ECOPRO Tech Sheet

EcoPro is a microbiological inoculant for use in aquaculture, containing selected beneficial strains of bacteria and yeast listed by AFFCO for use in animal feed in the USA. EcoPro also contains a 100% organic balanced nutrient formula that allows EcoPro's bacteria to multiply and produce the metabolites that make the product efficient. As a third component, EcoPro has an organic chlorine neutralizer. The total count of beneficial microbes is $1x10^{12}$ cels/kg. EcoPro works well in fresh, brackish or salt water at temperatures between 65 to 113°F (18 to 45°C).

ECOPRO has been listed by the Organic Materials Review Institute (OMRI) since 2012 for use in certified organic food production.

ECOPRO works through diverse mechanisms:

- Breaks down particulate organic matter by releasing exoenzymes
- Breaks down mucopolysaccharides, produced by Gram negative bacteria, that form a physical barrier to oxygen and lead to anaerobic sediments
- Absorbs dissolved organic matter more efficiently than Gram negative bacteria
- Absorbs ammonia and nitrites
- Reduces populations of deleterious bacteria by competition for nutrients and by production of active metabolites
- Enhances production of digestive enzymes (amylase, lipase, trypsin) in the digestive system of the cultured animals, leading to improve feed and protein conversion efficiencies that reduce feeding costs and increase growth and overhaul production
- Reduces or eliminates water exchange requirements saving energy and reducing risk of bringing unwanted microbes into the system

Application procedure

In order to obtain the benefits from probiotic strains we require both: the appropriate strains of bacteria, and the number of cells to carry out the activity. In order to get the numbers of cells to efficiently carry out the cleaning process at low cost we need to multiply the cells of ECOPRO.

Procedure to incubate ECOPRO

Wash a plastic tub and lid with dish soap, rinse well, fill recipient with water, add commercial liquid bleach (table presented below for determination of volume of sodium hypochlorite at different commercial concentrations needed per liter of water) or calcium hypochlorite in powder to get a final chlorine concentration of 10 ppm and leave for one hour. If you have an air pump, place the air-stone hooked to the pump in the water and turn it on during the disinfection process. Filter the air (0.2 microns) if you have the equipment.

Concentration of sodium hypochlorite	5.00%	6.00%	7.00%	8.00%
ml of sodium hypochlorite to get 1 liter of water @ 10 ppm Chlorine	0.42	0.35	0.3	0.26

After the disinfection process dissolve ECOPRO in the water at a rate of 10 grams per liter, leave the air pump on, place the lid and leave incubating for 18 to 24 hours at 25 to 35°C (77 to 95°F). At the end of the incubation period the number of bacteria should have multiplied between 500 and 3000 times, depending on the water quality, temperature and rate of aeration (amount of air and bubble size).

After the incubation process, pour the content of the tub directly into the water of the rearing tank or pond. If a paddle wheel aerator is used, we recommend to add the product in front of the created current to facilitate spread the product throughout the rearing system. Add the product after adding water to the system. The dose rate and frequency of application depend on the stocking density and water quality.

Dose rates of ECOPRO

The dose rates of ECOPRO depend on several factors

Planting density: Follow the tables below. A range of concentrations is given in these tables with the low rates for good environmental conditions and the high rates for adverse conditions.

Food quality: a bad quality feed usually has more fiber and because of poor nutritional balance, the target organisms consume more and excrete more due to poor assimilation efficiency. The highest the amount of fiber and feces the largest is the amount of probiotic required to degrade this organic matter. We recommend the use of high quality feeds to improve feed conversion efficiency, reduce the amount of feed used, and reduce the environmental impact.

Water quality: Waters with high organic matter content in particulate or dissolved form will require highest doses of probiotics for their depuration. Waters with pesticide residues or antibiotics will need larger doses of probiotics. Waters with higher levels of heavy metals or unbalanced minerals will require larger doses of probiotics. The production of foam in the presence of aeration indicates a large content of dissolved organic matter in the water. Under these conditions a larger dose of probiotics is recommended to reduce the amount of foam. We recommend to reduce the water exchange as these changes affect the ecological balance of the system, and stress the target organisms affecting the feed conversion efficiency. Additions of water without treatment is one of the main sources of pathogens into culture systems. If a water change has to be done we recommend to treat the water before adding it to the system, or apply probiotic just after water addition.

Sediment quality: The recommended low dose rates are for systems with clean bottoms, without accumulated organic matter. Larger doses of probiotics are needed in case of accumulated sediments rich in organic matter in order to degrade these organics and incorporate them into the trophic web of the culture system.

Temperature: ECOPRO works in waters with temperatures between 65 and 113°F (18 and 45°C).

Dose rates

The doses are presented in ml of product incubated at a rate of 10 gr. of ECOPRO per liter of water, according to the preparation instructions.

In order to determine the dry weight of ECOPRO needed, 1 ml of brewed product corresponds to 10 mg of dry ECOPRO before the incubation procedure.

Shrimp

Larval cycle

Stage of development	Dose of ECOPRO (ml/m^3/day)
Zoea 1	2
Zoea 2	3
Zoea 3	4

Grow-out ponds

Doses are in ml per cubic meter per week. Divide this number by the number of applications per week to determine volume per application.

	< 20 PL/m^2		20-50 PL/m^2		50-100 PL/m^2		100-200 PL/m^2	
Week	Low	High	Low	High	Low	High	Low	High
1 - 2	2	3	7	10	10	14	14	20
3 - 4	2.5	3.8	8	12	12	18	18	26
5 - 6	3	4.6	9	14	14	22	22	32
7 - 8	3.5	5.4	10	16	16	26	26	38
9 - 10	4.5	6.2	12	18	18	30	30	44
11 - 12	5.5	7	14	20	20	34	34	50
ml/m^3/cycle	42	60	120	180	180	288	288	420

Doses are presented in milliliters per cubic meter per week. Divide this number by the number of applications per week to determine the volume per application.

	200-300 PL/m^2		300-400 PL/m^2		400-500 PL/m^2		> 500 PL/m^2	
Week	Low	High	Low	High	Low	High	Low	High
1 - 2	20	28	30	40	40	60	60	86
3 - 4	26	36	38	53	53	78	78	112
5 - 6	32	44	46	65	65	96	96	136
7 - 8	38	52	54	77	77	114	114	162
9 - 10	44	60	66	92	92	132	132	190
11 - 12	50	68	78	105	105	150	150	220
ml/m^3/cycle	420	576	624	854	854	1260	1260	1812

In order to reduce pathogens concentrations, such as *Vibrio* in seawater or *Streptococcus iniae* in freshwater, it is necessary to increase the dose rate of ECOPRO (double or triple the dose according to the concentrations of the pathogen in the culture water). Apply ECOPRO daily until reducing pathogen concentrations, then go back to the doses used previously.

Treatments

Condition	ml/m^3/day
Chock	30 to 50
Disease	50 to 120

Fish

Earth ponds

Loading density at harvest 1.5 to 2 kg/m3

Week	ml/m^3/week
1 to 5	3
6 to 10	4
11 to 15	5
16 to 21	6

Tanks with liners

DOSE	ml/m^3/week
Hatchery	7 to 21

Prior to planting	2 to 20 ml/m3
Fish biomass/m3	ml/m^3/week
100 to 300 gr.	5 to 20
300 to 500 gr.	6 to 30
500 gr. to 1 kg	8 to 40
1 to 2 kg	10 to 50
2 to 3 kg	15 to 60
3 to 4 kg	20 to 70
4 to 6 kg	25 to 80
6 to 8 kg	30 to 90
8 to 10 kg	35 to 100
< 15 kg	40 to 120
< 20 kg	50 to 150

Culture with biofloc

Dose used for final densities of 4 to 8 kg of fish biomass/m^3 and fishes of 500 grams.

For other densities please extrapolate dose rates linearly, e.g. 20 ml/m3/day for 20 kg of fish biomass.

Month	ml/m^3/day
1	3 to 5
2	4 to 6
3	5 to 7
4	6 to 8
5	7 to 9
6 to 8	8 to 10

Treatments

Condition	ml/m^3/day
Chock	30 a 50
Disease	50 a 150

Algae production systems

The microbial recycling of nutrients in cultures of microalgae and macroalgae in fresh, brackish and salt water can be effectively enhanced by the addition of ECOPRO. Organic matter degradation, and transformation of different inorganic nitrogen forms stimulate algae and plant growth and development.

Add ECOPRO to the production system at concentrations of 10 to 100 ml/m^3/week as biomass increases. Always add ECOPRO after a water change. It is recommended to add ECOPRO at the moment of addition of mineral or organic nutrients. For optimal results keep the pH between 5 and 8.

Plant production systems

Integration of aquaculture with agriculture production systems has resulted in the most efficient nutrient management approach to grow crops. As natural sources of water, from wells to rivers, lakes and coastal systems are getting more polluted, closing production systems has proven effective controlling the main entry point of unwanted chemicals and microbial pathogens that result in unpredictable productivity and disease. Valuable organic and mineralized nutrients derived from aquaculture production systems treated with ECOPRO have proven to be the best fertilizers for hydroponic beds and substrate beds in close recirculating loops, or irrigated soils in raised beds or on the ground.

The quantity of nutrients discarted out of an aquaculture operation differs widely due to several factors including feed quality and physicochemical parameters. From our experience for a farm with a carrying capacity of 10 to 20 kg of fish or shrimp biomass per cubic meter we can fertilize 10 times the surface area of a land crop per surface area of the aquaculture system.

Recommendations

Do not skip the brewing process and add the probiotic directly to the production system. The rich nutrient formula might feed deleterious microbes that might be present in large concentrations in the production system.

Use all the product that has been incubated. Do not store left over product. Do not attempt to add nutrients and continue multiplying the cells as changes in the species composition (contamination) will lead to ineffective and sometimes deleterious brews that may cause mortality in your production system.

Store ECOPRO in airtight container in a dry place, avoiding exposure to the sun and extreme temperatures.