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Obtaining Furfural Dehydration of Pentose Solutions

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ABSTRACT

The pentose composition of plant waste generated has been studied. Optimal acid and salt catalysts have been selected.

Corn cob rods are used in significant quantities as raw materials for the production of furfural feed yeast in a number of southern plants of the country. However, the furfural yield achieved in practice usually does not exceed 9.56 of the mass of the feedstock, which is only 40% of the theoretical.

We have shown the possibility of significantly increasing the yield of furfural from this raw material if concentrated solutions of sulfuric acid are used as a catalyst. But this method is carried out at a relatively low pressure (0.3-0.4 MPa), which makes it difficult to regenerate heat to produce secondary steam. In this regard, the use of orthophosphoric acid is more promising, which in this case can be used twice, first as a catalyst for the formation of furfural, and then as a phosphoric nutrition when growing fodder yeast on cellolignin hydrolysates. In addition, this acid, to a lesser extent than sulfuric acid, destroys the cellulose part of the raw material.

In this regard, the dynamics and kinetics of furfural formation from corn rods in the presence of 10-30% orthophosphoric acid were studied at a laboratory installation (reactor volume 10 liters), which allows modeling an industrial process. The consumption of the catalyst varied in the range of 2-45 to the mass of abs. dry raw materials, and the temperature from 100 to 170 ° C. It is shown that the yield of furfural and the rate of its formation increase with an increase in all factors within the specified limits of their change. The maximum yield of furfural with a process duration of 90 minutes was 18.6% of a.s.s., which is almost 2 times higher than the yield of this product currently achieved in industry.[1,2]

The catalyst consumption has a much more significant effect on the yield of furfural from rice husks. This is due not only to the change in the number of catalysis centers, but also to the high ash content in this material. With an increase in the consumption of sulfuric acid to 9% of the abs. dry raw materials, the yield of Furfural, even at a relatively low temperature (137 ° C), is II. 4% of a.s.s., which is 1.7-1.8 times higher than what is currently achieved in industry.

A promising raw material for Furfural production is deciduous wood. For the hydrolysates of deciduous wood, the data obtained during the tests of the installation on the pentose RV of the corn stalk were accepted (for design study). To implement the dehydration process, new technical solutions are proposed, the implementation of which will significantly (1.4 times) increase the efficiency of continuous technology. According to the developed method of heating the hydrolysate to the reaction temperature, the process passes from vapor-liquid to liquid-phase. This leads to an increase in the concentration of Furfural in the furfural condensate by 3.5-4 times and significantly reduces the volume of the reaction unit (and, consequently, the metal content). Instead of the cellular model of the dehydrator, a tubular apparatus of the "pipe in a pipe" type is proposed.

The effect of salt catalysts in the solid phase on the formation and yield of furfural and destructive changes in cellolignin polysaccharides that are difficult to hydrolyze is investigated. The experiment was carried out on an installation simulating thermal and hydrodynamic conditions characteristic of industrial devices. The influence of kinetic factors on the process was determined, the values of temperature and catalyst flow were determined, at which the maximum Furfural yield corresponds to the most complete preservation of hard-to-hydrolyze polysaccharides in cellolignin. The results of desk research are presented in the table.

Results of desk studies of the furfural production process using salt catalysts in the solid phase

Type of raw material	Catalyst	Catalystconsumption from absolute dry weight, %	Furfural yield from absolute dry weight %	Yield of furfural to potential content%	The content of hardly hydrolysable polysaccharides in cellolignin from absolute dry weight, %	The amount of undestroyed hard-to-hydrolyze polysaccharides,% of the original content in cheese
Odubina	Ammonium chloride	2,0	10,3	77,0	36,9	97,2
Odubina	Double superphosphate	3,0	9,6	71,7	36,6	96,4
Birch wood (sawdust)	Double superphosphate	3,0	11,8	83,1	43,0	99,8
Birch wood (sawdust)	Ammonium chloride	3,0	12,7	69,4	41,2	95,6
Corn cob	Double superphosphate	3,0	17,5	77,8	34,5	94,8

The dynamics of furfural distillation from the initial samples impregnated with a dilute solution of sulfuric acid is compared. The diffusion coefficient is determined for these conditions of the process of its production. The diffusion rate of furfural depends on the temperature and size of the samples.

Two-phase hydrolysis of raw materials is carried out on existing technological lines using standard equipment, which is subjected to minimal reconstruction: periodically operating hydrolysis devices are additionally equipped with a filter device for the selection of furfural-containing vapors in the raw material layer.

Industrial tests carried out (raw materials - sunflower and rice husk, corn stalk, odubina and sawmill waste) have shown the effectiveness of the method of two-zone processing of raw materials with counter steam flows. Various designs of filtering devices for the selection of furfural-containing vapors were tested.

The developed technology ensures the achievement of sufficiently high economic indicators by increasing the yield of furfural by 20-30% while maintaining the yield of hexose sugars at the same level. The cost of I t furfural is reduced by 50-100 rubles.

Currently, the technology of two-phase hydrolysis with the production of furfural during two-zone processing of cotton husks with oncoming steam flows is undergoing industrial testing at the Andijan hydrolysis plant.

A new technological scheme of two-phase hydrolysis of wood raw materials using a filter device for vapor extraction and for the selection of hydrolysate at the percolation stage has been developed for hydrolysis devices of increased capacity (160 m3).

Thus, the possibility of obtaining furfural from pentose solutions formed has been investigated.

List of literature:

1. Шарков В.И., Куйбина Н.И. Химия гемицеллюлоз– Москва. Химия. 1972.
2. Морозов Е.Ф. Производство фурфурола – Москва. 1988. С. 200.
3. Назирташова Р.М., Киргизов Ш. Research of pentosal hydrolysis products of plant waste – The American journal of applied sciences http://www.usajournalshub.com./index.php/tajas
4. Назирташова Р.М., Матякубов Р. Отходы растительного происхождения-ценное сырья для получения фурфурола. – The American journal of inter disciplinary innovations and research www.usajournalshub.com