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PRODUCTION OF SUGARS FROM CELLULOSIC MATERIAL

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The present invention relates to the production of sugars from cellulosic material.

It is known that cellulose can be converted into sugar by treatment with highly concentrated hydrochloric acid, such as 41 per cent acid, but since hydrochloric acid of the desired concentration is not stable at ordinary temperature, this process offers great difficulties when it is desired to carry it out in a commercial scale. If on the other hand hydrochloric acid of a lower concentration be employed, for example a commercial 38 per cent acid, the cellulose is only incompletely converted into sugar.

We have now found that a practically complete conversion of cellulose into sugar can be easily obtained by acting with a mixture of commercial concentrated hydrochloric acid with concentrated phosphoric acid upon the initial material consisting of or comprising cellulose and recovering the sugars from the resulting acid liquid. It has been found that a strong, for example from 75 to 85 per cent, phosphoric acid, may be employed which is surprising since even an 89 per cent phosphoric acid when employed alone converts cellulose into sugar in the cold only to a very incomplete degree. According to the invention the concentration of the acids can be varied; for example a hydrochloric acid of from 35 to 38 per cent strength can be mixed with a phosphoric acid of from 70 to 89 per cent strength, which latter is still a liquid. The best results are usually obtained, depending on the nature of the material to be acted upon when the concentration of one of the said acids is near the aforesaid highest degree of concentration, but it is to be understood that the highest concentration of both acids is not required.

It is preferable to employ mixtures containing a greater amount of hydrochloric acid solution than of phosphoric acid. The hydrochloric acid can be removed from the reaction product in a simple manner after the reaction by heating the solution in vacuo. The phosphoric acid present accelerates the evaporation of the hydrochloric acid, which, as is known, can be removed only with great difficulties when converting cellulose into sugar with hydrochloric acid alone. The phosphoric acid is then separated in any suitable manner. The present process may be applied for the conversion of pure commercial cellulose into sugar as well as for the conversion of wood, straw, peat and other materials containing cellulose, into sugars, in which case the process may be carried out at a pressure above atmospheric pressure. Depending on the initial material employed, heating to, at the highest, 40° C. is sometimes advantageous. The process can be also performed while applying mechanical pressure and, if desired, while subjecting the reaction mixture to a slight pressure of gases, whereby the evolution of hydrochloric acid from the reaction mixture can be diminished, or the aforesaid modifications can be applied conjointly, if so desired.

Example

1 part of saw dust from pine wood is treated with a mixture of 5 parts of a 38 per cent hydrochloric acid and 2 parts of an 80 per cent phosphoric acid at 20° C. for 48 hours, whereby the lignocellulose is completely converted into sugar. The resulting solution is filtrated off from the insoluble residue, which amounts to about 35 per cent by weight of the initial material, the residue containing no appreciable amount of material convertible into sugar.

The resulting sugar solution is concentrated in vacuo at about 40° C., by which treatment the hydrochloric acid is volatilized; the phosphoric acid is, entirely or partly, removed by the conversion into dicalcium phosphate. After filtration of the phosphates separated out, the sugar solution can be employed for fermentation or converted into solid wood sugar, for example by spraying it into a chamber in countercurrent with a gaseous or vaporous drying agent such as dried or heated air or other gas.

What we claim is:

1. The process for the production of sugars from cellulosic materials, which comprises acting upon a material containing cellulose with a mixture of a strong phosphoric acid

and commercial concentrated hydrochloric acid.

2. The process for the production of sugars from cellulosic materials, which comprises acting upon cellulose with a mixture of strong phosphoric acid and commercial concentrated hydrochloric acid at a pressure above atmospheric pressure.

3. The process for the production of sugars from cellulosic materials, which comprises acting upon a material containing cellulose with a mixture of one part of a strong phosphoric acid and more than one part of commercial concentrated hydrochloric acid at about room temperature.

4. The process for the production of sugars from cellulosic materials, which comprises acting upon a material containing cellulose with a mixture of a phosphoric acid of a content between 70 and 89 per cent and a hydrochloric acid of a content between 35 and 38 per cent.

5. The process for the production of sugars from cellulosic materials, which comprises acting upon a material containing cellulose with a mixture of about 1 part of an about 80 per cent phosphoric acid and about 2½ parts of an about 38 per cent hydrochloric acid at about room temperature.

In testimony whereof we have hereunto set our hands.

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