INTRODUCTION

I. INTRODUCTION

Expansion of urban population and increased coverage of domestic water supply and sewerage give rise to greater quantities of municipal wastewater with the current emphasis on environmental health and water pollution issues. There is an increasing awareness of the need to dispose this wastewater safely and beneficially. Use of wastewater in agriculture could be an important consideration when its disposal is being planned in arid and semi arid regions. However, it should be realized that the quantity of wastewater available in most countries would account for only a small fraction of the total irrigation water requirements. Nevertheless, wastewater use will result in the conservation of higher quality water and its use for purposes other than irrigation.

Under many arid and semi-arid conditions, water is becoming increasingly a scarce resource. Planners are forced to consider any source of water, which might be used economically, safely and effectively. Whenever good quality water is scarce, water of "marginal"quality will have to be considered for use in agriculture. Although there is no universal definition of "marginal "water, for practical purposes, it can be defined as water that posses characteristics which have the potential to cause problems when it is used for an intended purpose. For example, municipal wastewater is of marginal quality because of the associated hazards due to its content of heavy metals. From the view point of irrigation, use of

"marginal" quality water requires more complex management monitoring procedures than when good quality water is used **(Pescod, 1992).**

Disposal of wastewater is a problem for many urban areas. Since, disposal of effluent was considered to be a growing problem, primarly because of environmental concerns degradation of surface water. So urban area wastewater disposal had commonly handled by treating it to certain level that ensure its disposing of in the most convenient and cheapest manner. Thus, disposal was primary consideration, since the amount of wastewater continued to increase as unavoidable consequence of population growth.

In Egypt, the agriculture sector uses 81.1 % of the total available water sources, which are estimated at 73.8 billion cubic meters (BCM) per annum. In fact the efficient use and preservation of water resources determine the future of agricultural development in Egypt, as water is the most limitation factor of agricultural extension, beside land and human resources. These resources are the River Nile, underground water, reuse of agriculture drainage water, treated wastewater and effective rainfall which are estimated annually to 55.5; 11.3; 5.0; 1.5 and 0.5 BCM respectively*. Thus, water scarcity in Egypt is a critical challenge, as Egypt will face a water deficit of 2.5 BCM by 2017 year.

This scarcity of high quality water resources drives Egypt to use low quality water such as treated municipal wastewater.

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* ***After, Ministry of Agric., Egypt, Cairo, 2003 (unpublished)***

This type of water has two negative side effects, which are interrelated .The first negative impact highly jeopardizes soil-plant system. This is due to the fact that both soil physical and chemical properties deteriorate due to the high load of exchangeable ions in wastewater. Meanwhile, the high concentrations of heavy metals absorbed by plant causes phytotoxic effects. The second negative impact is a health hazard municipal wastewater has on humans such as cumulative poisons and carcinogens

Consequently, the shortage in available fresh water supply in order to meet the contenious increase in population of various countries like Egypt from one hand and parallelled to the increased wastewater volume from the other, concerns were raised to face such problem. Consequently, this led to consideration of reuse of such wastewater, especially sewage effluent as an alternative water resource for irrigation purposes. While, the idea of converting wastewater to reclaimed water can be reutilized for irrigation was not a new one, **Parsons *et al.*, (2001-a).**

Conversion of wastewater to reclaimed water for crop irrigation conserves water and is an effective way to handle a growing urban problem" the disposal of wastewater". Using reclaimed water for citrus irrigation had a great imapct on tree growth, crop efficiency, tree physiology and fruit quality parameters. **(Parsons *et al.*, 2001-b).**

Under high concentrations of heavy metals in soils, heavy metal uptake is a process not regulated by the plant but in most cases probably passive following the electro-chemical gradient

chain. The amount taken up will then be a function of plant properties like as size of the root system or chemical changes in the rhizosphere, that were developed for other purposes, for example efficient uptake of N or P. contamination of shoots and harvest goods not only depends on total uptake, but also on the distribution within the plant. Heavy metals are strongly withheld in the root. Within the shoot the translocation varied among species and elements. The translocation factor (ratio of concentration in grain to shoot) for Cd was an average 0.27, but varied from 0.05 (maize) to 0.58 (sunflower). For Zn the translocation factor was around 0.4 and for Cu about 1 **(Claassen and Padeken, 1999).**

Absorption of heavy metals by plants depends on the extent of accumulation apparently without certain maximum limit which is related to plant type and species. Accordingly, toxicity levels are not successfully determined. In Egypt , the use of primary treated sewage effluent which generally rich in organic and other mineral substances has been practiced on the sandy farm of El-Gabal El-Asfar since 1931 year. Physical and chemical characteristics of sewage effluent vary with the dietary habit of the locality , population density, impurities of the industrial wastes, and the extent fertilizers and pesticides applied. The accumulation of heavy metals and its environmental impact on the growing plants in the area has been subjected to several investigations, their results indicated generally a remarkable variations in the uptake of heavy metals by different tree species.(citrus, pican ..etc) using leaf testing technique . The obtained results of heavy metal levels in plant samples ranged

between optimum to excessive however, no phytotoxicity symptoms were reported (**Mosalem, 1997**).

Effluent irrigation for economic development purpose can be considered only where term sustainability of the site is possible, and where appropriate monitoring measure are incorporated to quantify changes to the ecosystem .Effluent irrigation for disposal purpose is generally considered to be the least environmentally damaging solution to a municipal problem.. Sustainability in these cases might be viewed as sustainability of the environment at large as opposed to sustainability of the disposal site **(Hogg *et.al.*, 1997)** .

One of the most aspects of efficient horticultural production is irrigation both in quantitative and qualitative terms. Adequate water of acceptable quality can be a limiting factor, and in times of water shortage rationing has been shown to have significant and profound effect on plant growth in horticultural crops. One of the promising alternative is the use of treated sewage effluent, available in copious quantities in virtually all urban areas **(Fitzpatrick *et al.*, 1986).** Therefore, further studies aimed to throw some lights on the doubtfull about the possibility of reutilization of wastewater (sewage effluent) safely for irrigation purposes are needed in this respect.

Thus, the present study was devoted to investigate the possipility of agricultural using of municipal wastewater (safely) which is primarily consisting of domestic sewage and possibly contains a proportion of industrial effluents. Municipal wastewater is mainly comprised of water (99.9%) together with relatively small concentrations of suspended and dissolved

organic and inorganic solids. The inorganic substances include number of potentially toxic elements such as arsenic, chromium, copper, lead, mercury, zinc, etc. Even if toxic materials are not present in concentrations likely to affect humans, they might be at phytotoxic levels, which would limit their agricultural use. Consequently, the response of growth; productivity; nutritional status and heavy metals content of either fruitful trees or recently citrus transplants budded on some citrus rootstocks to irrigation with municipal wastewater (reclaimed sewage) in comparison to well and fresh water irrigation was conducted during both two experimental seasons extended from 2000 – 2003 years.

In addition, the main purpose of the present study was aimed to investigate the posipility of using the sewage watrer for irrigation of citrus trees not only dealing with its impact on growth and cropping measurments, but also to thow some lights on such agricultural practice from the human health point of view. In other words, it was also hoped to deside if using of sewage water for irrigation purpose could be considered as an environmental friendly practices or not through determining the heavy and toxic metals in the various plant organs, especially the edible ones by comparing to the permissible limits (below the concentrations that have toxic effect on human health).