Nutrient And Liquid Media For SSF

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I. INTRODUCTION

The concept of small scale biorefinery is suitable for Asian society such as Vietnam because of utilizing available agricultural biomass sources and its low installation and operation cost.[1] Thereby, this study aims to improve that process by recycling distilled SSF residue as supplemental nutrients for next SSF batches since the distilled SSF broth contains a rich protein source from yeast bodies. The utilization of the distilled residue will be more potentially sustainable than using imported CSL.

II. MATERIALS AND METHODS

Rice straw after alkaline pretreatment was loaded into an SSF tank with A.Cellulase enzyme and pre-cultivated yeast (*S.cerevisiae*).[2] The fermentation broth was distilled to obtain ethanol while distilled SSF residue was deposited sediment and separated into two layers. The top layer was almost water called Distilled residue-Liquid (DR-L). The bottom layer (Distilled residue-sludge or DR-S) was made dry and milled to powder (Distilled residue-Powder or DR-P). Fermentations using both of the above materials (DR-P and DR-L) were investigated in the 125ml flask test and (DR-S and DR-L) in 20L- mini reactor.

TABLE I. EXPERIMENT PROCEDURE

Reactor	125 ml- Flask Test					20 L-Mini Reactor	
Test ID	Test 1			Test 2		Test 3	
	C801	P801	P8015	C801	L800	C1601	PL16015
Straw	8%					16%	
Enzyme	1.875% vs. Biomass						
CSL	0.1%	-	-	0.1%	-	0.1%	-
DR-P	-	0.1%	0.15%	-	-		-
Water	~ 125 ml				-	~ 20L	-
DR-L					~125ml	-	~ 20L
DR-S	-	-	-	-	-	-	1.25%

III. DISCUSSION

In table 2, although SSF tests were carried out with the same dosage of nutrient (0.1wt.%), produced bioethanol concentration in the case of using CSL was much higher than DR-powder. This is expectable as CSL contains much more nutrient nitrogen content than SSF-powder. However, based on the advantages such as feasibility, self-supply, and convenient application of distilled SSF residue, it can increase the doses of these nutrients until getting the same N content as CSL. For such nitrogen balance, an SSF mixture with dosage of 0.15wt.% DR-powder has an equal amount of nitrogen as that using 0.1 wt.% CSL. Consequently, ethanol concentration of using 0.15 wt.% DR-P reached 1.39wt.%, which is approximate with 1.43% of SSF sample using 0.1 wt.% CSL.

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TABLE II. YIELD OF SSF TESTS.

Test ID	Test 1			Test 2		Test 3	
	C801	P801	P8015	C801	L800	C1601	M16015
Yield (%)	70.11	54.42	68.15	68.64	71.58	76.97	78.94

SSF-liquid may contain remained glucose and soluble proteins. For a shortcut to results skipping such analysis, in test 2 SSF-liquid was used as liquid media replacing for water with the same volume in an SSF flask test, and the ethanol concentration obtained was 1.46 wt.% (conversion yield of 71.58%). This result is favorable compared with what we gained from the conventional SSF process employing CSL. Due to the results of test 2, it was found that both powder and liquid of distilled residue are potential nutrients for the yeast. The aim of test 3 is to make trial fermentation in 20L mini reactor with 16wt% rice straw in terms of using the DR-S and DR-L as replacement of nutrient and water media). As a result, the ethanol concentration of SSF using distilled SSF residue was 3.52% significantly higher than using 0.1%wt CSL(3.28% ethanol).

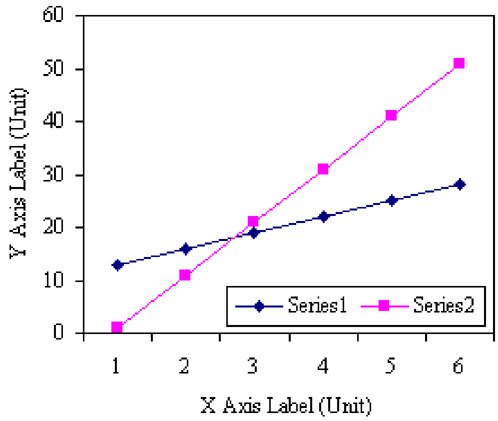

Figure 1. The Concentration of Ethanol.

IV. CONCLUSION

Distilled SSF residue can be considered as promising alternative nutrients for SSF, which replaces imported CSL and water media when using suitable dosages. Furthermore, utilization of the bottom product of distillation is not only economic advantages but also a sustainable process, adapting small scale biorefinery production.

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