Research Article [Abo-Elnasr *et al.*, 6(2): Feb., 2015:4221-4229]
CODEN (USA): IJPLCP ISSN: 0976-7126

INTERNATIONAL JOURNAL OF PHARMACY & LIFE SCIENCES
(Int. J. of Pharm. Life Sci.)

Role of Microorganisms in our life's as ecofrindely and replacement for chemical methods

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Abstract

Microorganisms are widely spreader in our environments. Some of them are pathogens, while many of them are useful for our life. In this regards, recently, many bio-industries are totally relying on the beneficial use of microorganisms, e.g. antibiotic and enzymes productions, wastewater treatment, biofuel and bioelectricity generation, and etc. Nowadays, a lot of debate is going on the overuse of chemical herbicides, pesticides and fertilizers, as they become an environmental hazard. On the other hand, our Egyptian society needs more attention on the improvement of water quality as well as development the agricultural field; thus, we paid our full attention to utilize certain types of microorganisms to improve the fertilization of agricultural soil and to contribute in the wastewater treatment process. There for we must to research seriously to found the safe and economic alternative replacement for chemical fertilization and more effectively wastewater treatment fast. Safety and easily procedure in correct way avoid chemicals and expensive and traditional methods for treatment. There's no doubt about that. Healthy soils require organic matter (compost, humus, biochar, and other sources of carbon), microbes, and moisture to promote a healthy environment for plants. The result is strong plants, healthier flowers, greater resistance to diseases and pests, and higher quality fruits and vegetables. During this study, isolation and characterization of strains isolates will be performed. Consequently, the bio-activity of the selected (isolates) on waste water treatment (either to decrease pH. TSS. SS, TDS and also decrease BOD. Via the accumulation features of microbes or to detoxify degrades (the toxic organic substance) as well as the enhancement of crop production will be carefully investigated (How?). (By introducing bacteria as bio-fertilizers). We look forward to exploit the benefits of microorganisms for:

- Removal the organic wastes as well as decrease the limit of some important parameter in the wastewater, not only this functions and factors which we search and hope to reach to the complete and high application form wastewater treatment by microorganisms but also increase the clarity of wastewater treatment thorough decrease or reduction the sulfides and bad odor which concept as undesirable factor and results for many pollutants and infection related to other pathogenic microorganisms which make them treated and reusable for the irrigation and other applications .
- Introducing bio-fertilizers for green food production and increasing the fertility of agricultural soil and increase crops and vegetables products. (Generally increase plant yields) with safety way and protect our healthy away from hazards and chemical fertilization problems.

Key-Words: Micro-organism, Eco-friendly, Chemical methods

Introduction

Aim of the Work: The main objectives of the current study: Utilizing bacterial isolates as bio fertilizers to enhance the soil fertility increase the soil quality and reduce the chemical fertilizers. Thus, during this study, several parameters and important factors will take into consideration to acquire optimized environmental conditions to exploit this concept on the Egyptian crops production and avoid the risk of using hazardous chemical fertilizers.

Investigating the role Microorganisms isolates in removing and decrease un desirable substances present in wastewater as well as the bioremediation of organic wastes, through the implementation of microbiological technology in the wastewater treatment process and decrease pathogenic microorganisms.

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Some of laboratory experiments and also Some experiments were done and applied to use of microorganisms as biofertilizer in some area of agriculture on different crops were performed to explain and show the efficacy, applety and quality of some Microorganisms to secret some useful product for plant and soil and increase the fertility of soil and increase yield of crop and important for agriculture.

Organic agriculture is to improve the food safety to the human in general.

A wide diversity of soil yeasts have been researched for their potential as bio-fertilizers (Gomaa and Mohamed, 2007; Eman et al., 2008).

Saccharomyces were able to oxidize elemental sulfur *in vitro* to produce phosphate, tetrathionate, and sulfate (Al- Falih and Wainwright, 1995).

Due to its cytokinin content, yeast treatments were suggested to play a beneficial role in cell division and cell enlargement (Natio et al. 1981). Yeast as a natural stimulator is also characterized by its richness in protein 47%, carbohydrates 33%, nucleic acid 8%, lipids 4%, and different minerals 8% such as Na, Fe, Mg, K, P, S, Zn, Mn, Cu, Si, Cr, Ni, Va and Li in addition to thiamin, riboflavin, pyridoxine, hormones and other growth regulating substances, biotin, B12 and folic acid (Nagodawithana 1991). Earlier reports explained the effect of yeast application on vegetative and fruit growth due to its richness in tryptophan which consider precursor of IAA (indole acetic acid) and on flower ignition due to its effect on carbohydrate accumulation (Warring and Philips 1973).

State of the art

One of the great challenges in Egypt is the low green area and the weakness of soil the soil fertility. Moreover, the other big challenge is the low water resources and the complex process of wastewater treatment.

Therefore, several attempts and studies have to be focused on such these challenges. From the microbiological point of view, it's worth to explorer the function of microorganisms in the enhancement of the agricultural soil fertility as well as the treatment of wastewater. Thus, it's assumed that the microbiological technologies could provide complementary strategies to overcome such these problems.

Biofertilizers for green food production

In the first task, besides to increase the quality of the agricultural soil and to decrease and/or avoid the chemicals consumption (pesticides, chemical soil fertilizers), biofertilizers [1]. Are used to improve the plant production in sustainable agriculture [2].

Biofertilizers, (Eco-solution), are defined as preparations containing living cells or latent cells of efficient strains of microorganisms that help crop plants' uptake of nutrients by their interactions in the rhizosphere when applied through seed or soil. They accelerate certain microbial processes in the soil which augment the extent of availability of nutrients in a form easily assimilated by plants [3].

Thus, our own Egyptian conditions have to be optimized according to our environmental circumstances and availability of resources.

The basic concept of this work is to use certain types of microorganisms in bio-fertilizers to restore the soil's natural nutrient cycle and build soil organic matter [5]. Through the use of bio-fertilizers, healthy plants can be grown, while enhancing the sustainability and the health of the soil. Since they play several roles, a preferred scientific term for such beneficial bacteria is "plant-growth promoting rhizobacteria" (PGPR). Therefore, they are extremely advantageous in enriching soil fertility and fulfilling plant nutrient requirements by supplying the organic nutrients through microorganism and their byproducts. Hence, bio-fertilizers do not contain any chemicals which are harmful to the living soil.

Microbiological Wastewater Treatment

This review examines the current understanding of detoxication mechanisms of lactobacilli and how, in the future, humans and animals might benefit from these organisms in remediation environmental contamination of food (Gregor Reid 2012).

Sewage treatment is one of the major problems faced by municipalities. Sewage is the wastewater comprising 99.9% water and 0.1% solid particles. The domestic sewage has high amount of organic and inorganic pollutants [1]. The untreated sewage causes foul smell (bad odor) [2]. The improper disposal of sewage causes pollution and destroys the aquatic organisms due to high organic content and biological oxygen demand (BOD) concentration [3]. So, the sewage has to be treated to reduce the environmental impact. The chemically treated water causes harmful effects due to toxic chemicals than the organisms which are originally present in the sewage [4]. The organisms present in wastewater degrade organic matter [5] and helps for further treatment. In conventional treatment method, bacteria remove the organic content of wastewater but the solid particle remains as sludge. The sludge can be used as fertilizer or incinerated, disposed into ocean or landfill. The conventional sewage treatment processes are expensive to operate and maintain [6] and causes pollution.

Solution contain Microorganism is the consortia of beneficial and naturally occurring microorganisms

which are not chemically synthesized or genetically modified.

The Solution contain Microorganism secretes organic acids and enzymes which acts on sewage and degrades complex organic matter into simpler ones [12].

The lactic acid bacteria enhance the breakdown of organic matter such as lignin and cellulose. Yeast produces antimicrobial substances and their metabolites are used as substrate for lactic acid bacteria.

What role do microorganisms play in wastewater treatment?

Wastewater treatment plants are designed to function as "microbiology farms", where bacteria and other microorganisms are fed oxygen and organic waste.

To provide a fundamental background on the relationship between *microbial activity*, and waste water *treatment*.

Material and Methods

Amount (g/L)

1 – Molasses 100 grams / liter water

2- Lactic acid bactria (yogurt 100 grams)

3 - Yeast: Saccharomyces cerevisiae 25 grams of yeast/litre of water.

4 - Sodium chloride (Nacl). 30 g of NaCl per litre water.

5- Solvent Matter (Water)

6 - Glass rod or sterol.

7- Lactobacillus delbruekii.

8- Lactobacillus fermentum.

Procedure:

l- Mix all content to make solution then incubate for 24 H. at room temperature after incubation period dilute the first solution with water (1: 9) concentration then incubate again for 24 h. at room temperature added this Collection to use with irrigation water for soil.

2- Assessment effect of this bio-fertilizer solution on seedling and plant growth.

The first application and 1st experiment which compare the difference between the use of bio-fertilizer and chemical fertilizer and the effect of it on plant .

When we need apply this solution to soil it can be reached to soil throw injected with irrigation water or spray on plant.

To compare the efficacy of use Microorganisms as biofertilizeres we added the above inject the above components with followed in four times in the same periods with chemical fertilization. And recorded the observations and results which we obtained carefully as follow:

Compare between the biofertilizers and chemical fertilizers with the same parameters and one type of each crop to reach the final results and the quality of use Biofertilizers.

2 – When we need to use microorganisms in wastewater treatment as biological treatment. We don't use sodium chloride and also Molasses but use medium without two components and make incubation for microorganisms for 24 hours and then become reedy to use in wastewater treatment purpose and recode the obtained results.

Plan of Work and Experimental Setup

- Survey of bacterial communities to find indicators of soil quality, via collection of microbial isolates from different types of soil and some clinical specimen.
- Isolation, purification and characterization the microbial isolates
- For the selection of target organisms, the enzymatic activity of characterized isolates will be tested.
- Comparing the enzymatic functions of different microbial isolates sources (e.g. soli or clinical isolates)
- Screening the antimicrobial activity of the selected isolates. For example test the biological activities of the target organisms on the plant diseases and wastewater.
- Under optimum conditions, the effects of the target microbial communities on different soil types will be investigated.
- Efficient microbes used.
- Compatibility of microorganisms with the breadwinner.
- Competitiveness of similar objects and found naturally in soil.
- Preparation of microorganisms in the organization around the roots of the host and its ability to survive the term biofertilizer intended ethnic dynamic plugins which extend the developing part of plant food needs and produces fertilizer from microorganisms to choose the desired microbe and then multiply at appropriate farms such as the transfer of microbial cultures to a carrier and saves enriched in appropriate circumstances for when used as a vaccine for seeds, soil or seedling.

The expected benefits and advantageous of use of biofertlizers

The use microorganism in the proposed system to act in a double function in the agricultural soil (to improve the fertility and to remove the residues of chemical hazardous will be explored. A proper management of the microbial communities in reactors will lead to sustainable processes.

Results and Discussion

The difference fertilization of the potato between bio-fertilizer and the azotes fertilization (chemical) is given in table 1.

Table 1: Effect of the Bio-fertilizer on Potato Production

S/No.	Comparison	Fertilization (Use Biofertilizer)	The fertilization without fertilizer Use the traditional fertilization
1.	Quantity of the pieties	1750Kg	1750Kg
2.	The planted area	1 ACRE	1 ACRE
3.	Age the output accumulated	85 DAY	105 DAY
4.	Size of the output	8880 KG/ ACRE	6000 KG/ ACRE

Table 2: Comparison the results between tow types of fertilization by the same parameters. Effect of the Bio-fertilizer on Production of Maize crop Shami

		Biofertilzer		Control	
No	**Agriculture area**	**Amount of yield crop**	**Amount of yield by Kg**	**Amount of yield crop**	**Amount of yield by Kg**
1.	1 Acre	27	5940	25.5	5655
2.	1.5 Acre	39 Ardab + 50 Kg	8270	34.5	7365
3.	0.5 Acre	14 Ardab + 100 Kg	3570	12	3090

Table 3: Length of shoot (cm)

	Biofertilzer	Control
Length of shoot (cm)	38(cm)	35(cm)

Table 4: Difference between weights of Maize Biofertilizer and chemical fertilizer as control

	Biofertilzer	Control
Weight	0.5 (kg)	0.35 (kg)

Table 5: Effect of (Use Biofertilizer) on germination of wheat seeds and shoots elongation

S.G.M. Amount	Time (days) required for imitation of germination	Length of shoot (cm) per day after germination				
		Days				
		3	4	5	6	7
R1	1	2.2	3	4	5.3	6.2
R 2	2	1.5	2.3	3.4	4.1	4.6
R3	2	1.6	2.4	3.1	4	4.7
R4	2	1.4	2.1	3	3.6	4.2
Control	2	1.3	1.6	2.3	3	4

Table 6: Effect of (Use Biofertilizer) on Fresh weight and Length of wheat shoots after 20 days cultivation under ambient conditions

Tested solution contain microorganisms	Average of Fresh weight of shoots (g)	Average of length (cm) of shoots
Control	0.189	22
R1	0.268	26
R2	0215	24
R3	0.242	24
R4	0.186	22

Table 7: Effect of the Bio-fertilizer on Wheat Production

		Bio-Fertilizer		Control	
No.	**Agriculture area**	**Amount of yield crop**	**Amount of yield by Kg**	**Amount of yield crop**	**Amount of yield by Kg**
1	1 Acre	26	3900 kg	22.5Ardab	3375 Kg
2	1 /2	13 Ardab + 100 Kg	2050 Kg	12 Ardab	1800 Kg
3	2 Acre	46	6900 Kg	42 Ardab	6300 Kg
4	6 Acre	150 Ardab + 50Kg	22550 Kg	141 Ardab	21150 Kg

Received on the basis of the weight of the crop Alardb 150 kg.

2 – Wastewater treatment results:

The application of biological treatment for wastewater .

2. 1. TSS decreasing by using microbial Treatment

Test No.	**Raw water without treatment TSS** mg/l	**Microbial treatment TSS** mg/l	**Efficiency (%)**
1	460 mg/l	210 mg/l	54.3
2	330 mg/l	206 mg/l	37.5
3	670 mg/l	433.3 mg/l	35.3

2.2. TDS decreasing by using microbial Treatment

Test No.	**Raw water without treatment TSS** mg/l	**Microbial treatment TSS** mg/l	**Efficiency (%)**
1	825 mg/l	627 mg/l	24
2	668 mg/l	549 mg/l	17.8
3	640 mg/l	604 mg/l	5.6

2.3. pH changes by using microbial Treatment

Test No.	**Raw water without treatment TSS** mg/l	**Microbial treatment TSS** mg/l	**Efficiency (%)**
1	8.7 **(pH)**	7.69 **(pH)**	11.6
2	8.4 **(pH)**	7.8 **(pH)**	7.14
3	7.64 **(pH)**	7.16 **(pH)**	6.28

2.4. BOD decreasing by using microbial Treatment

Test No.	**Raw water without treatment TSS** mg/l	**Microbial treatment TSS** mg/l	**Efficiency (%)**
1	664.5 mg/l	285 mg/l	57.1 %
2	490.5 mg/l	234 mg/l	52.3
3	390 mg/l	206 mg/l	47.1

2.5. ***Effects of microbial treatment on: Wastewater bad-smell (odder)*** was decreased.

2.6. Wastewater Purity and clearness were increased.

The role of rhizospere microorganisms in the promotion of plant growth has received considerable attention (Glick, 1995, Bashan etal., 2004). These microorganisms can affect plant growth directly or indirectly. Indirect effects are those related to the production of metabolites, such as siderophores (Buysens etal. 2004), which increase plant growth by decreasing the activities of pathogens of deleterious microorganisms. Direct effects reported include production of plant growth regulators such as auxins, gibberellins and cytokinis that directly promote plant growth (Bottini etal., 2004; Kuklinsky – Sobral etal., 2004) and by enhancement of plant nutrient uptake (Glick, 1445).

The application of used bio-fertilizer in agriculture purpose.

Experiments show the increasing of yield for all types of finally product for test crops which were done under the same conditions and parameters also operated with carefully.

Obtained results in table 1 – show the efficacy of use biofetilizer in the amount of yield and also decease the time of agriculture date of potato which was important in the product rich to market early this useful in price for farmer to increase income for him.

Also get more time for soil aeration and agitation it need for healthy soil.

Decrees the possiplity of infection of crop by harmful microorganisms and some disease.

Result in tables (2, 2 and 4) – explain the efficacy of using biofetilizer in good results which need for farmer and look forward up to good quality and maximum of yield .

Obtained results in tables (5, 6 and 7) showed that four tested solution contain microorganisms demonstrated various behaviors toward wheat plant growth. Biofertilizer strain number had stimulatory effects, Results in Tables (5, 6) obviously revealed that solution contain microorganisms number R1 was the best tested one for the wheat plant growth promotion compared to other tested ones. Its role as plant growth promoter can be directly or indirectly. Indirectly, it may be produce metabolites that enhance plant growth by decreasing activities of pathogen microorganism as indicated by Buysens etal. (1996) or directly by producing plant growth regulators such as auxins, gibberellins, cytokinins and polyamines as indicated by Bottini etal. (2004) and Kuklinsky-Sobral etal. (2004) or by enhancing plant nutrient uptake as reported by Glick (1996). Further work should be planned to throw more light on this mechanism.

Total suspended solids: In table (1) TSS decreasing by using microbial Treatment solution when added to wastewater

Total dissolved solids: The Solution contains Microorganism reduced the TDS of sewage.

The variety of results depending on contact time with water. As show in table 2.

pH: pH changes by using microbial Treatment and decreased

Wastewater bad-smell (odder) reduced.

Untreated sewage causes foul smell (bad odor) were reduced.

Waste water Purity and clearness increased

The effects of lactic acid bacteria (LAB) on hydrogen fermentation of organic waste were investigated. These results suggest that the inhibitory effect of lactic acid bacteria on hydrogen production was caused by bacteriocins excreted from LAB which have a deleterious effect on other bacteria. To suppress any effect by LAB, heat treatment of this waste was investigated as a possible pretreatment step.

The selected Microbial consortium was formulated and its efficiency for sewage treatment was studied. The results showed that the biological treatment of sewage reduced pH, TDS and TSS respectively. The malodor and turbidity of sewage was reduced. The treatment process is highly viable and economical. The Microorganisms' treated water is non-toxic and safe to dispose as it contains beneficial microorganisms. So it uses to reduce the environmental impact of conventional methods.

Conclusion

Tested solution contains microorganisms showed different behaviors toward wheat seed germination as well as wheat plant growth. Stimulatory effect on seed germination and plant growth was ascertained by some solution contain microorganisms. The Composition of biofertilizer divided in to two parts

Part 1 types and species of Microorganisms which present in solution form.

Part 2 the food for microorganisms and use as beneficial additive for soil and plants also increase fertility of soil such as 1 - Venass which contain useful substances for soil and plant growth production. And also this solution contain Milk

And some studies have shown that in addition to Venass sandy soil increases the productivity of wheat. Venass also found that increases the proportion of nitrogen, phosphorus, potassium and organic matter in the soil.

Also found that when you add Venass of the soil reduces the amount of fertilizer needed for crop production as the land extends venass nearly 62% of

phosphorus 100% of the potassium necessary for the production of strategic wheat crop.
Have been many studies on the Venass all of which showed that it contains a lot of useful elements that can be used to increase crop productivity, and examples of this in Venezuela reached (Gomez, 1996), where he conducted experiments for three years showed that with the addition venass increases the productivity of crop sugar cane, without affecting the quality of cane sugar.
Also found out that also extends Venass sugar cane and 55% of the nitrogen and 72% of phosphorus 100% of potassium.
The primary organic and inorganic chemical components of vinass are proteins, organic acids, amino acids, unfermented carbohydrates, vitamins, and minerals (Hidalgo, 2009). In particular, high concentrations of potassium, calcium, magnesium, sulfur, and nitrogen are typically found as components of vinass, which makes it particularly attractive as a soil amendment/fertilizer. Glycerol, lactic acid, ethanol, and acetic acid (all byproducts of the fermentation process) are the major organic compounds found in cane and beet vinass. The principal anions present are sulfate and chloride, with molasses stillage (i.e., distillation residue) having a higher salt loading than other stillages (Willington, 1982).
2- Wastewater treatment using the microbial technology exhibited big advantages in TSS and TDS decreasing and controlling the water pH.
Microbial treatment showed a good feature on bad odder of the wastewater and increasing the water clarification.
Removal of microbial pathogens from wastewater by using the microbial technology.
Microorganisms play a major role in decomposing waste organic matter, removing
Bad odor, coagulating nonsettlable colloidal solids, and stabilizing organic matter .These microorganisms convert colloidal and dissolved carbonaceous organic matter into various gases and cell tissue. The cell tissue, having a specific gravity greater than water, can then be removed from treated water through gravity settling. (Liu and Liptak, 1999).
In the treatment of wastewater three types of overall processes are distinguished to represent the conversion of organic wastes by microorganisms. The classification is based on whether the environment where the process takes place is aerobic, anaerobic or photosynthetic. Under aerobic conditions, micro-organisms utilize oxygen to oxidize organic substances to obtain energy for maintenance and the synthesis of cellular material. Under anaerobic conditions, the microorganisms utilize nitrates, sulphates and other hydrogen acceptors to obtain energy for the synthesis of cellular material from organic substances (Spellman, 2000) .
Photosynthetic organisms use carbon dioxide as a carbon source, inorganic nutrients as sources of phosphate and nitrogen and utilize light energy to drive the conversion process Microorganisms also produce waste products, some of which are desirable and some undesirable. Gases such as CO_2 and N_2 are desirable, since they can be easily separated and do not produce pollution. Gases such as H_2S, although easily separated require treatment for odor (Liu and Liptak, 1999).
Microorganisms are significant in water and wastewater because of their roles in disease transmission and in biological treatment processes. Water, wastewater, and other water practitioners must have considerable knowledge of the microbiological characteristics of water and wastewater (Spellman, 2003).
This report described the role of microorganisms on wastewater, reactions involved in their activities, environmental parameters affecting their growth and activities, biological cycles and microbial groups associated with various biological wastewater treatment processes.

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How to cite this article
Khatab O.H., Nasib M.A.A., Ghoneimy E.A., Abo-Elnasr A.A., Hassan H.A-A, Hassan M.Y.A. and Attitalla I.H. (2015). Role of Microorganisms in our life's as ecofrindely and replacement for chemical methods. *Int. J. Pharm. Life Sci.*, 6(2):4221-4229.
Source of Support: Nil; Conflict of Interest: None declared
Received: 01.01.15; Revised: 15.01.15; Accepted: 26.01.15