this can be recovered and/or re-used in other parts of the refinery, obviating these steps will be a significant improvement to the production of glycolaldehyde and the other products of the thermolytic fragmentation, since it will simplify the pre-processing of the raw material and thus reduce the costs associated with the production of glycolaldehyde from raw sugar.

However, the prior art has only succeeded in obtaining high yields of glycolaldehyde with refined or purified sugar solutions as carbohydrate feedstock for the thermolytic fragmentation.

Thus, there is a need for a process for production of glycolaldehyde from a carbohydrate feedstock which is industrially applicable and more energy efficient and less costly than the known processes, which are based on converting refined sugar, yet providing a high yield of glycolaldehyde.

SUMMARY

In one aspect of the present disclosure, there is provided a process for the production of glycolaldehyde comprising the step of thermolytic fragmentation of a salt-depleted carbohydrate feedstock comprising at least 20 wt/wt % mono- and/or di-saccharide(s) and less than 200 ppm salts to obtain the glycolaldehyde.

In another aspect of the present disclosure, there is provided a process for the production of glycolaldehyde from a crude carbohydrate material comprising at least 20 wt/wt % mono- and/or di-saccharide(s), said process comprising the steps of:

a. removing salt from said crude carbohydrate material, to provide a salt-depleted carbohydrate feedstock comprising less than 200 ppm salts;

b. performing thermolytic fragmentation on the salt-depleted carbohydrate feedstock so as to obtain glycolaldehyde.

In a further aspect of the present disclosure, there is provided a system for continuously performing the process as disclosed herein, said system comprising an ion-exchange unit having an inlet and an outlet, and a thermolytic fragmentation unit having inlet and outlet, wherein the outlet of said ion-exchange unit is fluidly connected to the inlet of said thermolytic fragmentation unit.

Experiments by the present inventors have shown that when a crude carbohydrate material comprising mono- and/or di-saccharide(s) is used as feedstock for thermolytic fragmentation, the yield of glycolaldehyde is lower than that obtained with a feedstock of high purity sugar. However, as described above the process of obtaining a high purity sugar feedstock from a crude carbohydrate material is energy intensive and costly. If the selectivity towards glycolaldehyde during thermolytic fragmentation (and thus the yield of glycolaldehyde) could be increased even though a crude carbohydrate material was used as carbohydrate feedstock, then thermolytic fragmentation could prove to be a simple process for large scale production of glycolaldehyde, which would allow for the production of commodity chemicals starting from glycolaldehyde.

It has surprisingly been found by the present inventor(s) that the primary cause of this decreased yield when using a crude carbohydrate feedstock (i.e. a carbohydrate feedstock containing a crude carbohydrate material) is not the presence of all of the common impurities, such as proteins, oligosaccharides, caramel, organic acids or furanics, but rather the presence of salts. The present inventors have found that by removing this impurity of salts, for example by an ion exchange procedure, the yield can be increased to the same level as observed for a high purity sugar as carbohydrate material. It is surprising that the salt appears to have a negative effect on the yield of glycolaldehyde using a carbohydrate feedstock comprising mono- and/or di-saccharide, especially as previous investigations of the effect of salts have shown a significant beneficial effect of salt on the yield of glycolaldehyde during polysaccharide pyrolysis (Patwardhan, P., Satrio, J., Brown, R. & Shanks, B. Influence

of inorganic salts on the primary pyrolysis products of cellulose. Bioresource technology 101, 4646–55 (2010)).

So, the present disclosure relates to a process for the production of glycolaldehyde comprising the step of thermolytic fragmentation of a salt-depleted carbohydrate feedstock comprising mono- and/or di-saccharide(s) and less than 200 ppm salts to obtain the glycolaldehyde.

The present disclosure also relates to a process for the production of glycolaldehyde from a crude carbohydrate material comprising mono- and/or di-saccharide(s), said process comprising the steps of:

removing salt from said crude carbohydrate material, to provide a salt-depleted carbohydrate feedstock comprising less than 200 ppm salts;

performing thermolytic fragmentation on the salt-depleted carbohydrate feedstock so as to provide glycolaldehyde.

The present disclosure further relates to thermolytic fragmentation of a salt-depleted carbohydrate feedstock comprising mono- and/or di-saccharide(s) and less than 200 ppm salts, said process including the step of removing salt from a crude carbohydrate feedstock, prior to said thermolytic fragmentation.

The present disclosure also relates to the use of a carbohydrate feedstock comprising mono- and/or di-saccharide(s) and less than 200 ppm salts in thermolytic fragmentation for producing glycolaldehyde.

Unless otherwise specified, ppm is meant to refer to parts per million on a weight basis.

The present disclosure further relates to a system for continuously performing the process as disclosed herein, said system comprising an ion-exchange unit having an inlet and an outlet, and a thermolytic fragmentation unit having inlet and outlet, wherein the outlet of said ion-exhange unit is fluidly connected to the inlet of said thermolytic fragmentation unit.

The present disclosure also relates to a process for the preparation of ethylene glycol from a carbohydrate feedstock comprising mono- and/or di-saccharide(s), the process comprising carrying out the steps for the production of glycolaldehyde as disclosed herein to obtain a fragmentation product;