〈論　文〉

# 生物学的添加物の投与による上向流式嫌気性スラッジブランケト(UASB)反応槽の効率改善に関する研究

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## 概　要

本研究では，高率の嫌気性反応槽であるUASB(Upflow Anaerobic Sludge Blanket)を用いて，非粒状化消化汚泥にセルロース型の生物学的重合体（biopolymer）であるキチン質（chitin）を添加した場合における，嫌気性消化効率に及ぼす影響について検討した。人工合成試料水は市販牛乳を水道水で希釈した溶液に栄養塩を添加したものを用い，非粒状化ものである植種汚泥として下水処理場の消化汚泥を用いた。実験は回分式実験と連続式実験の２種類で行った。回分式実験においては，人工合成試料の注入濃度とキチン添加率の最適条件を設定し，回分式実験の結果に基づいて，連続式実験では有機物除去特性とメタンガス発生率について検討した。

回分式実験結果，試料注入濃度が5.0～6.7g·SCOD/$l$である場合，COD除去率は95％以上であり，最大ガス発生率は468.0～403.8m$l$·biogas/g·CODであった。また，微生物量は32.7～35.0mg·VSS/$l$であり，初期植種液の2.2～2.3倍に達する増殖を示した。しかし，キチン添加率を151.5mg/g·VSS以上にした場合，ガス発生率は増加したが，COD除去率は90％以下に低下し，もっと長い滞留時間が必要であった。

連続式実験においては，キチン質が嫌気性消化の効率に影響する因子を把握するため，有機物の除去特性とメタンガスの発生率を分析した。なお，比較実験として，キチン質を添加しない非粒状化消化汚泥だけの処理実験を行った。

１g·VSS消化汚泥当たり150mgキチン質を添加したA反応槽の場合，VLR（Volumetric Loading Rate）を段階的に増加させた運転期間52～57日間で安定的な処理が達成できた。その反面，キチン質を投与しなかったC反応槽においては，安定的な処

# A Study on the Improved Performance of Upflow Anaerobic Suldge Blanket Reactor (UASB) by Addition of Bio-supplement

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**Abstract**

The purpose of this study is to assess the possibility for anaerobic digestion enhancements of adding chitin as cellulose-like biopolymer to the basic, non-granular seed sludge in UASB (Upflow Anaerobic Sludge Blanket) reactor. For this study, commercial milk diluted with tap water (added mineral salt medium) was used as synthetic influent and the basic, non-granular seed sludge was anaerobically digested sludge from domestic sewage treatment plant.

The experiment consisted of batch test for the optimum substrate concentration and for the optimum adding rate of chitin and laboratory-scale continuous test for the organic (SCOD) removal rate and for the methane gas production rate. The laboratory-cale continuous experiment carried out about three reactors : A reactor＝addition of 150 mg・chitin to 1 g. VSS of non-granular digested sewage sludge as seed, B reactor＝addition of 650 mg・chitin to 1g・VSS of non-granular digested sewage sludge as seed, and C reactor＝digested sewage sludge only as seed. The results as follows :

According to the results of applying the batch experimental date, the optimum values for substrate concentration and adding rate of chitin were 5.0～6.7g・COD/$l$, 65.8～151.5 mg・chitin/g・VSS, respectively, because the biogas and biomass produced in that case were maximum values as 468.0～403.8m$l$. biogas/g・COD, 32.7～35.0mg・VSS/$l$, respectively, and also COD removal rate was above 95%, but addition over 151.5mg・chitin/g・VSS showed long lag time and the COD removal rate below 90%, although the gas production

rate was high.

In the laboratory-scale continuous experiment, the steady state at the A reactor was achived at 52 to 57 days after operation compared that the control reactor C required over 80 days after operation. As the maximum acceptable volumetric loading rate (VLR) and HRT at the A reactor were 19.65kg · SCOD/$m^3$ · day and 6.67 hrs, respectively, these values were about 5 times as big as the control reactor of 4.33kg · SCOD/$m^3$ · day and 30.32 hrs. As the methane yield at A reactor when the VLR of 19.65kg · SCOD/$m^3$ · day was 0.23$l$ · $CH_4$/g · SCOD added (at STP), that was about 2.5 times compared to the control reactor of 0.09$l$ · $CH_4$/g · SCOD added (at STP). It was shown that the addition of 150mg · chitin to 1g · VSS of seed sludge could significantly increase the biomass-retaining capacity.

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