water; separation of water from stream (VII) to below 1% by mass by distillation to give a stream (VIII), wherein the removal of water from stream (VII) is carried out in two columns, with the first being operated at a lower pressure and the bottom product therefrom being purified further in a second column operated at a higher pressure,
f) Recirculation; total or partial recirculation of the methanol-containing stream (VIII) to the MTBE synthesis.

The process of the disclosureinvention is characterized in that the water content is reduced to below 1% by mass in the fraction (VIII) in process step e).

The advantage of the process of the disclosureinvention is not only the utilization of the isobutene bound as TBA for the dissociation. Only a relatively small amount of wastewater is obtained as additional stream and this can, for example, be passed to

a water treatment plant. On the other hand, if TBA were discharged from the process as a separate stream, this would have to be processed separately. The route of isolation or blending into a residual MTBE stream which is marketed, for example as carburettor fuel, as is often indicated in the literature, is possible to only a limited extent. In Europe, for example, the typical specification for marketable MTBE is an ether content of 98%.

Depending on the catalyst used in the process step of dissociation of the ether, there is a risk that the subsequent workup steps will have an acidic pH. The cause can be, for example, the release of traces of acid by the catalyst or the formation of, for example, formic acid as secondary reaction in the dissociation reaction. This can have the consequence that no inexpensive unalloyed steels can be used in these subsequent process steps, but instead it becomes necessary to use higher priced, high alloy steels in order to avoid corrosion caused by the acidic conditions. To avoid this, an alkali stream can be introduced in process step d) or in process step e) of the process of the invention. A further advantage of the process of the disclosure~~invention~~ is that the alkali can be discharged from the process in a simple way together with the water fraction in the removal of water in process step e). There is therefore no risk of the alkali being recirculated to process step a) and here possibly leading to damage to the catalyst used.

The disclosure~~invention~~ further provides a shell-and-tube apparatus having the following elements:

i) bundle of tubes

ii) tube plate,

iii) deflection plates,

iv) inner shell,

v) pressure-bearing outer shell containing at least one inlet and outlet,

vi) space within the shell containing a fluid which gives off or takes up heat,

characterized in that the inner shell is joined without leaving a gap or with a small gap to the deflection plates installed over the length of the bundle of tubes and to the tube plate, with the fluid present in the space within the shell enclosing the inner shell on both sides.