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, wherein the salt-depleted carbohydrate feedstock comprises one or more impurities selected from the group of arsenic, lead, sulfate, sulfur dioxide, and 5-(hydroxymethyl)furfural.

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, wherein the salt-depleted carbohydrate feedstock comprises one or more impurities selected from the group of arsenic, lead, sulfate, sulfur dioxide, and 5-(hydroxymethyl)furfural;

b. performing the thermolytic fragmentation as disclosed herein.

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 suitable for removing salt from the crude carbohydrate material to provide the salt-depleted

carbohydrate feedstock; and having an inlet and an outlet, and a thermolytic fragmentation unit suitable for performing thermolytic fragmentation on the salt-depleted carbohydrate feedstock so as to obtain glycolaldehyde; and 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

CLAIMS

1. 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, wherein the salt-depleted carbohydrate feedstock comprises one or more impurities selected from the group of arsenic, lead, sulfate, sulfur dioxide, and 5-(hydroxymethyl)furfural.

2. The process according to claim 1, wherein the salt-depleted carbohydrate feedstock has a color above 75 ICUMSA units (IU).

3. The process according to any one of the preceding claims, wherein the salt-depleted carbohydrate feedstock comprises more than 30 wt/wt %, more than 40 wt/wt %, more than 50 wt/wt %, more than 60 wt/wt %, more than 70 wt/wt %, more than 80 wt/wt %, such as in the range of 50-95, 60-95, 70-95 or 80-95 wt/wt % mono-saccharide(s).

4. The process according to any one of the preceding claims, wherein the salt-depleted carbohydrate feedstock comprises a total amount of heavy metals of more than 5 mg/kg.

5. The process according to any one of the preceding claims, wherein the salt-depleted carbohydrate feedstock has a residue on ignition above 0.5 wt/wt %.

6. The process according to any one of the preceding claims, wherein the pH of the salt-depleted carbohydrate feedstock is below 6.

7. The process according to any one of the preceding claims, wherein the salt-depleted carbohydrate feedstock is of non-food grade purity as defined by the Food Chemicals Codex.

8. The process according to any one of the preceding claims, wherein the process comprises a prior step of salt-depleting a crude carbohydrate material to obtain a salt-depleted carbohydrate feedstock comprising less than 200 ppm salts, wherein the salt-depleted carbohydrate feedstock comprises one or more impurities selected from the group of arsenic, lead, sulfate, sulfur dioxide, and 5-(hydroxymethyl)furfural.

9. The process according to claim 8, wherein the crude carbohydrate material is salt-depleted by means of ion-exchange.

10. The process according to any one of claims 8 or 9, wherein the crude carbohydrate material is selected from cane sugar, cane sugar syrup, cellulose hydrolysate, starch hydrolysate, hemi-cellulose hydrolysate, corn syrup, sugar beet syrup; or a mixture thereof.

11. The process according to any one of the preceding claims, wherein the salt-depleted carbohydrate feedstock comprises less than 180 ppm, less than 170 ppm, less than 160 ppm, less than 150 ppm, less than 140 ppm, less than 100 ppm, less than 70 ppm or less than 50 ppm salts.

12. The process according to any one of the preceding claims, wherein the salt-depleted carbohydrate feedstock is injected into a thermolytic fragmentation unit in the form of an aqueous solution.

13. 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, wherein the salt-depleted carbohydrate feedstock comprises one or more impurities selected from the group of arsenic, lead, sulfate, sulfur dioxide, and 5-(hydroxymethyl)furfural;

    b. performing the thermolytic fragmentation according to any one of claims 1-12.

14. A system for continuously performing the process according to any one of claims 1-13, said system comprising an ion-exchange unit suitable for removing salt from the crude carbohydrate material to provide the salt-depleted carbohydrate feedstock; and having an inlet and an outlet, and a thermolytic fragmentation unit suitable for performing thermolytic fragmentation on the salt-depleted carbohydrate feedstock so as to obtain glycolaldehyde; and having inlet and outlet, wherein the outlet of said ion-exchange unit is fluidly connected to the inlet of said thermolytic fragmentation unit.