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Waste Water Agricultural Cultivation and Heavy metals in Vegetables: In Context of Bikaner City, Rajasthan India

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ABSTRACT

The scarcity of irrigation water resources is resulting in the utilization of domestic and industrial water sources. Wastewater, particularly in the context of agriculture. Within densely populated regions. The presence of metals and toxic chemicals in these waste waters results in the contamination of agricultural products and livestock, leading to the exposure of heavy metals and hazardous chemicals to humans and subsequent health risks. This aspect is also associated with the rising incidence of cancer and kidney disorders. The current study focuses on conducting a human health risk assessment specifically related to certain heavy metals that are of toxicological significance.

Keywords: Wastewater, Polluted, Risks to health, Health evaluation, Toxic metals.

INTRODUCTION

Decreasing water level and shortage of water is being a major problem world wide. For agriculture purpose this problem gives rise to the use of alternative sources of water. Most of these water sources are affected by the dumping of waste from various types of industries like mining, textiles, chemical etc. Due to reason this waste water may contains many organic toxic substances that could have hazardous impact on human health. In addition, technological development has contributed to increase other industrial dumping that contaminates surface waters.

The irregular disposal of industrial wasteshas created pollution problems since this waste is disseminated in the environment or is accumulated in sediments, aquatic organisms, and water.

There are many studies on the possible effects of chemical substances on humans through laboratory.

Experiments in animals and information are available on the incidence of cancer by prolonged exposure to toxic substances. Experiments in plants and insects, as the Drosophila(fruit fly), demonstrate that toxic substances of chemical origin induce genetic mutations and chromosome aberrations. These experiments demonstrate that exists a risk, but it is not simple toextrapolate these results to human beings.

The population is exposed to toxic chemical compounds through the use of wastewater in agriculture. Theoretically, wastewater of industrialorigin should not be used for this purpose but in developing countries formal and clandestine industries dispose of their effluents to the municipalsewerage with or without authorization and without any treatment. This exposes the population, to relatively small quantities for chemical compounds and may produce chronic intoxications with seriousconsequences.

Another health hazard pose by inadequate disposal of wastewater is the use of sediments for soil improvement because they contain toxic elements that may accumulate (PAHO,1989).

The environmental impact of chemical residues in wastewater used for irrigation and the prediction of their effects on human health are a very complex matter. In addition, it should be considered that the standards of developed countries do not apply to areas with different characteristics. The factors that influence the nature and intensity of the impact on health are: the climate,nutritional status, genetic predisposition, type of work and exposure level.

The indiscriminate use of pesticides also influences the deterioration of water quality. This resource can be contaminated by runoffs from crops, atmospheric precipitations and, to a lesser extent, by domestic sewage. Polychlorinated biphenyls (PCB), present in lager quantity in pesticides and other organochlorine compounds, are degraded very slowly in the environment and are bioaccumulative, thus, they represent a potential danger. Air and water are vehicles through which PCB are dispersed in the environment, although food also constitute an important vehicle. As a consequence, PCB residues are found in living organisms form many regions. The highest concentrations are usually present neatindustrial areas .

Industrialization and urban development without adequate planning increase human health hazards by exposure to chemical substances through air, water sediments, and food. The nature of this risk and its potential danger has been recognized a few years ago and its effects still have not been evaluated (PAHO, 1990).

The identification and confirmation of such effects are difficult because epidemiological studies last long, the population migrates, and exposure time is unknown. In addition, chronic diseases canhave various causes and, in many cases, they are not classified correctly.

Usually, in developing countries there is not statistical information on the trends and causes of diseases produced by ingestion of chemical substances through agricultural and livestock products. However, several studies have deconstructed adsorption of heavy metals by plants, such as wheat and rich that can affect the consumers (WHO, 1992). An epidemiological evidence was the case of Toyama, Japan, where the population was affected by the ingestion of cadmium containedin rice; the origin of this element was a nearby mine that contaminated the irrigation water.

The nature of human health hazards by exposure to toxic chemical compounds varies considerably. In general, they increase birth defects, abortions and certain forms of cancer, and decrease the average weight of children at birth.

Case study: wastewater use in agriculture in Bikaner, India

The study "health risk evaluation due to wastewater use in agriculture" was conducted in four agricultural areas (Bikaner East, Karni Industrial area, central market, Reliance fresh retail outlet).

General objective of the study

To evaluated the chemical-toxicological level of contamination of the agricultural products irrigated with raw and treated wastewater.

Specific objectives

- To determine the concentration of toxic heavymetals and synthetic organic compounds (pesticides and polychlorinated biphenyls) in rivers, raw wastewater and treated wastewater used for irrigation.
- To determine to concentration of toxic heavy metals, pesticides, and polychlorinated biphenyls in agricultural and livestock products (vegetables and milk) form areas irrigated with water of rivers, raw wastewaterand treated wastewater.
- To compare the potential risk associated with toxic chemical compounds present in watersof rivers, raw wastewater and treated wastewater used to irrigate agricultural and livestock products.
- To train professionals in the measurement of metallic organic toxic substances and, thus, to increase the local analytical capacity.
- However the present paper is mainly concerned with some heavy metals of toxicological interest.

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Methodology

The study was conducted in Bikaner, India to evaluate the presence and concentration of toxic chemical compounds in waters used for irrigation and in agricultural and livestock products from areas of reuses, a control area, and markets. In addition, soils and sludge were analyzed. The areas selected for the study were: Bikaner East, (control area), karni industrial area (use of industrial and domestic waste water) central market (use of ground water and canal water) reliance fresh retail outlet. Analyses of metals, pesticides, and PCB were carried out in all water samples.

The following analytical procedures were appliedWater

The analytical methodologies proposed by the Health and Welfare, Ottawa, Canada, National Water Research (Burlington) and by the Standard Methods (15a. edition, 1985) were used.

Agricultural products

The recommendations of the Health Protection Branch Laboratory, Food Laboratory, Toronto, Canada, and the analytical methodologies of CEPIS developed with the support of JICA were applied.

Soil and sludge

The methodologies proposed by USPEA and by the standard Methods (15a. edition, 1985) were adopted.

For analytical quality control, measurements were subject to an analytical quality control program developed by CEPIS laboratory and the methodology used by international authorities.

Recovery tests were performed with selected samples to which known quantities of analite were added, in addition, control tests of distilled water and solvents for pesticides and PCBwere done.

RESULTS

With respect to the results, in industrial wastewater high levels of heavy metals were found: arsenics (7 to 220µg/1), (5 to 43µg/1), lead (10 1 253µg/1), copper (50 to 250µg/1), iron (1.800 to 6.400µg/1), and zinc (60 to 2.460µg/1), (see Figure 1). Chlorinated pesticides in different sampling points were very low (<700ng/1). With regard to PCB, the highest value was detected in Bikaner east (270µg/1). In general, removal of heavy metals,pesticides, and PCB is produced in stabilization ponds.

The agricultural and livestock products selected for the study were: Reddish Potato, Brinjal, Carrot, Cabbage, and milk from the areas of study and nearby markets. The highest value of lead wasdetected in brinjal samples from markets (0,037µg/
) (see Table 1). Cadmium does not constitute and problem in the areas studies. With regard to metal concentration and hygiene agriculture products available at Reliance fresh outlet were found to bebest.

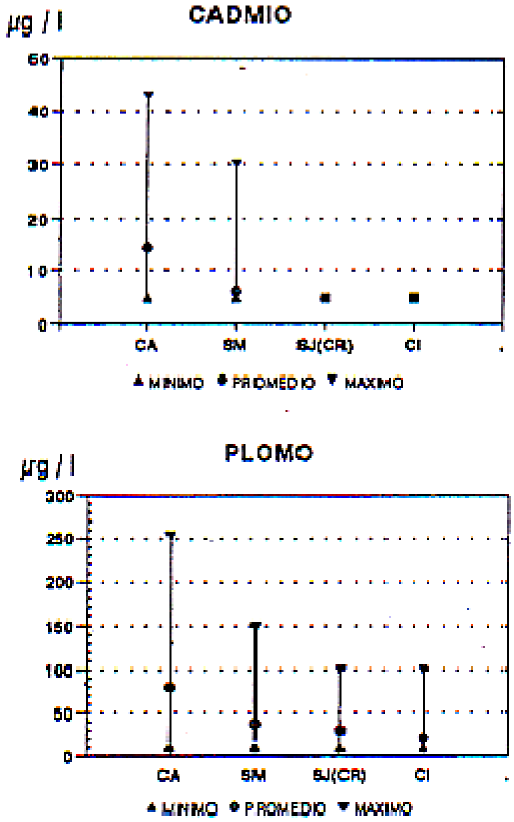

Fig. 1: Metals of toxicologicalinterest in irrigation water

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Table 1: Lead and cadmium in agricultural products

Area	Sampling place	Species	Concentration	
			Pb (µg/g)	Cd(µg/g)
Bikaner east	Agricultural	Reddish	<0.004	<0.013
	Area	Potato	0.004	<0.003
		Brinjal	0.014	<0.003
		Carrot	<0.002	<0.003
	Market	Reddish Potato	<0.004	<0.033
		Brinjal Carrot	0.004	<0.003
		Cabbage	0.003	<0.033
			<0.002	<0.003
			<0.003	<0.003
		Reddish		
		Potato		
Karni industrial		Brinjal Carrot	0.004	<0,003
area		Tomato	0.003	<0,003
	Agricultural Area		0.037	<0,003
			<0,002	<0,003
		Reddish Potato	<0,002	<0,003
Centeral Markets	Market	Brinjal CarrotTomato		
of Bikaner			<0,003	<0,003
		Reddish Potato	<0,002	<0,003
		Brinjal Carrot	<0,003	<0,003
		Tomato	<0,002	<0,003
Reliance			<0,002	<0,003
Fresh Retail	Retail Chain		<0,002	<0,003
outlet	shop		<0,002	<0,003
			<0,002	<0,003
			<0,002	<0,003
			<0,002	<0,003

CONCLUSIONS

The use of industrial wastewater in agriculture and livestock represent and potential risk for health, due to the toxic nature of chemical compounds and to the concentrations to which the products are exposed. Irrigation water with low levels of lead (around 30 µg/1) has a minimum influence in the toxicological quality of vegetables whose edible part grows beneath the soil.

Vegetables growing at the soil surface levelmay be contaminated by atmospheric emissions containing lead.

For irrigation water, the permissible limit values of toxic chemical compounds should not be regarded as absolute values, but should be adaptedto the local conditions considering contributions from other sources. Wastewater treatment by meansof stabilization ponds as well as commonly available treatment plants removes toxic elements when low concentrations are found in raw wastewater.

´ The establishment of permissible maximum limits of toxic substances should be studied for irrigation water considering conditions of soil, types of plant, and bioaccumulation.

´ Metal Toxicity seems to be a significant factorfor the increasing cases of cancer and kidney diseases.

- A continuous study with this respect and keen public awareness is required.
- A responsible planning implementation and strict regulation of environmental laws is required.
- State government seems to do only table and data work as posing itself aware with the respect of human health and environmental perspective on national und international desk.
- Delayed effects of this governmental and public unawareness may result as serious human health hazard.

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