# Volatile Fatty Acids Production fromBrown Seaweed

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## INTRODUCTION

The world has to face up to the emergency that is the climate crisis by sharply reducing global carbon dioxide emissions so as to turn down the earth's thermostat and avert catastrophe [1]. The greenhouse effect and the disaster that would be fossil fuel's complete depletion make biomass an attractive source that would also circumvent problems associated with oil prices and oil spills [2]. Biomass is considered a renewable source at zero emission as it fixes $CO_2$ from the atmosphere through photosynthesis [3] and marine biomass has recently received more attention as a resource for biofuel production [4].Furthermore, bioenergy from marine biomass is important source to mitigate greenhouse gas emissions and substitute of fossil fuels [5].

According to Food and Agriculture Organization (FAO), the algae production was 14.8 million tonnes in 2005 from algal culture and 1.3 million tonnes from gathering (FAO, 2007). In 2005, 7.8 million tonnes of brown algae were produced, red algae production amounted to 4.8 million tonnes, green algae came to 13,000 tonnes, and other aquatic plants represented 2.1 million tonnes wet weight.

This research focuses on anaerobic fermentation of hydrolyzedbrown seaweed using sewage sludge to determine microorganism effect forVFAsproduction.

## EXPERIMENTAL

### Microorganism and nutrient

Microorganism was used from sewage sludge which was collected at Busan wastewater treatment factory and [6] showed dry nutrient mixture for it.

### Experimental procedure

The fermentation was carried out in 1L fixed-bed fermentors under anaerobic conditions at 35°C. The fermentors(F1-F3) were fed with 18 g/L hydrolyzedbrown seaweed, nutrient, 0.5 mL inhibitor, distillated water and 30 mL, 60 mL and 90 mL of microorganism, respectively;total operating volume is 900 mL.The

pH was measured with Hanna instruments pH meter (Model HI 9321) and kept at pH 7 by $NH_4HCO_3$ buffer solution.Everyday, 10 mL liquid samples were collected for pH checking and VFAs analysis. The sample needs centrifuge to remove scum before analysis; and it could be stored at – 15 °C if not used immediately.


**Fig. 1**.Laboratory scale model fermentor for the production of Volatile fatty acids

Analytical Methods

Acid analysis was performed using a Shimadzu 17A gas chromatograph with capillary column (Agilent Technologies, Inc., model HP-FFAP, 50 m x 0.32 mm x 0.50 μm). The GC was operated with a flame ionization detector (FID) at 250 °C and injector at 200 °C. The oven temperature increased from 80 °C to 200 °C at 10 °C/min and was held an additional 4 min at 200 °C. Before analysis, liquid samples were mixed with 1.162 g/L of internal standard (4-methyl-n-valeric acid) and acidified with 3-M phosphoric acid.

## RESULTS AND DISCUSSION

During early fermentation, (0 ~ 36 h), there was absence of VFAs; it was maybe due to non-detected small amount. After 36 h, all fermentors gave similarly amount of acid follow the time; this demonstrated that the effect of microorganism on this material is not much. The period time to get high yield acid was from 108 to 252 h (see Fig. 2). And the maximum VFAs concentration is about 6.0 g/L of the fermentor F2 using 60 mL sewage sludge at 204 h.

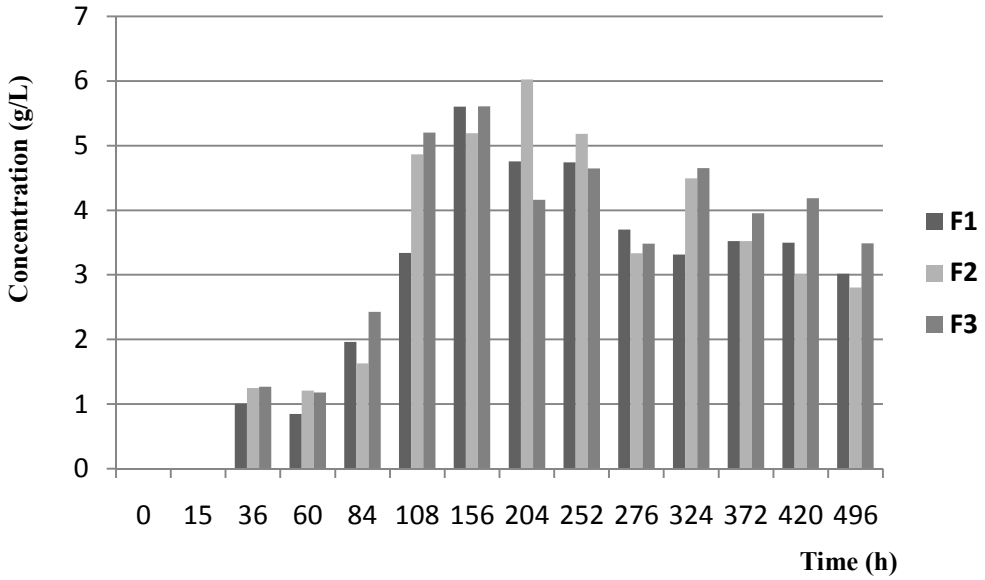


**Fig.2**. Totalvolatile fatty acids concentration

Most biomass conversion technology focuses on alcohols [7]. Alcohols as ethanol are a viable option as it can be directly used into transport in different blends with gasoline [8]. And fig. 3 showed the main components is acetic, propionic and butyric acid at 204 h. All these acids can convert to high value alcohol easily. It can be concluded that the fermentation of seaweed using sewage sludge produce high light acid (C2~C4) concentrations which can be converted to high value energy.

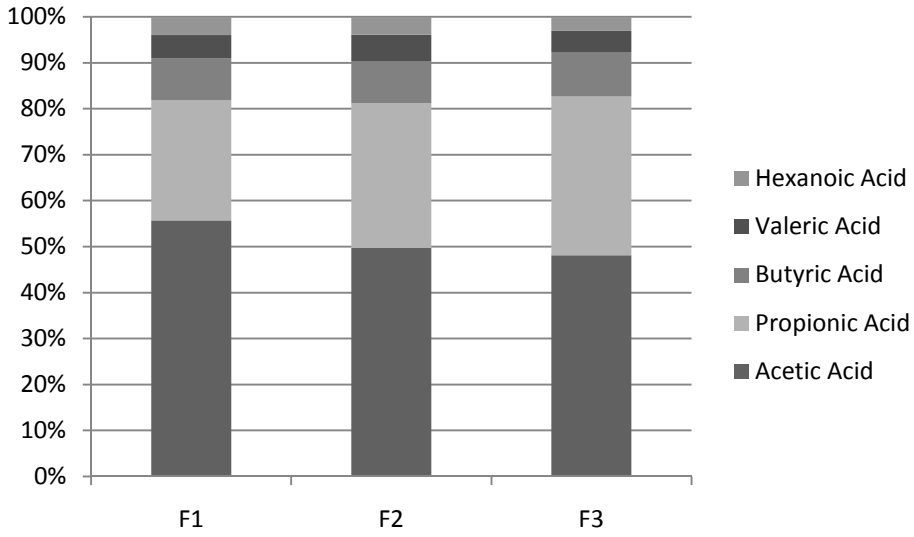


**Fig.3**.Percentage composition of VFAs at 204 h

## CONCLUSIONS

The effect of microorganism is not too much on this hydrolyzed brown seaweed. The maximum VFAs concentration is about 6.0 g/L of the fermentor F2 using 60 mL sewage sludge at 204 h. The period time to get high yield acid was from 108 to 252 h, and it was got high light acid (acetic, propionic and butyric acid) concentrations which can be converted to high value energy.

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