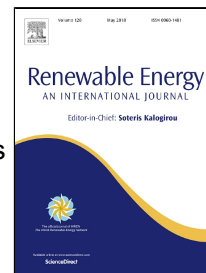


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## A much cheaper method to separate ethanol after solid-state fermentation process in renewable energy production

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### Abstract

Planar Thermal Source (PTS) was used to separate ethanol from Solid-State Fermented crushed straw Material (SSFM) instead of the traditional separation method of water steam in Advanced Solid-State Fermentation technology (ASSF). Complete thermo gravimetric test was done on prepared material to study the mass change rules under heating of PTS. Factors considered were temperature of PTS ( $T$ , 20~100°C), wet content of material ( $\theta$ , 0.1~0.9), ethanol concentration in wet of material ( $\omega$ , 0.03~0.11). The weight order of factors on material mass change speed  $V$  was  $T > \theta > \omega$ , and  $\omega$  can be ignored for that was an order of magnitude less important than  $\theta$  and  $T$ .  $V$  linearly increases with higher  $T$ , increases by power function with higher  $\theta$ .  $V$  model with  $T$  and  $\theta$  was regressed. As ethanol separating from SSFM can be considered as ethanol evaporating from ethanol solution, ethanol solution evaporation model was derived. Above all, model of ethanol separation from SSFM by PTS was derived. The cost model was added. Software was programmed to calculate the separation process and its cost. The method will promote the ASSF technology to produce fuel ethanol. The study can also be reference on drying process of other crushed plant material.

### Key words

Fuel ethanol

Ethanol separation

Crushed straw material

Solid-state fermentation

ASSF

Planar thermal source

### 1. Introduction

China produce 0.6~0.8 billion tons of straw every year [1, 2]. However, the economic utilizing level is low. Burning, making paper and producing food for animals are most used. Some new utilizing ways are hard to put into industrial production for its high cost and complex technology [3-9]. Prof. Li Shizhong in Tsinghua University changed the solid-state fermentation process from batch type to continuous by using rotary drum as

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