MICROBIAL COMMUNITY DYNAMICS DURING START-UP OF AN OSA PROCESS

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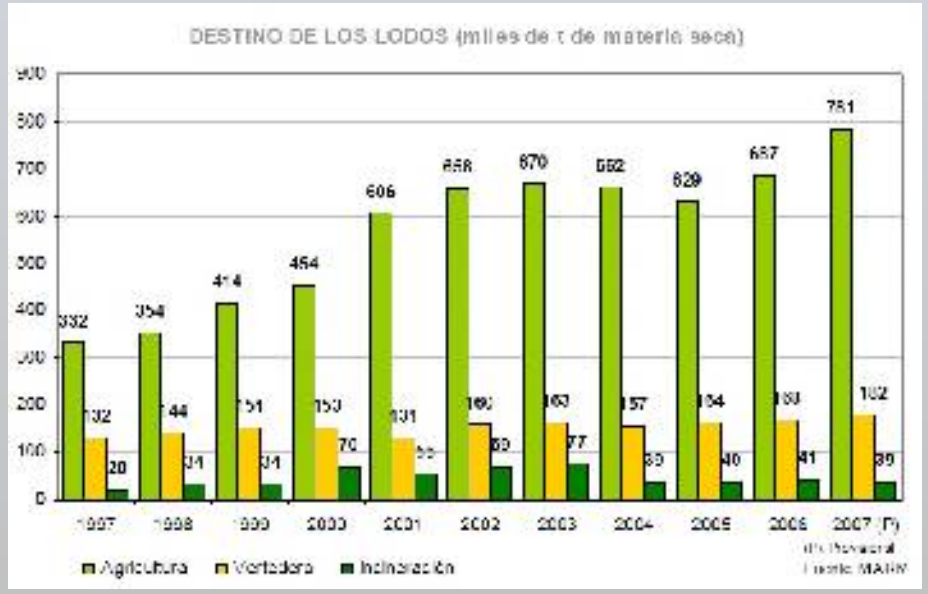
OBJECTIVES

- Reducing production of excess sludge associated with activated sludge processes by a biological process.

- Identify and understand the consequences physical, chemical and biological, of the biological process in wastewater treatment by activated sludge.

- In this study, in particular, to distinguish the evolution of the microbial community in the star-up of the pilot plant.

INTRODUCTION



Development technologies

Physico-chemical reduction of excess sludge production in CAS:

(1) Cell lysis and endogenous metabolism

Ozonation

Chlorination

Thermochemical treatments

Increased oxygen concentration

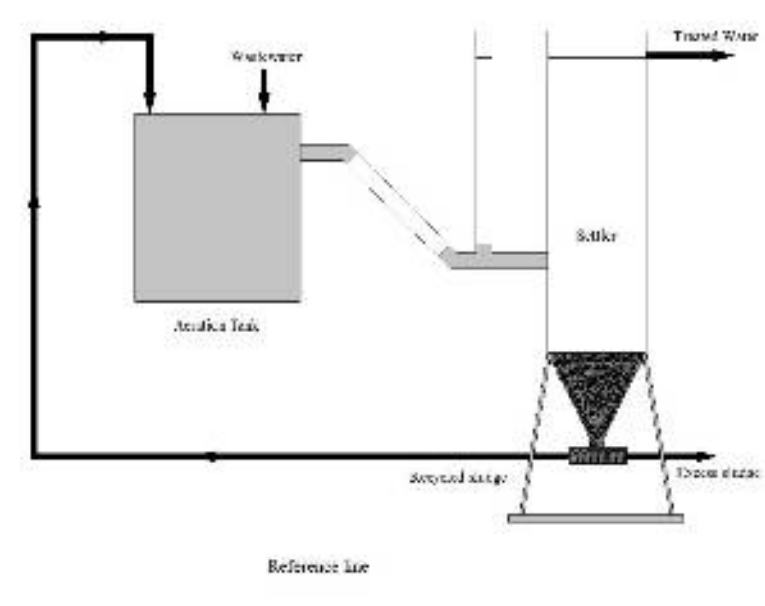
(2) Decoupling energy

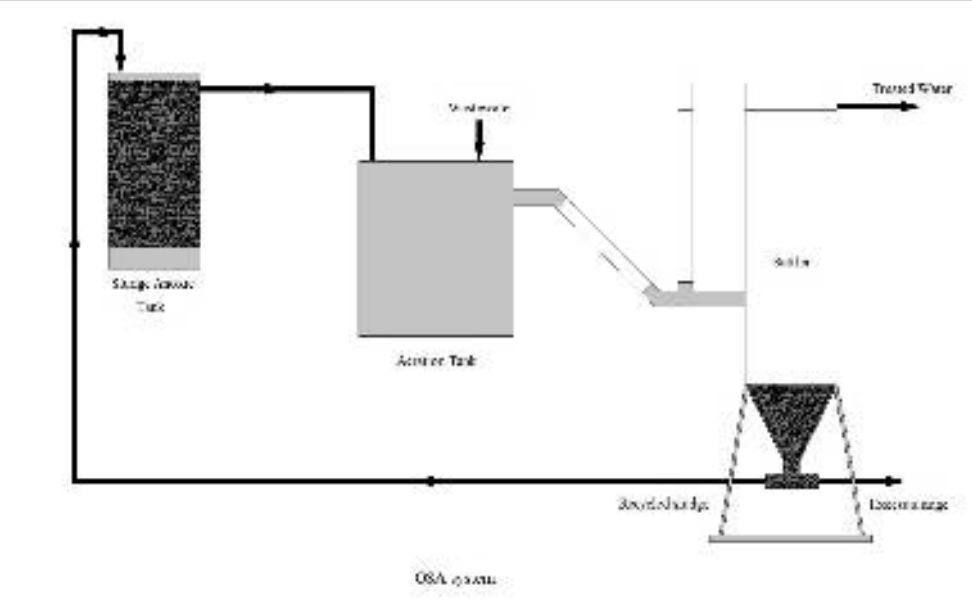
Biological reduction of excess sludge production in CAS

(1) Predation of bacteria by microfauna

(2) MBR´s

(3) OSA System





PREVIOUS STUDIES

- VI Jornadas de Transferencia de Tecnología sobre Microbiología del Fango Activo. Sevilla, 2009. ISBN 978-84-613-7691-9.

Aerobic period (h)	non-Aerobic period (h)	R_{SSV} (%)
24	-	14
12	12	29

Reduction of sludge in the reactors of 6 L at 32 days.

Aerobic period (h)	non-Aerobic period (h)	R_{SSV} (%)
24	-	26
12	12	49

Reduction of sludge in the reactors of 2 L at 10 days

Sludge reduction 50 %

➢ 7th ANQUE International Congress. Oviedo, Spain, 2010. ISBN 978-84-693-2258-1.

Name	Aerobic period (h)	non-Aerobic period (h)	Reduction$_{TSS}$ (%)	Reduction$_{SSV}$ (%)	Production$_{Phospholipids}$ (%)
Control	24	0	0	0	21
OSA 4/4	4	4	7	-24	10
OSA 6/6	6	6	46	100	-5
OSA 12/12	12	12	**56**	135	-4

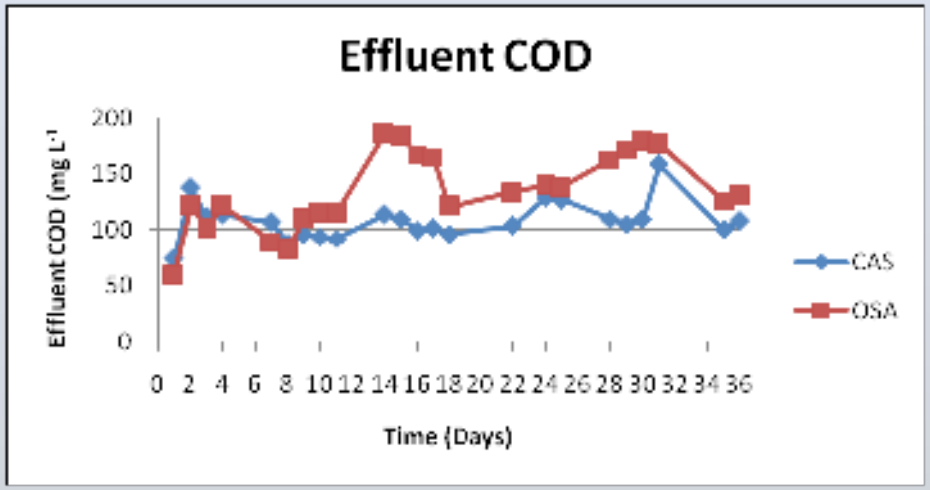
Summary of results

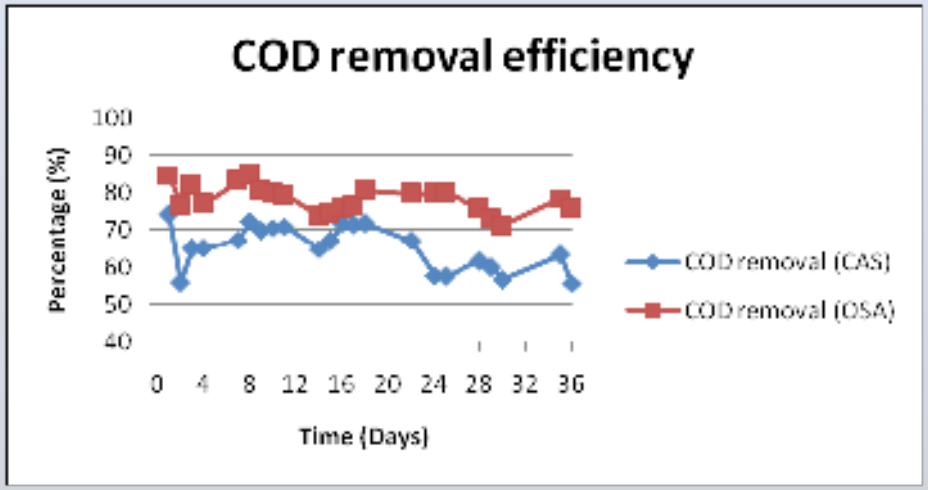
METHODS

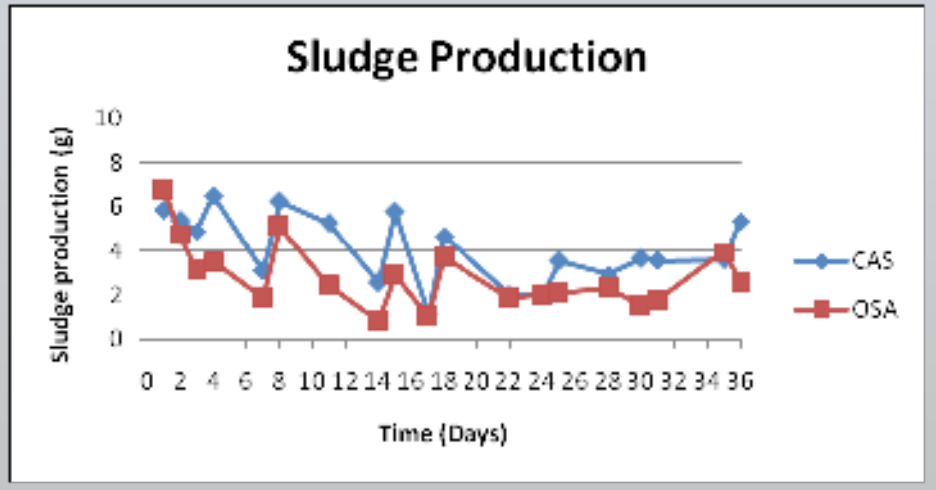
METHODS

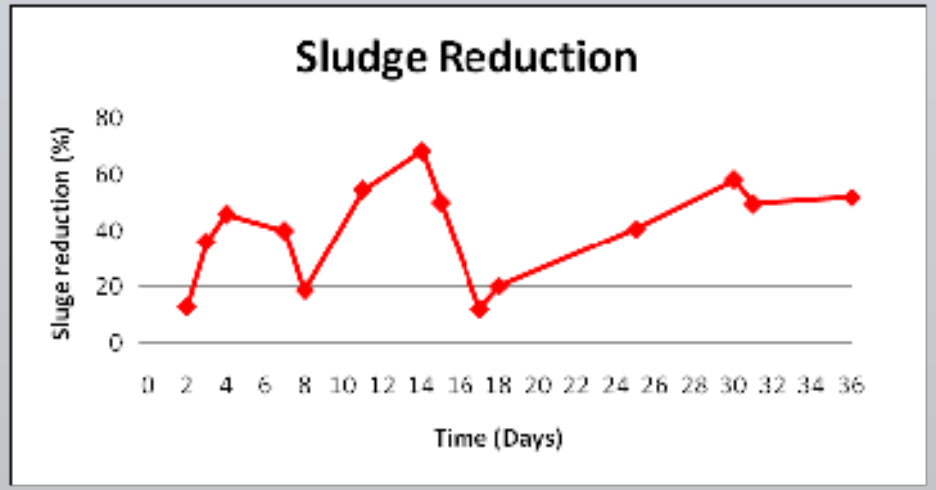
- Aerobic reactor volume: 5 L
- THR: 12 h
- Settler volume: 3,5 L
- THR: 14 h
- OSA tank volume: 1,5 L
- THR: 3,2 h
- MLSS Aerobic reactor: 3 g L^{-1}
- MLSS OSA tank: 1,5 g L^{-1}
- Room temperature: 25 ºC
- Synthetic wastewater (glucose as carbon source) _____ 0,15 g L^{-1}
- Initial COD (Influent) _____ 330 mg L^{-1}
- OD Aerobic reactors _____ 5 mgL^{-1}
- OD OSA tank: _____ < 2mgL^{-1}
- Chemical Organic Demand (COD) and Total Suspended Solids (TSS) were analyzed.
- Microscopic examination of the mixed liquors from the aerobic reactors and the anoxic tank was performed twice per week using an NIKON E200
- It was study the macro-and microscopic characteristics of activated sludge: Sludge Index (SI)

RESULTS AND DISCUSSION







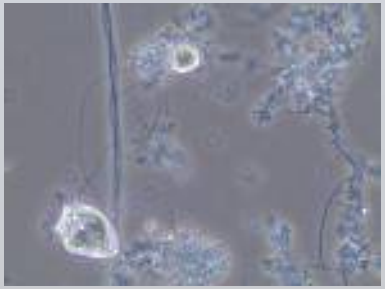
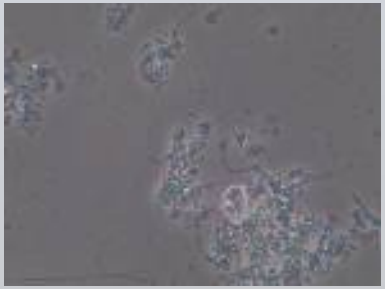
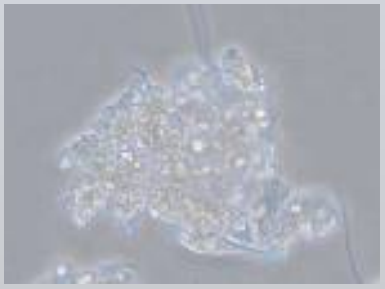
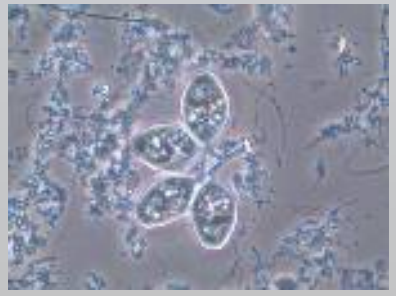


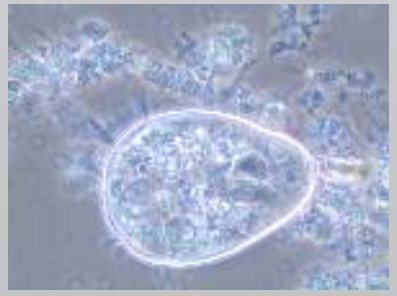
Sludge reduction 58 %

RESULTS AND DISCUSSION

Species composition of the initial sample of sludge

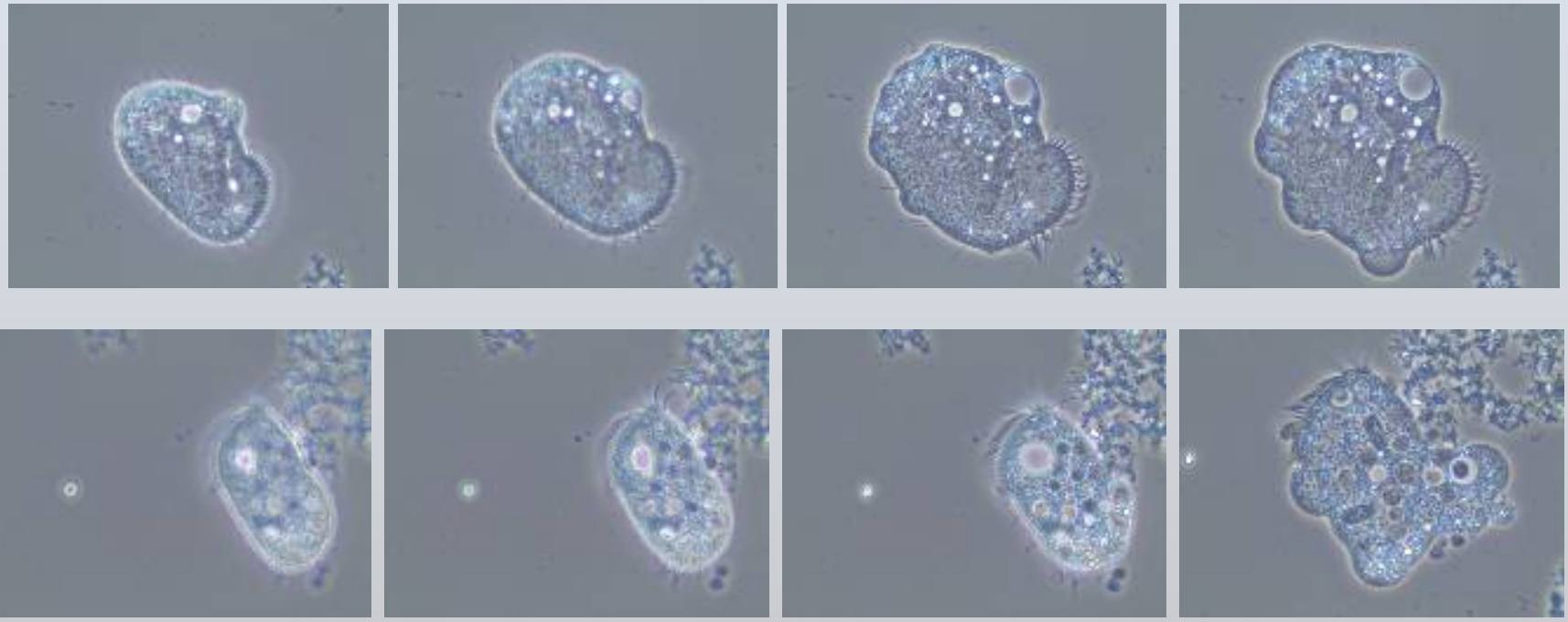
Functional group	Species
Bacteriophages sessile	*Vorticlla spp., Opercularia sp.* *Campanella umbelaria,* *Epistylis sp.*
Bacteriophages crawlers	*Acineria uncinata,* *Aspidisca cicada*
Carnivores sucker	Tokophrya sp. (T)

RESULTS AND DISCUSSION

Anoxic tank

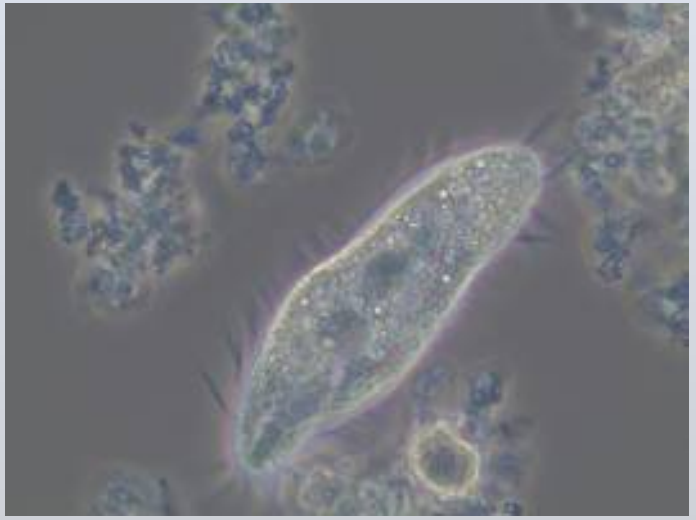


RESULTS AND DISCUSSION

Species composition of different functional groups of microfauna after 20 days of study

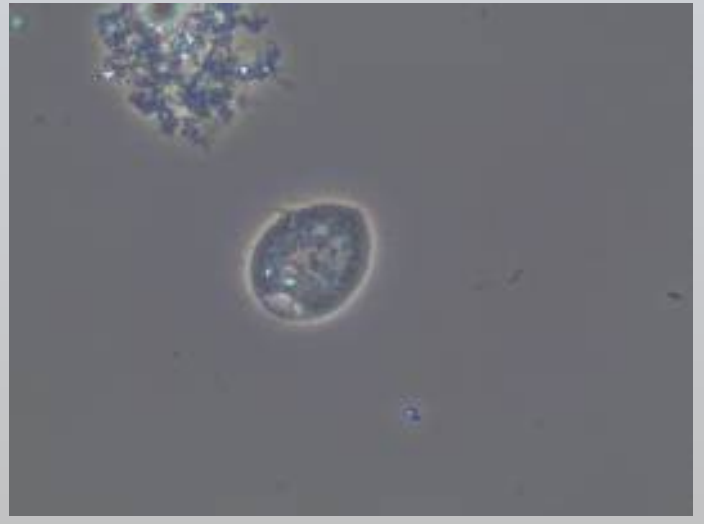
- CAS control

Functional group	Species
Bacteriophages sessile	*Vorticlla spp., Epistylis sp.*
Bacteriophages crawlers	*Oxytricha sp, Acineria uncinata*
Bacteriophages swimmers	*Cinetochilum sp,Paramecium sp.*
Metazoan	Rotiferos*



- OSA system

Functional group	Species
Bacteriophages sessile	*Vorticlla spp, Epistylis sp.*
Bacteriophages crawlers	*Oxytricha sp**
Bacteriophages swimmers	*Cinetochilum sp*
Carnivores sucker	Tokophrya sp. *



RESULTS AND DISCUSSION

Relative abundance of different species of filamentous bacteria after 20 days of study. CAS system

Dominant and secondary filaments	Relative abundance
Type 1851	Dominant (3-5)
Type 0961	Dominant / Secondary (2-3)
Type 0041	Dominant / Secondary (2-3)
Haliscomenobacter hydrossis	Dominant / Secondary (2-3)

Relative abundance of different species of filamentous bacteria after 20 days of study. OSA system

Dominant and secondary filaments	Relative abundance
Sphaerotilus natans	Dominant (3-5)
Nostocodia limicola	Dominant (3-5)
Type 0675	Dominant / Secondary (2-3)
Haliscomenobacter hydrossis	Dominant / Secondary (2-3)

RESULTS AND DISCUSSION

SI for the two pilot plants during the study period

Systems	Time	SI
CAS	First week	42 (regular)
	After 12 days	47 (regular)
	After 20 days	64 (good)
OSA	First week	42 (regular)
	After 12 days	44 (regular)
	After 20 days	58 (regular)

Sludge Index (SI)
0-20 (Abysmal)
20-40 (Bad)
40-60 (Regular)
60-80 (Well)
80-100 (Optimal)

CONCLUSIONS

- The OSA system showed good performance for the removal of COD and cell debris, while reduce around 60% of excess sludge production, during the start-up period.

- The microscopic analysis revealed that bacterial communities in the processes were different.

- CAS control process contained more protozoa and metazoans than the OSA system in both number and variety.

- The microfauna in the OSA system needed approximately 15 days to adapt to the altered environment, after which it could be observed an increased of small ciliates and free-swimmings.

- These findings indicate that the impact of the OSA system adjust the microbial community structure, while maintaining the metabolic activity.

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Thank you very much for your attention

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