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Integrated system of phytodepuration for agro-industrial waste water –An eco friendly technology

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Abstract

The integrated system of phytodepuration (ISP) is a biotechnology based on the combination of phytodepuration in pluriculture and conventional depuration (sewage treatment) technology .It is different from other conventional phytodepurative system in this technology chemical products such as flocculants and disinfectants not required and due to no sludge production it is an ecofriendly technology which is safer to environment.

Keywords: ISP, ecofriendly, pluriculture, sewage, sludge

INTRODUCTION

ISP is a biotechnology based on the combination of conventional biological treatment of sewage and phytodepuration. In it the decomposition of organic substance s into inorganic compounds which we can say nutrients is achieved through biological process of aerobic micro-organism. The inorganic compound absorbed and transformed by rooted plants microalgae.

The operative characters tics of the process allow a simplification of the systems planning and management. The resulting costs are reduced in comparison with conventional technologies of depuration.

In ISP plan the treatment of waste water carried out in three stages-

1. Screening of all the sewage in flow to remove non biodegradable solids.
2. Biological treatment with conventional oxidation system
3. Reaction in phytodepuration tanks divided in to two sections, the first with rooted plants and the other with phytoplankton.

At the end of the process, the effluent discharged is completely depurated of all organic and inorganic compounds that cause pollution, and can be used in agriculture, industrial use.

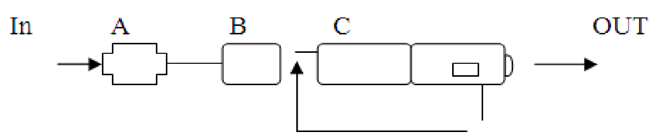
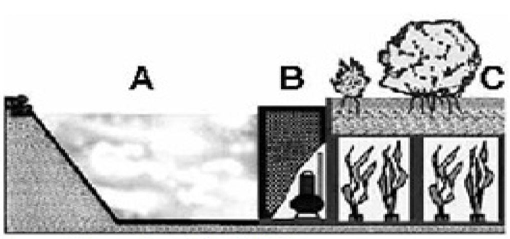


Fig 1. [general chart]



A – Pond with fish
B- Recirculation pump
C- Rooted plant section

Fig 2.[Phytodepurative system]

ISP main advantages

Recovery of pre-existent depuration structures. This system can reuse and integrate conventional treatment plants that are out of order or not working properly or efficiently.

- The building of ISP treatment plants is cheap and easy, and is suitable for local organization.
- Effluent has the qualities of an unpolluted river and can be used in agriculture, etc.
- Total absence of unpleasant smells or colours of the basin water and of troublesome insects.
- Possibility of embodying the system in public contracts on water treatment and land management.
- Contributes to reclamation of coasts, rivers or lakes which receive the treated effluent.
- Modest cost for the construction and maintenance of the system.
- No need of foreign technicians.
- Produced biomass can be re-used “as is”, or after preliminary transformation.
- ISP works well with water of polluted rivers and lakes; or with saline and brackish waters.
- ISP does not produce biological sludge.

Functional comparison

The table below shows a functional comparison between ISP and conventional treatment technologies.

	ISP	CONVENTIONAL TECHNOLOGY
	System Structure	
	Pre-treatments Primary biological stage Phytoabsorbing basin	Pre-treatments Primary biological stage Secondary biological stage Denitrification and dephosphatizing system
	Depurative efficiency	
	Unchanged	Changeable, according to the organic load and flow
	Effluent quality guarantee	
	Effluent discharged by the ISP is not affected by variations in load or flow.	Effluent quality is not guaranteed if machinery installed does not function properly.
	Energy expenditure	
	Lower electrical energy consumption; up to 80% less in comparison with other technologies	High energy expense due to greater number of machines required in the different depurative stages
	Maintenance and management	
	Low management is required: two visits per week	Need of diligent, continuous, daily maintenance
	Management costs	
	No expenditure for chemical products such as flocculants and/or disinfectants	Use of chemical products of different kinds with consequent tarring system problems and high costs
	Sludge production	
	No biological sludge production Sludge	Production and draining problems

ISP applications: - In dairy sewage treatment, vinegar sewage treatment, paper and pulp industry, agrochemical industry etc.

Dairy Sewage Treatment

Stage A: consists of an Imhoff tank that collects the dairy sewage. Its volume is 5 m3 and it is equipped with a barrel pump. During the primary decantation, solid materials fall at the bottom of the tank. The liquid part is pumped to Stage B for biological treatment.

Stage B: Considering the space available, the biological pre-treatment chosen is a compact solution with the same yield and depurative efficiency as the conventional depuration systems, but without unsightly and noisy external structures. The biological technology used is the Submerged Oxygenated Percolating System (SOPS); it consists of an oxidation tank (parallelepiped-shaped 22 m. long, 4 m. wide, 2 m. deep, 80 m3 total volume), divided into two parallel channels by an intermediate wall. Special plastic strips are laid out at the bottom of the channels to support the adhesive biological film (Figure 5).

The oxidation tank is equipped with two submerged oxygenators that supply the needed oxygen for the digestion of the organic substance and circulate the water continuously. From Stage B, water passes to Stage C through an overflow pipe.

Stage C: the phytodepurative basin is pie shaped, in the form of an arc of a circle, with a total volume of 500 m3, area of 420 m2 and depth of 1.2 m (Figure 4).In the basin one can distinguish between: The following example shows typical ISP applications.

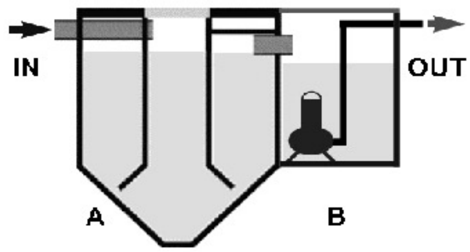
(i) Section 1 basin with evergreen rooted plants and (ii) Section 2 pond with fish and phytoplankton activity

Section 1 - basin with rooted plants(figure This consists of a tank of reinforced concrete divided into two parallel channels; on top is an iron covering that supports a stratum of gravel, 40 cm thick, where 400 rooted plants have been planted in hydroponics cultivation. Vegetable species used are *Pittosforum* sp., *Laurus comunis* and *Laurus nobilis*.

Section 2 - Pond with fish: This is a small aerobic lagoon where phytoplankton activity is fostered. Microalgae absorb nutrients (N and P) and produce oxygen through photosynthesis. It also reduces pathogenic bacteria with the result that the effluent has a low concentration of bacteria, without using chlorination of conventional systems. The purified effluent flows to the final well and is piped underground for sub irrigation.

Fish: Fish prevent both eutrophic phenomenon and the proliferation of troublesome insects (mosquitoes, flies, etc.). Several species of fish live in the pond: (i) herbivorous species, feeding on microalgae and organic sediments and (ii) predatory species, feeding on larvae and insects.

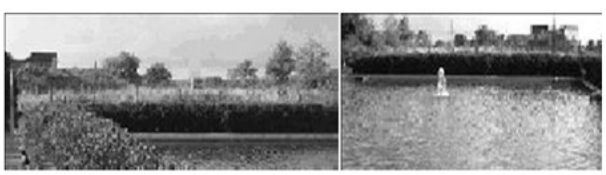
Internal water re-circulation: A pump system installed in the pond allows continuous water circulation at the head of the phyto-absorbing basin allowing oxygen distribution that is essential for successful growth of the rooted plants. Internal re-circulation feeds also the fountain situated in the middle of the pound. Apart from aesthetic the fountain mixes water homogeneously thus avoiding stagnation.



A- Imhoff tank
B- Feed pump to the biological stage
Fig 4.

Ponds with rooted plant and fish

Sub merged oxygenated percolating system



Ponds with rooted plant and fish
Fig 6-7

CONCLUSION

The ISP technology is ecofriendly and safer for our environment. Effluent discharged through ISP plants has no chemical products and it is easy to operate.

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