II-417 SUPPORT MEDIA FOR ANAEROBIC MICROORGANISMS

Tohoku Univ. * Valentin Nenov
Tohoku Univ. Akito Matsumoto
Tohoku Univ. Tatsuya Noike

Based on the potential possibility of some materials with large pores /1/ and ion-exchange abillity /2/ to be attached easily by microorganisms, the goal of the present study was to get comparative data for the attachment of anaerobic microorganisms onto various granular media.Considering also that all anaerobic processes have start-up problems, our attention was focused on the initial stage of biofilm formation.

EXPERIMENT

Anaerobic digestion experiments were performed in batch reactors (vials) with volume of 120ml.The vials were placed in a reciprocal shaker (Fig.1).They were operated at 35°C and pH=7. Support materials tested are shown in Table 1.

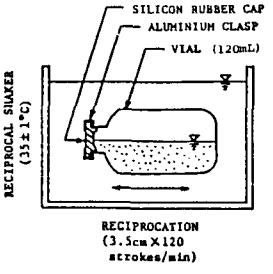

Fig.1.Experiment unit

Table 1

MEDIA	DIA,mm	AVER.PORE SIZE, m
Ion exchange resins		
Amberlite IRA-938(strong base)	0.30-0.40	9
Amberlite IRA-400(strong base)	0.40-0.53	-
Amberlite 200-C (strong acid)	0.50-0.65	0.01
Polymeric adsorbents		
Amberlite XAD-2	0.3-1.2	0.009
Amberlite XAD-7	0.3-1.2	0.009
Activated carbon		
SP	0.27	<0.1
MP	0.25-0.59	<0.1
LP	0.30-0.84	<0.1
Nonporous media(glass partcl.)	0.4	-

Reactors were started by filling them with 15ml support media,5ml distilled water,10ml substrate and 50ml seed sludge(corresponding to the substrate).As a sustrate, acetic acid(HAc),HAc with addition of yeast extract(HAc/YE) and skim milk(SM) were used.The filling-draw experiment continued 30-35 days.After this period (biofilm formation"BF"period),the mixed liqiour was removed and replaced with solution containing only substrate. The disired substrate concentration was 1500mg COD/l.The activity of the system following the removal of mixed liqiour was considered to be mainly the result of attached biofilm developed during the BF-period.The period followed the mixed liqiour withdrawl was named "response" period. Parameters measured were pH,gas production,gas content,volatile fatty acids and biomass concentration(attached and suspended). Attached biomass was observed by Scanning Electron Microscopy (SEM).

RESULTS

Methane production rate during the response period and final biomass concentration in the reactors are shown in Table 2.Gas production of nonmentioned reactors was below 0.01g COD/l.

System type	HAc	HAc/YE	SM	HAc	HAc/YE	SM	HAc	HAc/YE	HAc	HAc/YE	HAc	HAc/YE
Methane prod. rate,gCOD/l.d	0.28	0.47	0.12	0.14	0.21	0.03	0.12	0.25	0.10	0.15	0.03	0.11
Corr.coeff.	.9997	.9980	.9925	.9528	.9874	.9926	.9989	.9903	.9842	.9986	.9954	.9953
Biomass,g/l	0.14	0.15	0.12	0.14	-	0.13	0.25	0.23	0.15	0.18	0.23	0.30

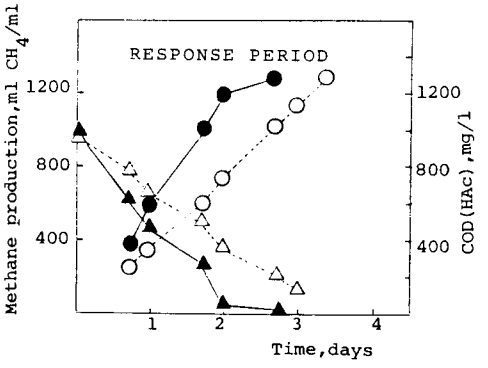

Fig.2.Reactor performance through the response period (Amb.IRA-938); CH_4production (HAc, HAc/YE), COD(HAc)conc. (HAc, HAc/YE)

A typical example of reactor behaviour through the response period is presented in Fig.2.Biomass concentration measurments revealed that for all media,except for Amb. IRA-938,the total biomass is equal to suspended one.In case of Amb.IRA 938 reactor,it was found that 86, 67 and 100% of the total biomass (for HAc,HAc/YE and SM system resp.), was attached.A biomass attachement on external and partly on the internal surface of this material was observed (by SEM).

DISCUSSION

It has been shown that within the specific experiment conditions (reciprocal bath), the most important factor for methanogenic bacteria attachment on the granular media tested,is pore size;significant attachement of biomass occurs only in the case of supermacroporous resin Amb.IRA-938.Considering that the size of predominant microrganisms existing is 0.5-5 m, their penetration and accumulation in Amb.IRA-938 pores could be explained.A high accumulation of anaerobic microorganisms was also reported by Messing(1) on inorganic matherials with large pore diameter.Another factor besides pore size,influencing reactor performance(HAc system) is yeast extract concentration.No significant differences were found in biomass concentration nor were there visible differences in SEM samples between HAc and HAc/YE reactors,but as rule HAc/YE reactors were more efficient.This data confirmed the results of Baresi(3),indicating that although the rate of methanogenesis is dependent on higher YE concentration,yeast extract addition is not growth factor.

REFERENCES

(1)Messing R.A.,Biotechnology and Bioengineering,vol.XXIV.,pp 1115-1123,1982.;(2)Daniels S.,Dev. Ind.Microbiol.,13,211,1972.; (3)Baresi L.et al,Applied and Env.Microbiol.,pp.186-197,July, 1978.

ACKNOWLEDGMENT

The authors would like to express their appreciation to ORGANO CO.LTD..