Typically, the hydrotreatment reactions are exothermal, and therefore it is possible to optimize the energy consumption of the process, by heat exchange between feed and effluent. If ammonia and halides are present a problem in this respect is however that in a feed/effluent heat exchanger feed temperatures below 270°C may result in cold zones in the heat exchanger, where e.g. ammonium chloride may precipitate.

According to the present invention a halides removal washing system is described, which is able to absorb halides from a process gas stream with a wash water injected into the process gas stream by means of an injector pipe and -nozzle.

WO 2015/050635 relates to a process for removing sulfur and halides from a hydrocarbon stream by hydrotreatment. The document is silent on the presence of nitrogen in the intermediate stream, and contrary to the present disclosure it explicitly recommends recuperation of heat from the hydrotreated product by heat exchange with chilled water, which is highly likely to cause precipitation of salts, if nitrogen was present.

BRIEF SUMMARY ~~OF THE INVENTION~~

In an aspect of the present disclosure, there is provided a halides removal washing system comprising a process gas duct for process gas comprising hydrocarbons and halides, an injector pipe extending into the process gas duct, said injector pipe has a wash water inlet in a first end of the injector pipe arranged outside the process gas duct and a wash water outlet with an injector nozzle in a second end of the injector pipe adapted to spray the wash water into the process gas in the process gas duct downstream of the injector nozzle.

In another aspect of the present disclosure, there is provided a use of a halides removal washing system disclosed herein in a hydrotreatment process.

The halides removal washing system of the ~~invention~~present disclosure comprises a process gas duct suited for conduction of a process gas comprising halides. The system also comprises an injector pipe extending into the process gas duct. The injector pipe has a wash water inlet in a first end arranged outside the process gas duct and a wash water outlet with an injector nozzle in a second end of the injector pipe arranged within the process gas duct. The injector nozzle is adapted to spray the wash water into the process gas in the process gas duct downstream of the injector nozzle to absorb halides from the process gas.

The halides removal washing system of this ~~invention~~present disclosure when used in a process gas duct with process gas comprising halides has the advantages that it ensures that NH_4Cl will not precipitate on any surfaces when operated properly. Thermal stress on pressure bearing parts at injection is avoided by the mechanical design as it will be explained in more details in relation to the figures. The mixing of wash water and feed ensures washout of HCl above 99.9 %.

In an ~~embodiment~~example of the ~~invention~~present disclosure the system comprises anti-precipitation means arranged around at least a part of the injector pipe which extends into the process gas duct. It is to be understood that anti-precipitation means are means which helps ensure that the surface of the injector pipe will not be cold relative to the process gas. If the surface of the injector pipe is relative cold compared to the process gas around it, there is a risk that parts of the process gas will precipitate on the surface of the injector pipe, which may lead to corrosion. The anti-precipitation means may for example be heating means or insulation.

In a further ~~embodiment~~example anti-precipitation means are arranged around at least a part of the injector nozzle. It is especially beneficial to provide the injector pipe and the injector nozzle with anti-precipitation means, since these members may otherwise provide relative cold surfaces on which there is a high risk of precipitation of parts of the process gas.

The anti-precipitation means may be in form of heat insulation. In a further ~~embodiment~~example the anti-precipitation means may be an injector purge channel adapted to provide a relative hot purge fluid compared to the temperature of the wash water. In a further ~~embodiment~~example, the anti-precipitation means may be a heat tracing, e.g. electrical heating wiring, an electrical wiring which can heat up the surfaces of the injector nozzle and the injector pipe when an electrical current is sent through the electrical wiring.

The effects of the heat insulation, the purge channel, heat tracing and further anti-precipitation means is avoidance of precipitation on surfaces which otherwise would be relative cold as compared to the process gas.

In an ~~embodiment~~example of the ~~invention~~present disclosure, the process gas duct has an anti-corrosion liner arranged on the inside surface of the process gas duct downstream of the injector nozzle. In an ~~embodiment~~example, this anti-corrosion liner may be arranged adjacent to the inside surface of the process gas duct, leaving a gap between the inside surface of the process gas duct and the anti-corrosion liner. This gap allows for a purge fluid to flow between the anti-corrosion liner and the process gas duct. The gap may in one ~~embodiment~~example be in the range of 0.2 – 50 mm. Furthermore, a sealing may be provided between the anti-corrosion liner and the process gas duct for the process gas not to enter the gap and for controlled flow of the purge gas. Also, a purge fluid connection to the process gas duct downstream of the injector nozzle may be provided, which is adapted to purge fluid into the gap.

In an ~~embodiment~~example of the ~~invention~~present disclosure one or more mixers are arranged within the process gas duct downstream of the injector nozzle to provide mixing of the process gas.

In a further ~~embodiment~~example of the ~~invention~~present disclosure, not only one but a plurality of injector pipes and a plurality of injector nozzles are provided. The plurality of injector pipes and -nozzles may be arranged within a single process gas duct or there may also be a plurality of process gas ducts, each with one or more injector pipes and -nozzles. The plurality of process gas ducts may all be connected to a common process gas duct upstream of the injector nozzles in a manifold setup.

As mentioned in the above, the described halides removal washing system may be used in a hydrotreatment process.