An object of the embodiments disclosed herein~~present invention~~ is generally to overcome as far as possible the disadvantages of the prior art processes. In particular it was an object to develop a process for the production of methacrylic acid or a methacrylic acid ester with a reduced formation of by-products and of a clogging that is caused by these by-products.

A further object is to increase the flexibility of the methacrylic acid and/or methyl methacrylate production process in view of the raw material basis by using methacrolein for the oxidation in the gas phase, which is originating from at least two different chemical sources.

A further object is to increase the independence of the methacrylic acid and/or methyl methacrylate production process from up- and downturns of costs and availability of a single raw material source and to increase the security of supply by enabling the process to switch temporarily between at least two different sources.

A further object is to increase the overall yield of the methacrylic acid and/or methyl methacrylate production process by recovering methacrylic acid from high boiler phases.

A further object is to increase the overall efficiency and/or yield of the methacrylic acid production process by recovering organic compounds from process waste water.

Another object of the ~~present invention~~embodiments disclosed herein is to recover water from the process waste water by reducing as far as possible the contamination of this waste water with organic compounds so that the water can be re-used, subjected to a biological purification process, or discharged to the environment, optionally after a biological or other type of purification process, rather than being incinerated together with the organic compounds.

A further object is to increase the overall efficiency and/or yield of the methacrylic acid production process by recovering organic compounds from process waste water.

These objects were solved by providing a novel process characterized in that a C_4 compound, especially Methacrolein, is oxidised in step a1) and that this C_4 compound

thereby originates from a mixture of at least two different C_4 compound comprising feed streams.

In an aspect, there is provided a process for preparation of at least one of methacrylic acid and a methacrylic acid ester, comprising process steps:

a1) gas phase oxidation of a C_4 compound to obtain a reaction phase comprising methacrylic acid;

a2) quenching of the reaction phase to obtain a crude aqueous phase comprising methacrylic acid;

a3) separation of at least a part of the methacrylic acid from the aqueous phase comprising methacrylic acid to obtain at least one crude methacrylic acid-comprising phase;

a4) separation and optionally purification of at least a part of the methacrylic acid from the crude methacrylic acid-comprising phase obtained in process step a3) by means of a thermal separation process;

a5) optionally, esterification of at least a part of the methacrylic acid obtained in step a4);

characterized in that the C_4 compound oxidised in step a1) originates from a mixture of at least two different methacrolein comprising feed streams and this mixture comprises

1 to 99 percent by weight of a first methacrolein comprising feed stream obtained by the heterogeneously catalysed gas phase oxidation of isobutylene or tert-butyl alcohol or isobutylaldehyde or a mixture of two or more thereof, and

99 to 1 percent by weight of a second methacrolein comprising feed stream obtained by the reaction of propionaldehyde with a C_1 extending agent.

In another aspect, there is provided a device for production of at least one of methacrylic acid and a methacrylic acid ester, comprising at least the following components in fluid-conducting communication with each other:

- a gas phase oxidation unit (A1), comprising a methacrolein providing unit, wherein the methacrolein is obtained by the heterogeneously catalysed gas phase oxidation of a C_4-source

- A methacrolein providing unit (F3), wherein the methacrolein is obtained by the reaction of propionaldehyde with a C_1 extending agent, which feeds in the gas phase oxidation unit (A1)
- a quench unit (A2),
- a first extraction unit (A3),
- a first separation unit (A4),
- optionally, a first esterification unit (A4),
- a second separation unit (B),
- optionally, a third separation unit (C),
- optionally, a fourth separation unit (D),

wherein the first separation unit is a thermal separation unit comprising at least one bottom outlet in the lower third thereof, the at least one bottom outlet being in fluid-conducting communication with at least one inlet of the second separation unit (B) and wherein the methacrolein to be oxidized in the gas phase oxidation unit (A1) can be obtained either completely from the first methacrolein providing unit, or completely from the second methacrolein providing unit or in any mixture of both.

In detail a contribution to solving the above objects is made by a process for preparation of at least one of methacrylic acid and a methacrylic acid ester, comprising process steps:

a1) gas phase oxidation of at least one C_4 compound to obtain a reaction phase comprising methacrylic acid;

a2) quenching of the reaction phase to obtain a crude aqueous phase comprising methacrylic acid;

a3) separation of at least a part of the methacrylic acid from the crude aqueous phase comprising methacrylic acid to obtain at least one crude methacrylic acid-comprising phase

a4) separation and optionally purification of at least a part of the methacrylic acid from the crude methacrylic acid-comprising; phase obtained in process step a3) by means of a thermal separation process,

a5) optionally, esterification of at least a part of the methacrylic acid obtained in step a4);

characterized in that the C_4 compound oxidised in step a1) is a methacrolein comprising mixture, wherein said methacrolein can optionally originate from at least two different methacrolein sources,

a first methacrolein source being a feed stream obtained by the heterogeneously catalysed gas phase oxidation of isobutylene or tert-butyl alcohol or isobutylaldehyde or a mixture of two or more thereof,

a second methacrolein source being a feed stream obtained by the reaction of propionaldehyde with a C_1 extending agent,

and where said methacrolein can be obtained either completely from the first methacrolein source, or completely from the second methacrolein source or from any mixture of both.

Another contribution to solving the above objects is also made by a process with the steps a1) to a5) as before, which is characterized in that the C_4 compound oxidised in step a1) originates from a mixture of at least two different methacrolein comprising feed streams and this mixture comprises