3-7 Development of Treatment Process for Wastewater from Milking Parlor

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ABSTRACT

Milk from diseased cows cannot be consumed so that to be disposed. In this research, a new treatment process of this milk (wasted milk) was studied from a view point of resource recovery to make the treatment sustainable. In fiscal year of 2003, a prototype of the process was developed, and treatment efficiency was studied; 75% of protein (casein) was removed as sediment. 97% of carbohydrate (lactose) was removed in fermentation process, while 26% of that was transformed into lactate.

KEYWORDS

Wasted milk, resource recovery, treatment, casein, lactose, lactate

INTRODUCTION

Wastewater from milking parlor is one of the pollutant sources in agricultural area because of its high organic content. It usually contains washing effluent from milker, the milking system, and also wasted milk which is disposed because it was taken from diseased cows and containing medicine for treatment. The wasted milk has extremely high organic content (BOD concentration bout 120 g/L) which is about 600 times higher than domestic sewage, so that the discharge of the milk gives severe environmental impact even with small amount. However, treatment facility does not spread especially to small farmers because of cost.

In this research, a new treatment process of wasted milk was studied from a view point of resource recovery, so that farmers can obtain benefit from the materials they recovered from the process. In fiscal year of 2003, a prototype of the process was developed, and treatment efficiency was studied.

The new process consists of two steps; casein, the major component of milk protein, is to be recovered by coagulation followed by transformation of lactose, the main component of milk carbohydrate, into lactate.

MATERIALS AND METHODS

Commercial milk was diluted 10 times to be used in this study. pH of the diluted milk was adjusted to around the isoelectric point by adding HCl so that casein in milk precipitated to be removed. A 100 mL of the supernatant after coagulation was supplied to L-lactic acid fermentation. After adding 2 g of east extract and 1 mL of *Bacillus coagulans* JCM2258, the supernatant in a grass reactor was incubated at pH5.5 and 55 degree for four days (Maeda *et al*., 2011).

Turbidity was measured as the absorbance in 5 cm grass cell at 660 nm wavelength. Concentrations of lactose and lactate were measured with an enzymatic analysis kit by r-biopharm.

RESULTS AND DISCUSSION

Concentration change in total organic carbon (TOC) and turbidity was shown in Fig. 1. The concentration was shown as that before dilution of 10 times. TOC of raw milk was extremely high as 78 gC/L. At pH 4.5 self-coagulation of casein occurred, and clear supernatant with turbidity 0.055 was derived (turbidity removal rate >99%), while TOC removal was just 50%. This was because lactate, the main carbohydrate in milk, remained still. Total nitrogen (TN) was decreased by 75%, which showed the protein reduction.

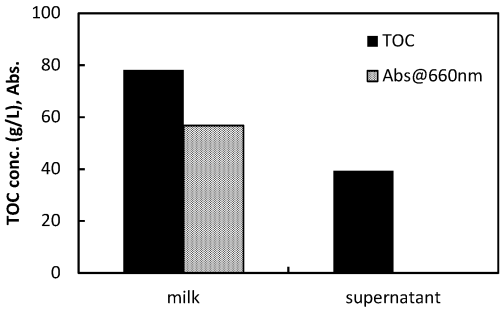

Fig. 1 Changes in TOC and turbidity by coagulation

Figure 2 shows concentration changes of lactose and lactate, the product by fermentation from lactose, during coagulation and L-lactic acid fermentation. During the coagulation process, lactose concentration remained still, but decreased in fermentation reaching to 1.2 g/L (3% of initial concentration) after four days. On the other hand, lactate concentration increased to become 11 g/L at last. The conversion ratio from lactose into lactate was 26%.

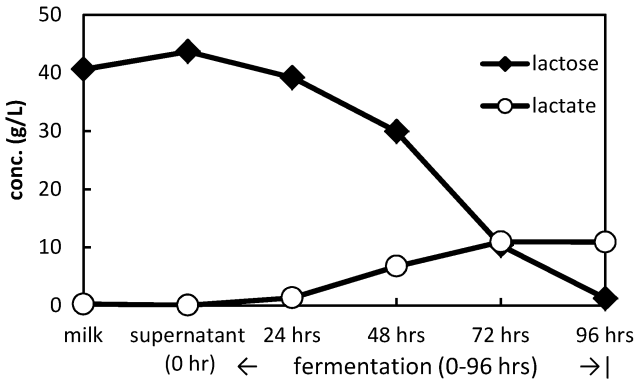

Fig. 2 Concentration Change in lactose and lactate

CONCLUSIONS AND PERSPECTIVES

In this research, a new treatment process of this milk (wasted milk) was studied from a view point of resource recovery to make the treatment sustainable. A prototype of the process was developed, and treatment efficiency was studied; 75% of protein (casein) was removed as sediment. 97% of carbohydrate (lactose) was removed in fermentation process, while 26% of that was transformed into lactate. The transformation ratio (yield) in the fermentation process should be improved in further study.

REFERENCES

Maeda, K., Akao S., Hosoi Y., Nagare H., Maeda M. and Fujiwara T. (2011) Comparative Evaluation of Different Pretreatment Methods for Enzymatic Saccharification of Lignocellulose. Journal of Japan Society of Civil Engineering, Ser. G, 67(7), III_433-III_440.