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GLUCOSE SYNTHESIS OF ORGANIC WASTE WITH ULTRASONIC TECHNOLOGY USING CHLORIDE ACID CATALYST OF HYDROLYSIS PROCESS

D. Irawan* and Z. Arifin
Department of Chemical Engineering, Politeknik Negeri Samarinda, Jl. Ciptomangunkusumo Kampus Gn. Lipan, Samarinda (75131), Indonesia
*E-mail : ddy_iwn@yahoo.com

ABSTRACT
The process of biofuel production uses organic waste which does two important step, hydrolysis and fermentation. Hydrolysis process will result in reduction sugar and then it will be fermented to biofuel such as biobutanol. Chemical hydrolysis process is using ultrasonic that can save time and descend temperature of the process.So it can keep energy using on hydrolysis process. Organic waste like fruit peels and vegetables residual as many as 100 grams and HCl solution with blending ratio of 1 : 6 w/v mixed at hydrolysis reactor with a batch system where it fixed with ultrasonic of 28kHz and temperature measurement. Hydrolysis did with a variation of operation temperature, time of the process, and HCl concentration. it will result in hydrolysate and then glucose level analyzed with schrool luff method. Hydrolysate at a temperature of the process of 90 ^{o}C, time of the process of 30 minutes and HCl concentration of 1 % results in glucose yield of 36.82 %.
Keywords: chloride acid, glucose, hydrolysis, organic waste, ultrasonic

INTRODUCTION

Process technology of biofuel developing 2nd generation directs to the raw material of non-food which organic waste biomass conversion can be chosen. Waste organic is having lignocellulose contains what it contains 3 main-compliments, cellulose (30 - 50 % weight), hemicellulose (15-35 % weight) and lignin (13-30 % weight). The important production process of biofuel from organic waste is hydrolysis and fermentation.Hydrolysis of organic waste will be resulting reduction glucose. That conventional process used to chloride acid solution of 0.75% at a temperature of 120^{o}C for 30 minutes which results in glucose of 27.30 % and yield of glucose 15.07% [2]. Hydrolysate contains glucose, it will be fermented to be biobutanol using *clostridium acetobutylicum*[3]
Chemical hydrolysis of organic waste needs a high temperature for cracking lignocellulose to be glucose. Lignocellulose hydrolysis needed ultrasonic waves which its process did lower temperature, short in time glucose yield higher[10,8,6]. Hydrolysis with ultrasonic waves can decrease heating consumption and timing process so that technology get outcome production good.

EXPERIMENTAL

Organic waste as raw material contains fruit peels and vegetable where it is the most component of waste organic in Samarinda[1]. Hydrolysis process did batch reactor where completed by ultrasonic, heater and temperature control. The reaction will happen at temperature 70-90^{o}C using of HCl solution at concentration 0.5 – 1.25% with blending comparison of raw material and an acid solution of 1 : 6 w/v. Hydrolysate as glucose will be analyzed with luff-schrool method and calculated as glucose yield

RESULTS AND DISCUSSION

Hydrolysis process of organic waste caught lignocellulose to aim hemicellulose bound cracking, lignin contain eliminating and to the defective of cellulose crystal structure to be rustic glucose compound[11].

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The bound cracking process of hemicellulose and lignin from this research, it isn't only using heat delivered to the reaction but ultrasonic waves need. Cavitation effect of ultrasonic waves can defective for each polysaccharide bound structure.

The ultrasonic effect is more effective to crack of cellulose bounding, hemicellulose bounding and lignin bounding which it can accelerate of hydrolysis process. Temperature and timing process is to be short in time. The yield of glucose from hydrolysis process with ultrasonic waves can be seen in Fig.-1 below.

Figure-1 can be seen glucose yield from hydrolysis process of organic waste with ultrasonic waves (time variants) gives higher of glucose yield compare to without using ultrasonic waves. Cavitation phenomenon and acoustic phenomenon mixturing happen of ultrasonic application in a liquid solution. That process forces reaction to be homogenate for all timing process instead of initial process. Ultrasonic application on liquid will be creating of cavitation and hotspot so it can be increased for all chemical reaction level.

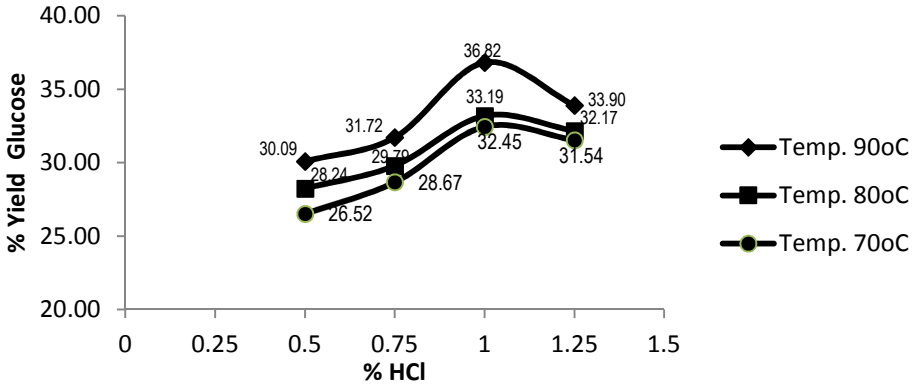

Fig.-1: HCl concentration versus glucose yield for temperature variant for 30 minutes.

High-intensity ultrasonic application on polysaccharide materials and accurate solutes can cause of significant changing of structure and function from carbohydrate. That process can do with the modifying process of polysaccharides bounding[12]. Ultrasonic waves can be cracking lignin bound, cellulose-bound and hemicellulose bound so hydrolysis process to cellulose and hemicellulose is easier without doing at high temperature.[4]

HCl concentration used to Hydrolysis process of organic waste with ultrasonic should concern of that process. Graphic one can be seen for each temperature variant process, HCl concentration transposition will change glucose yield. Acid concentration enhancement causes cellulose and hemicellulose to degrade glucose and other glucose compounds[5]. Replenishment of strong acid low concentration can be an increase of glucose quantity at lignocellulose hydrolysis because H^+ ion on strong acid can be breaking glycoside in cellulose[9].

Glucose yield at graphic 1 will gradually increase until HCl concentration is 1 % and then it will decrease at HCl concentration is 1.25%. Enhancement of acid concentration on hydrolysis should be increase glucose yield. However this research shows enhancement of acid concentration above 1 %, it doesn't increase proportionally based on yield result.

Acid concentration enhancement on hydrolysis process effects glucose and other glucose will be more degrading to be hydroxymethylfurfural and furfural so it will be as formic acid[7]. That results are predicted as glucose yield defective at HCl concentration more than 1 %.

CONCLUSION

Hydrolysis process of organic waste with ultrasonic waves results glucose yield higher than conventional hydrolysis process. Hydrolysis at a temperature of 90°C uses 1 % HCl concentration for 30 minutes proceeds glucose yield of 36.82 %.

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