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Safety Practice and Occupational Exposure to Physical And Chemical Hazards in Pesticides and Fertilizers Packing Industry

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Abstract: In pesticides and fertilizer formulation and packaging processes, workers may be exposed to toluene, benzene, xylene, carbon monoxide emissions as well as noise and reduced illumination during milling, mixing, loading, packaging and storage operations. Occupational hazards are associated with exposure to mixtures containing high proportions of active ingredients, and exposure to carriers/fillers and additives. The present study was designed to assess occupational exposure to chemicals, physical, hazards and safety practice in the pesticides and fertilizers packing industry. It was conducted in pesticide and fertilizer packing industry. Occupational exposure to organic solvents as toluene, benzene, xylene and carbon Monoxide as well as noise and illumination levels were carried out using calibrated instruments. Safety practice was done using safety questionnaire. Analyzed data revealed high significance increase levels of toluene, benzene, xylene, and carbon Monoxide as well as in the levels of noise and illumination in fertilizers and pesticides packing departments in comparison with administrative area. Nevertheless, the conditions of many of the safety practice are not satisfactory while the others are satisfactory and adequate. It was concluded that there are great needs for improvement, including identifying and controlling the hazards. providing information, training, monitoring and also legislative requirements that need to be met.

INTRODUCTION

In pesticides and fertilizer formulation and packaging processes, workers may be exposed to toluene, benzene ,xylene, carbon monoxide emissions as well as noise and illumination during, milling, and mixing operations. Occupational hazards are associated with exposure to mixtures containing high proportions of active ingredients, and with exposure to carriers/fillers and additives[1,2] .

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The formulating process may also include physical hazards or chemical particulate produce from dust, powder, granule, pellet, and emulsifiable concentrate[1]. Pesticides storage facilities as well as processing sites constitute a potential hazard to the workers and the environment in case of a major accident[3] .

Organic solvent and Carbon monoxide emissions are generated when solvent-based liquid as toluene, benzene and xylene formulations are produced (e.g., preparation of granulated products by impregnation and use of emulsifiable concentrate products), and during equipment cleaning with solvents.[4]

Occupational exposure to pesticides and fertilizer in manufacturing plants occur in processes such as mixing, loading, packaing, and storage.[5]

Noise has become a major problem in industrialized societies. Adverse health effects caused by noise will increase anxiety, sleep loss, hearing hearing impairment or ear damage. Several Studies revealed that pesticides and fertilizers formulation industry workers are expected to present high level of exposure to noise.[6-8]

Poor lighting can be a health hazard, strained eyes, and may cause eye discomfort and headaches.[9]

Adequate safety practice, therefore, have the highest priority, and become important elements in the industry. Some of the safety considerations in industry include: structure safety, fire safety, health safety, special emergencies, accident prevention, etc.[10]The present study was designed to assess some chemical, physical, and safety practices in the pesticides and fertilizers formulation industry

MATERIAL AND METHODS

The present studies were conducted in pesticide and fertilizer packing industry located in Dammam City. An inventory were carried out where the available

departments were selected including: raw material storage, mixing , packaging process as an exposure area ,and administrative office as a control.

Assessment of occupational exposure to organic solvents as toluene, benzene, Xylene, and carbon Monoxide in different pesticide and fertilizer packing plant departments were done using calibrated MIRAN[11].

Calibrated Sound Pressure Level meter (TES 1352A) was used for assessment of occupational exposure to noise in different pesticide and fertilizer packing plant departments.[12] The noise was measured at workers' head level.

Illumination levels were measured using calibrated Lux meter[21]. Assessment of safety practice in pesticide and fertilizer packing industry was used safety questionnaire [10]

Statistical Analysis

The collected data were subjected to statistical analysis and presented graphically using SPSS software. Descriptive statistics and Student "t test" were carried out to the collected data.

Table 1: Comparison between chemicals exposure in pesticide packing departments and Administrative control area

	Pesticide packing departments Mean ±SD	Administrative control area Mean ±SD	P- value
Toluene(ppm)	2.52± 2.160	1.38 ± 0.82	0.004*
Benzene(ppm)	22.91 ± 15.83	1.69 ± 1.16	0.005*
Xylene(ppm)	7.75 ± 5.47	1.74 ± 2.23	0.002*
Carbon Monoxide (ppm)	11.47±2.68	2.50±1.95	0.007*

*P< 0.01

RESULTS and DISCUSSION

There are significant increase in the level of toluene xylene, benzene, and CO in pesticide formulating departments in comparison with administrative control area .

Table 3: comparison between chemical exposure in departments and administrative control area of fertilizers formulating industry .

	Fertilizers packing departments Mean ±SD	Administrative control area Mean ±SD	P- value
Toluene(ppm)	2.80 ± 2.16	1.38 ± 0.82	0.009*
Benzene(ppm)	9.53 ± 7.32	1.69 ± 1.16	0.003*
Xylene(ppm)	4.30 ± 2.29	1.74 ± 2.23	0.006*
Carbon Monoxide (ppm)	15.44 ±2.4	11.47 ±1.9	0.007*

*P< 0.01

There are significant increase in the level of toluene, xylene, benzene, and CO in different department comparison with administrative control office. The mean level of benzene were 22.9 ppm in pesticide packing departments which is higher than such levels in fertilizers packing departments (9.53) ppm and the two levels highly exceed the TLV recommended limits of 0.5 ppm[11] and might be due to the uses of multi-types of organic solvents inside the industry especially in pesticides and fertilizers packing industry and these finding represent high risk to the worker,[13,14] table (1) The mean level of toluene in pesticide packing departments were 2.52 ppm (table 1) and 2.8 ppm (table 2) in fertilizers packing area but the levels is still below the TLV recommended limits of 50 ppm. In pesticides departments the mean levels of xylene were 7.75 ppm (Table 1) , higher than such levels in fertilizers departments of 4.30 ppm but the levels is still below the TLV recommended limits of 100 ppm. The mean level of carbon monoxide of

(11.47) ppm and (15.44) ppm were found in pesticide and fertilizers departments, respectively. However, the levels is still below the TLV recommended limits of 25 ppm.

Table3: Comparison between physicals exposure (Noise and illumination) in pesticide formulating industry and Administrative control area

	Pesticide formulating departments Mean ±SD	Administrative control area Mean ±SD	P- value
Noise(dB)	89.00 ± 10.98	56.21 ± 5.60	0.005*
Illumination(Lux)	461.17 ± 222.61	568.10 ± 162.71	0.006*

*P< 0.01

Table 4: Comparison between physicals (Noise and illumination) in fertilizers Packing industry.

	Fertilizers formulating departments Mean ±SD	Administrative control area Mean ±SD	P -value
Noise(dB)	87.00 ± 10.98	56.21 ± 5.60	0.002*
Illumination(Lux)	321.37 ± 214.69	555.10 ± 192.91	0.004*

*P< 0.01

Concerning noise and illumination levels, there is significant increase in the level of noise level and illumination in different department in comparison with administrative control office. In the present study the level of illumination in pesticide and fertilizers packing industry reaches an average of (461 and 321 lux), respectively ,which are below the OSHA standard level of 500 lux which in turn can cause serious health effects as glare, cathartic, and eye strain

and these finding are in accordance with recent studies.[13,15,16]

The level of noise in our study are reach an average of 89 and 87 dB in pesticides and fertilizers departments respectively, which exceeds the OSHA standard level of 85 dB which in turn can cause serious health effects as NHL and in chronic stage might case an occupational defenses [13,17-19].

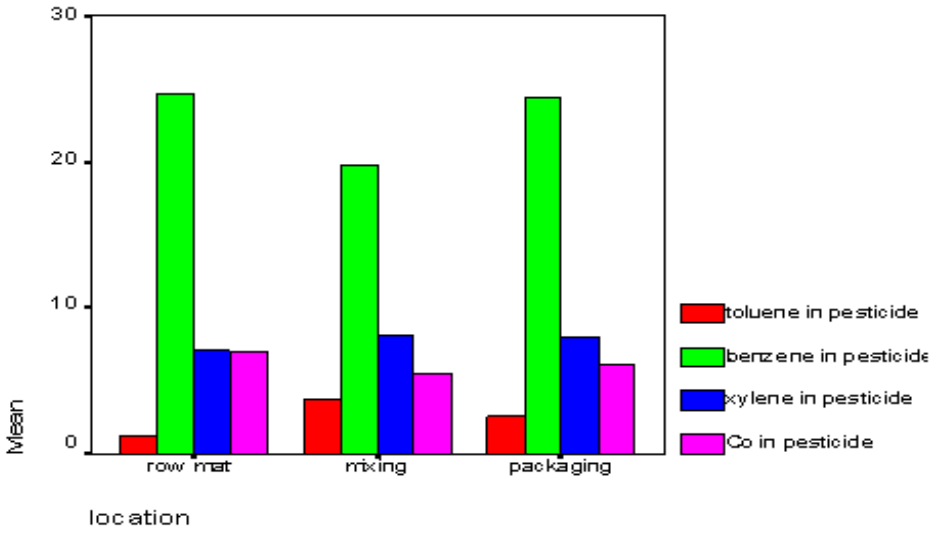

Figure 1: Comparison between chemical exposures in pesticides packing industry departments.

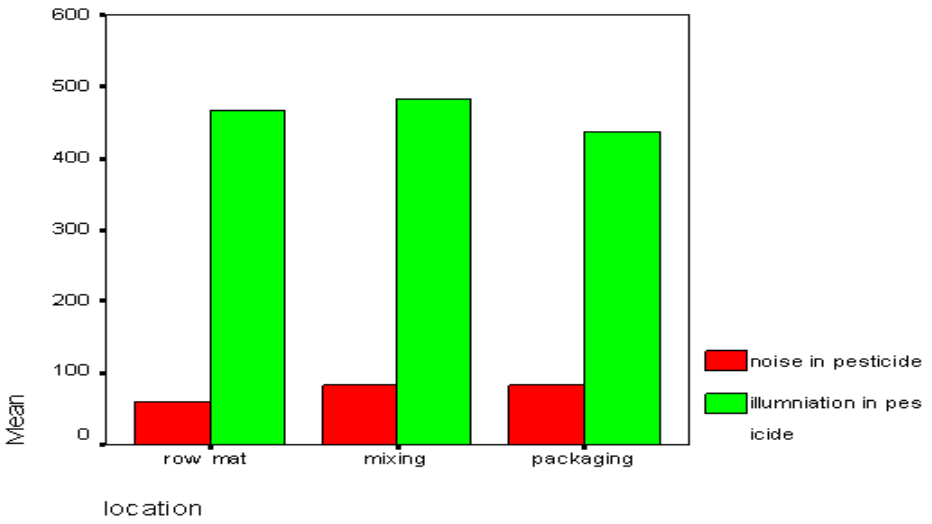

Figure 2: Comparison between physical exposure in pesticide packing industry department.

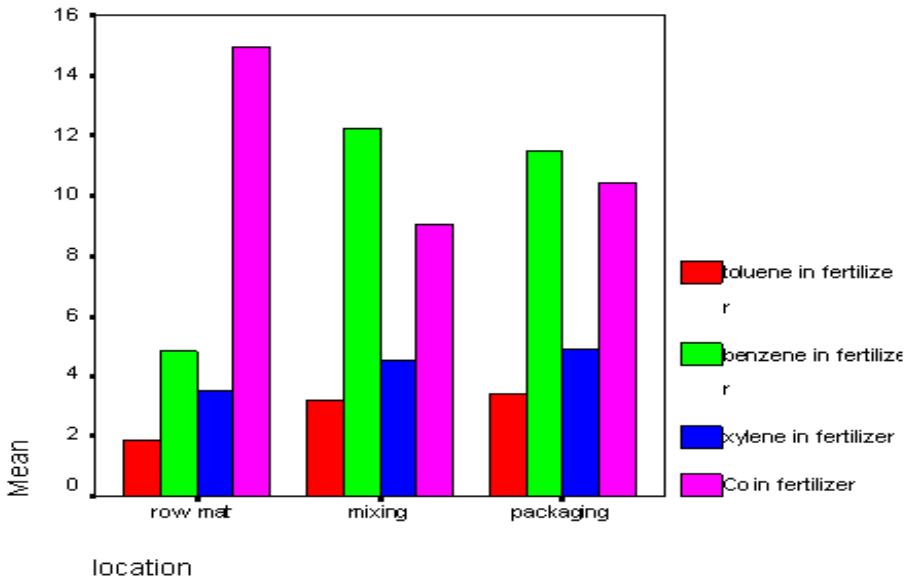

Figure 3: Comparison between chemical exposure in fertilizers packing industry departments.

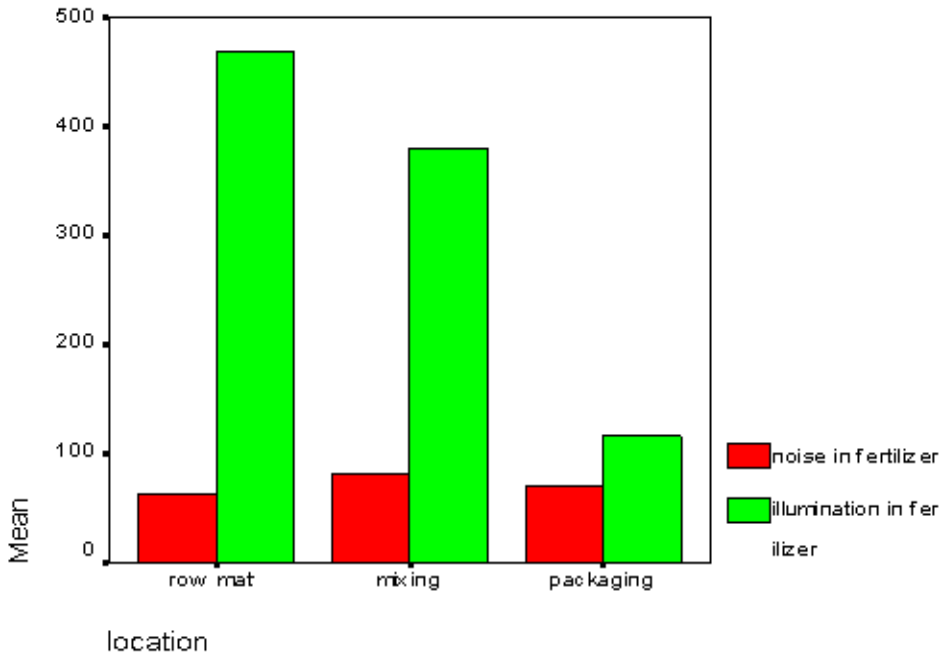

Figure 4: Comparison between physicals (Noise and illumination) in fertilizers packing industry department .

The evaluation of safety practice is presented in table 5.

Table (5): The evaluation score of the chosen safety practice criteria (adequate and poor) was based on safety questionnaire which were assessed.

Safety practice	Adequate	Poor
Hazardous chemicals	55	45
Written safety plan	60	40
Safety training	40	60
Emergency prepared	35	65
Hazardous material safety	60	40
Occupational safety policy	70	30
Fire safety	80	20
Electricity safety	90	10
Uses of flammable liquids	35	65
Lighting	45	55
Noise	30	70
First safety training	70	30
First aid	15	85
Layout	50	50
Safety signs	55	45
housekeeping	60	40
Spills	30	70
Uses of Personal protection equipment	20	80
Safe guard	70	30
Presence of accident records	10	90

Occupational health and safety assessment are concerned with implementation of prospective plan for the protection of the work environment. It is designed to provide data of the adequacy of the environmental safety performance of their facilities, and of their adherence to applicable environment safety regulations; and to submit solutions and proposals for implementing essential environmental improvements economically.[20]

In the present study the conditions of many of the safety practices are not satisfactory as emergency, safety training, flammable liquid, lighting, Noise, First aid, Spill, personal protective equipment and accident records. However, the other conditions are satisfactory and adequate.

The use of local exhaust ventilation (LEV) techniques in other industrial operations resulted in low occupational exposures. However, the use of engineering control strategies is found to be more effective, compared to personal protective equipment (the most common practice in most of occupational settings)[15].

CONCLUSION

The present study concluded that exposed to hazards: xylene, benzene, toluene, CO, noise, and low level of illumination exposure in the fertilizers formulation industry represent potential risk to the exposed workers.

There are significant areas in need of improvement, including identifying and controlling the hazards. Providing information, training and monitoring are also legislative requirements that need to be met.

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