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THE TREATMENT OF DAIRY WASTE BY ACTIVATED SLUDGE PROCESS



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ABSTRACT

This research was intended to study the treatment efficiency of dairy waste by activated sludge system. The Physical and Chemical characteristics of the waste were assessed.

The results of this study could be summarized as follow:-

1. The waste from the Bangkok Dairy Plant had high BOD_5 value about 4600 mg./l. and COD was about 7000mg./l.
2. The reduction of BOD_5 and COD were more than 90 %
3. The reduction of volatile suspended solids, BOD_5 , COD as observed at 28 °C was a function of time.
4. The relationship between the BOD_5/COD ratio at 28 °C are 0.667.
5. The organic removal rate (m) by assimilation varied from 0.430 to 0.438.
6. The logarithmic growth rate constant for natural logarithm K_1 for the log growth phase varied from 0.124 hr.⁻¹ to 0.152 hr.⁻¹

7. The declining growth rate constant for natural logarithm $-K_2$ for the declining growth phase varied from 0.255 hr.^{-1} to 0.267 hr.^{-1}

8. The endogenous growth rate constant for natural logarithm $-K_3$ for the endogenous growth phase varied from 0.0515 hr.^{-1} to 0.0667 hr.^{-1}

9. The nitrogen requirements based on COD, expressed as the ammonia - nitrogen varied from 3.65 $\text{lb.N./100 lb. COD removed}$ to 3.80 $\text{lb.N./100 lb. COD removed}$.

10. The nitrogen requirements based on BOD_5 , expressed as the ammonia - nitrogen varied from 6.10 $\text{lb.N./100 lb. BOD}_5$ removed to 6.35 $\text{lb.N./100 lb. BOD}_5$ removed.

หัวข้อวิทยานิพนธ์ การกำจัดน้ำทิ้งจากโรงงานอาหารนมโดยกรรมวิธี แอคติเวทเศตเศลลจ์

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ผลของการทดลองพอจะสรุปผลได้ดังนี้

1. น้ำเสียจากโรงงานอาหารนมบางกอกเคอรัฟแลน มี BOD₅ สูงประมาณ 4600 mg./l. และ COD ประมาณ 7000 mg./l.
2. ประสิทธิภาพในการกำจัดน้ำเสียโดยวิธีนี้ ทำให้ BOD₅ และ COD มีค่าลดลง เกินกว่า 90 %
3. ค่าของ Suspended Solids, BOD₅ และ COD ที่ลดลงที่อุณหภูมิ 28 °C จะขึ้นอยู่กับเวลา
4. อัตราส่วนระหว่าง BOD₅/COD ที่ 28 °C มีค่าเท่ากับ 0.677
5. อัตราการกำจัดอินทรีย์สาร (m) โดย assimilation มีค่าระหว่าง 0.430 ถึง 0.438
6. ค่าคงที่ K₁ สำหรับช่วง log growth มีค่าระหว่าง 0.124 hr.⁻¹ ถึง 0.152 hr.⁻¹
7. ค่าคงที่ -K₂ สำหรับช่วง declining growth มีค่าระหว่าง 0.255 hr.⁻¹ ถึง 0.267 hr.⁻¹
8. ค่าคงที่ -K₃ สำหรับช่วง endogenous growth มีค่าระหว่าง 0.0515 hr.⁻¹ ถึง 0.0667 hr.⁻¹

9. ไนโตรเจนที่ใช้สำหรับแบคทีเรียในการทำให้ COD มีค่าลดลง มีค่าระหว่าง
3.65 lb.N./100 lb. COD removed ถึง 3.80 lb. N./100 lb. COD
removed.

10. ไนโตรเจนที่ใช้สำหรับแบคทีเรียในการทำให้ BOD₅ มีค่าลดลง มีค่าระหว่าง
6.10 lb.N./100 lb. BOD₅ removed ถึง 6.35 lb. N./100 lb. BOD₅
removed.

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LIST OF SYMBOLS AND ABBREVIATIONS

- a = The fraction of 5 - day BOD or COD removed which is used for synthesize sludge at any time.
- a' = The coefficient represents that fraction of organics consumed to supply energy for synthesis
- A = The total interfacial area, sq. ft.
- b' = The coefficient represents the endogenous respiration rate, mg./l./hr.
- BOD₅ = The 5 - day biochemical oxygen demand, mg./l.
- C_L = O₂ concentration at the cell interface.
- C_O = The initial COD concentration that can be oxidized, mg./l.
- C = COD remaining, mg./l.
- COD = Chemical Oxygen Demand, mg./l.
- C_M = O₂ concentration within the cell
- C_r = COD removed, mg./l.
- D = Diffusivity of oxygen
- D.O. = Dissolved Oxygen, mg./l.
- i = Organic loading intensity = $C_o / (S_o \cdot t)$, hr.⁻¹
- K_i = Initial removal rate coefficient
- K_{La} = Overall coefficient for oxygen transfer
- K_L = The overall diffusion coefficient based on liquid film resistance, ft³ of Vol./Sec./ft². area.
- K_T = The aeration coefficient at temperature T.
- K₂₀ = The aeration coefficient at 20 °C.

- K_1 = Logarithmic growth rate constant for natural logarithm, hr.^{-1}
 k_1 = Logarithmic growth rate constant for common logarithm, hr.^{-1}
 $-K_2$ = Declining growth rate constant for natural logarithm, hr.^{-1}
 $-k_2$ = Declining growth rate constant for common logarithm, hr.^{-1}
 $-K_3$ = Endogenous growth rate constant for natural logarithm, hr.^{-1}
 $-k_3$ = Endogenous growth rate constant for common logarithm, hr.^{-1}
 I_e = Oxidizable BOD remaining, mg./l.
 I_o = Total amount of initial BOD that can be oxidized as a limit of the oxidation process, mg./l.
 I_r = Quantity of BOD removed, mg./l.
 I_{ri} = BOD removed over specified time interval, mg./l.
 I_i = Maximum BOD removable over specified time interval, mg./l.
 m = Organic removal rate by assimilation, hr.^{-1}
 $MLSS$ = Mixed Liquor suspended solids, mg./l.
 $MLVSS$ = Mixed liquor volatile suspended solids, mg./l.
 N = Ammonia - nitrogen present at time t , mg./l. as N.
 N_r = Ammonia - nitrogen removed, mg./l. as N.
 $\text{NH}_3 - \text{N}$ = Ammonia - nitrogen, mg./l.
 $\text{NO}_3 - \text{N}$ = Nitrate - nitrogen, mg./l.
 r = Oxygen consumed, mg./l.

- r_r = Oxygen uptake rate, mg./l./hr.
- S = The sludge concentration present, mg./l. suspended solids or volatile suspended solids.
- S_o = The initial sludge mass per unit volume, mg./l. suspended solids or volatile solids.
- S_a = The average sludge concentration over the range under consideration, mg./l. suspended solids or volatile solids.
- T = Temperature , °C.
- t = Time in hour or day.
- Total S.S. = Total suspended solids. , mg./l.
- Total D.S. = Total dissolved solids. , mg./l.
- VSS = Volatile Suspended solids , mg./l.