This project is funded by the European Union

SABANA
Sustainable Algae Biorefinery for Agriculture aNd Aquaculture

Risk assessment

Possible risks of the cultivation of microalgae in wastewaters and slurry were investigate

- **Microbiological risk (pathogens in algae biomass)**
- **Accumulation of metals**
- **Accumulation of organic micropollutant**

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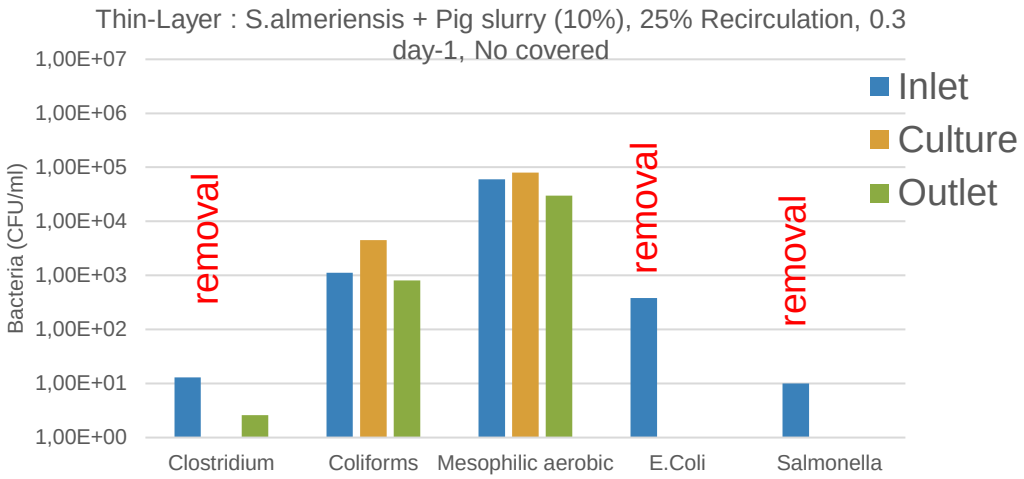
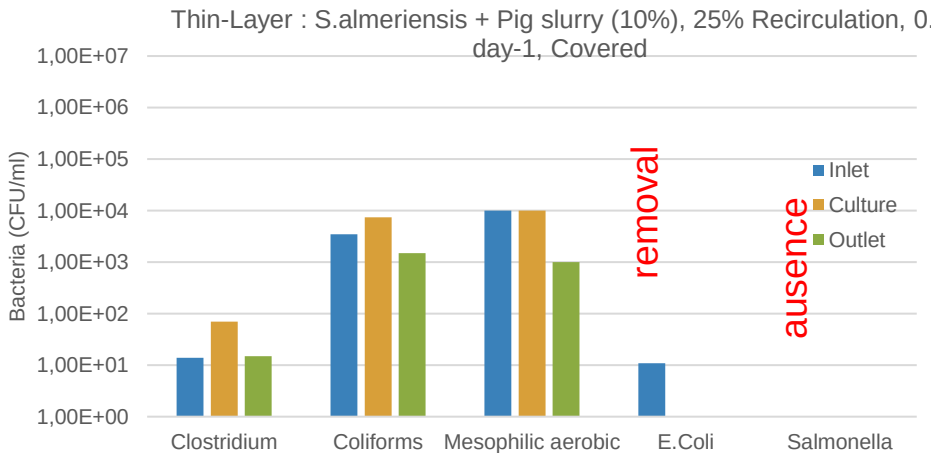
Microbiological risk

Freshwater strain Scenedesmus almeriensis grown in 10% pig slurry



No E coli and salmonella absent in the biomass,

Depuration of wastewater
No accumulation in biomass



For clostridium same order of magnitude

Sample	Clostridium (CFU/mL)	Coliforms (CFU/mL)	Mesophilic aerobic microbiota	E.Coli (CFU/mL)	Salmonella
Inlet	1,40E+01	3,50E+03	1,00E+04	1,10E+01	Ausencia
Culture	7,00E+01	7,40E+03	1,00E+04	0/100µL	Ausencia
Outlet (	1,50E+01	1,50E+03	1,00E+03	1,00E+00	Ausencia

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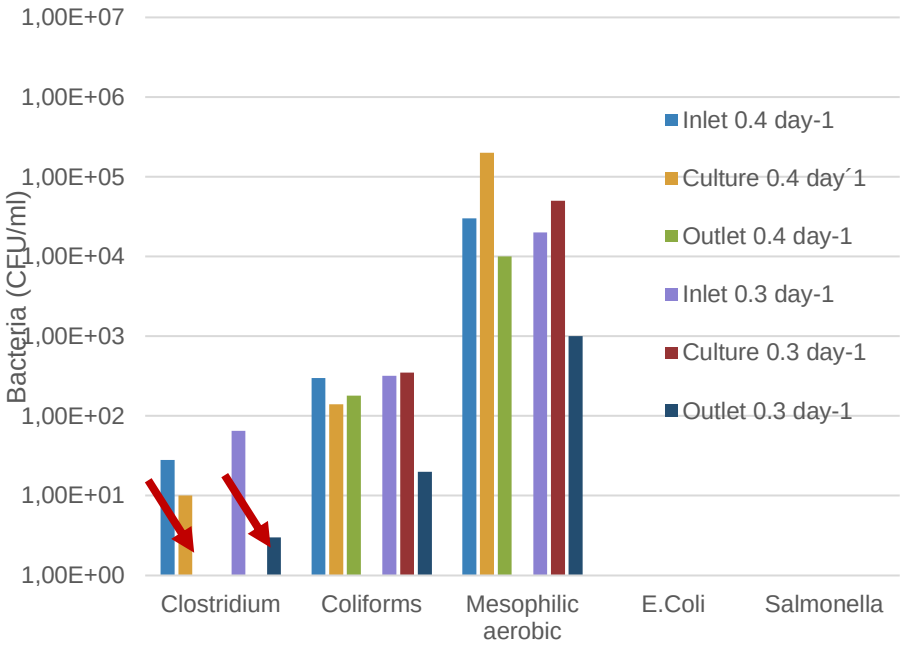
Microbiological risk

Seawater strain Nannochloropsis gaditana grown in 10% pig slurry



Salmonella was recorded in untreated pig slurry

Absence of Salmonella and E Coli in inlet (growing médium) and biomass

Decrease of clostridium colonies (1 order of magnitude)

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Microbiological risk

All **aquafeed** tested (apart control) included 10% Microalgae (N.gaditana) grown in slurry

DIETS	Total viable aerobic count	Enterobacteriaceae	E. coli	Sulfite-reducing Clostridia spores	Salmonella spp.
	log CFU/g (SD)			log CFG/g	in 25 g
Control	3.70	<2.00	<2.00	2.00	Absent
NSM	4.24	<2.00	<2.00	<2.00	Absent
NPM	5.34	<2.00	<2.00	4.57*	Absent
NSM-H	3.95	<2.00	<2.00	<2.00	Absent
NPM-H	4.40	<2.00	<2.00	3.25*	Absent
SSM	4.15	<2.00	<2.00	<2.00	Absent
SPM	5.41	<2.00	<2.00	3.00*	Absent
SSM-H	4.45	<2.00	<2.00	<2.00	Absent
SPM-H	3.78	<2.00	<2.00	<2.00	Absent

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Metals

Element	BG11	6%	*C. vulgaris* control	*C. vulgaris* pig slurry 6%
	mg L^{-1}	mg L^{-1}	mg kg^{-1}	mg kg^{-1}
P	7	11	1770 ± 186	3771 ± 51
K	18	116	3592 ± 242	6166 ± 415
Na	9	15	1828 ± 102	2288 ± 125
Mg	7	2	1319 ± 59	907 ± 13
Ca	10	9	1836 ± 33	2539 ± 44
Fe	1.02	0.45	226 ± 5.59	208 ± 11.88
Zn	0.05	0.17	12.27 ± 0.61	75.95 ± 0.84
Cu	0.03	0.05	0.27 ± 0.25	5.69 ± 0.38
Pb	Bdl	0.0015	0.86 ± 1.05	0.39 ± 0.51
Cd	Bdl	0.0005	0.07	0.41

- Higher uptake of PK and Na
- Increased Cd uptake, but final concentration below directive 2002/32/CE for feed (as a reference)

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Organic micropollutants

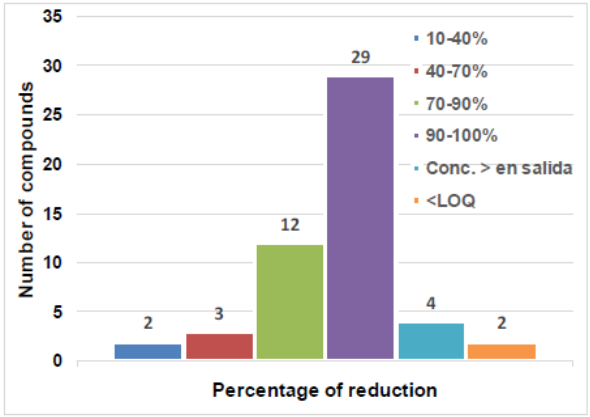

Figure 2.- Removal of micropollutants from wastewater by microalgae.

- 29 compounds are 90% degraded during microalgae growth

Table 7 .- Presence of micropollutants on dry biomass of microalgae produced on wastewater

	Concentración (ug/kg)		Concentración (ug/kg)
FÁRMACOS	BIOMASA	PLAGUICIDAS	BIOMASA
4-AAA	1,57	Acetamiprid	1,88
Cafeine	3,14	Azoxystrobin	1,83
Carbamazepine	2,75	Buprofezin	0,99
Citalopram	24,37	Carbendazim	0,57
Cotinine	1,35	Chlorfenvinphos	5,50
Diazepam	1,28	Cyprodinil	5,68
Mepivacaine	1,52	Dimethomorph	2,29
Metoclopramine	1,09	Diuron	9,54
Paraxanthine	1,66	Imidacloprid	3,81
Pentoxifylline	0,06	Isoproturon	1,83
Primidone	1,32	Metalaxyl	0,51
Venlafaxine	10,30	Myclobutanil	1,63
O-Venlafaxine	20,16	Pirimicarb	0,40
Lidocaine	5,22	Propamocarb	13,64
		Simazine	1,53
		Tebuconazole	4,13
		Thiabendazole	3,68