Original Article

Exposure to tobacco dust in primary tobacco-processing workers

M Mohammadyan[1], A Alizadeh[2], S Etemadinejad[3]

ABSTRACT

Objective: Numerous workers are engaged in processing of tobacco in Iran and therefore, their exposures to tobacco dust are likely to be high. The aim of this study was to evaluate the workers' exposure to tobacco dust.

Methodology: Total dusts were collected within the workers' breathing zone using a Personal Air Sampler (PAS) and respirable dusts were measured using a real time monitor (Micro Dust Pro) with a particle size adapter in different parts of the factory. To weigh the filters a microbalance accurate to 5 decimal places was used.

Results: The mean total tobacco dust concentrations for personal exposure near breathing zone in this study was 9.32 mgm^{-3} that was lower than TLV recommended by American Conference of Governmental Industrial Hygienists (ACGIH). In contrast the mean respirable dust concentrations was 3.28 mgm^{-3} which is higher than Threshold Limit Value (TLV).

Conclusion: Dust control methods such as good maintenance of existent dust emission control systems, insulation of dust sources and designing suitable local exhaust ventilation should be applied to maintain workers' health.

KEY WORDS: Tobacco dust, Exposure, Indoor, Tobacco workplace.

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1. M Mohammadyan, Ph.D.,
Department of Occupational Health,
2. A Alizadeh , M.S,
Department of Occupational Health,
3. S Etemadinejad, MD,
Department of Occupational Health,
1-3: Mazandaran University of Medical sciences,
Khazar Abad Road,
University campus,
Sari, Iran.

Correspondence:

M Mohammadyan, Ph.D.,
Research Center of Health Science,
Mazandaran University of Medical Sciences,
Khazar Abad Road,
University campus,
Sari, Iran.
E.mail: mohammadyan@yahoo.com

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INTRODUCTION

Organic dusts may cause a variety of adverse health effects in the respiratory airways. They may also cause acute or chronic respiratory symptoms and some changes in lung functions. As early as 1948, Mc Cormick and colleague reported that certain potential health hazard exist for tobacco workers in tobacco industries.[1] Other studies documented an increased prevalence of respiratory diseases such as asthma, chronic obstractive bronchitis, and allergic respiratory or nasal diseases in workers exposed to tobacco dust.[2-9]

Numerous workers are engaged in the growth, preparation for sale, shipment and processing of tobacco in the north of Iran. Some of them are working in an old industry with poor ventilation system. Therefore, their exposures to tobacco dust concentrations are likely to be high. The walkthrough survey of workers showed complaints of respiratory

Table-I: Mean personal exposure to total tobacco dust for workers in different locations

Sampling location	*N*	*Mean(mgm^{-3})*	*SD*	*Min (mgm^{-3})*	*Max (mgm^{-3})*
Stems manipulation tray	5	9.59	0.92	8.86	11.04
Tips manipulation tray	5	10.88	1.58	8.60	12.38
Stems feeder	5	6.82	1.97	4.50	9.50
Tips feeder	5	6.74	1.78	5.30	9.80
Threshing	5	12.73	1.12	11.6	13.94
Total	25	9.35	2.75	4.5	13.94

system and eye irritation due to the dust exposure. The aim of this study was to evaluate the tobacco dust concentrations both in the workers' breathing zone as well as all work stations in a tobacco-processing factory.

METHODOLOGY

The tobacco processing factory investigated was located in the northern part of Iran. The primary raw materials are tobacco leaves that are processed in different steps such as tips manipulation tray, stems manipulation tray, threshing and stems add moist feeder and wrapping. A real time monitor (MicroDust Pro, Casella, UK) was used to measure respirable tobacco dust concentrations in 45 sampling stations in different parts of the factory.

To measure the respirable dust concentrations, a size selective sampling cyclone was used in combination with a particle size adapter and a small Poly Urethane Foam (PFU) filter that was designed for PM_4 size fraction monitoring. A small personal sampling pump was used to provide a continuous two lit/min airflow through the gravimetric adaptor and photo detector. For gravimetric calibration, particles were then collected on three sample filters (Teflon filter, Gelman Science, PTEF, 2.0 mm, 37 mm, SKCinc, UK), which was assembled into the cassette, behind the air sample stream. Gravimetric results were then compared with real time data and correction factors were calculated. The gravimetric correction factors varied from 1.08 to 1.20. The mean correction factor of 1.14 was applied for all real time data of respirable particle concentrations.

Twenty five samples of total tobacco dust were collected within the workers' breathing zone during an 8-hour shift, using a Roken (Tokyo, Japan) TR Personal Air Sampler (PAS) model PS-4 with a 25 mm glass fibre filter. The flow rate was set at 1.5 lmin"1 using a personal sampler pump (Apex Personal Air Sampling Pump, Casella, UK). To weigh the filters a microbalance accurate to 5 decimal places (0.01 mg sensitivity) was used. Samples were collected from different parts of work place. The SPSS software for Windows XP was used to analyze data resulted from personal exposures and indoor tobacco dust concentrations.

RESULTS

In this study a total of 45 respirable particles samples from different locations inside workplace and 25 total dust samples for personal exposure measurement were collected. The mean exposure to total dust for all tobacco processing workers was 9.35±2.75 mgm^{-3}. The minimum mean exposure was found in a worker who was working in tips feeder location (6.74 mgm^{-3}) and the maximum mean exposure to total tobacco dust was 12.73 mgm^{-3} for a worker who was working in threshing location.

One way ANOVA test showed that there was a significant difference between average exposures to

Table-II: Mean respirable tobacco dust concentrations in different locations

Sampling location	*N*	*Mean (mgm^{-3})*	*SD*	*Min (mgm^{-3})*	*Max (mgm^{-3})*
Stems manipulation tray	9	3.37	1.22	1.89	5.40
Tips manipulation tray	9	3.44	1.65	1.19	6.30
Stems feeder	9	3.32	1.50	1.53	6.10
Tips feeder	9	2.93	1.43	1.34	5.60
Threshing	9	3.33	1.31	1.83	6.20
Total	45	3.28	1.38	1.19	6.30

Table-III: Range of the Personal Exposure (PE) and Indoor Workplace (IW) total and respirable tobacco dust concentrations in other studies

Study	*Country*	*Tobacco dust concentration (mgm^{-3})*	
		Total	*Respirable*
Current study (2009)	Iran	PE*: 6.74-12.73	IW**: 2.93-3.44
Patel et al. (2009)	India	PE: 15.1-17.08	PE: 3.90-6.05
		IW: 10.78-12.23	IW: 3.20-4.55
Zhang et al. (2005)	China	IW: 13.76-29.55	
Chloros et al. (2004)	Greece	IW: 45.3-54.4	
Dehdashti et al. (2003)	Iran	IW: 4.2-24.1	
Kjaergaard et al. (1989)	Denmark	PE: 0-5.7	IW:0.08-1

* PE (Personal Exposure)
**IW (Indoor Work place)

total tobacco dust among workers in most locations. However, no significant differences were found between workers' exposure in tips and stems manipulation trays, tips manipulation tray and threshing and also tips and stems feeders (Table-I). Table-II shows the mean respirable tobacco dust concentrations in different locations of studied tobacco-processing industry. The overall mean respirable dust was 3.28±1.38 mgm^{-3} which is higher than Threshold Limit Value (TLV) recommended by American Conference of Governmental Industrial Hygienists (ACGIH) for respirable particles not otherwise classify.[10] The maximum mean respirable tobacco dust concentration was found in threshing location (3.44 mgm^{-3}) and the minimum mean concentration was 2.93 mgm^{-3} in stems feeder location (the only location that the mean respirable dust concentration was lower than TLV). One way ANOVA test showed that there was no significant difference between average respirable tobacco dust concentrations in all locations.

DISCUSSION

The mean total tobacco dust concentrations for personal exposure near breathing zone in this study was 9.32 mgm^{-3} (ranged from 6.74 to 12.73) that was lower than TLV recommended by ACGIH for respirable dusts not otherwise classified. On the other hand, the mean respirable dust concentrations was 3.28 mgm^{-3} (ranged from 2.93 to 3.44 mgm^{-3}). In comparison the range of personal exposure and workplace respirable particles in other main studies are summarized in Table-III. The mean and range of the exposure to total dusts and working environmental tobacco dust concentrations in this study were lower than those measured in other studies carried out in India[11] China[9], Greece[12], and in Iran.[13] In contrast range of the respirable and total tobacco dust concentrations in a Danish study carried out by Kjaergaard and co-workers in a factory producing cheroots was considerably lower than those resulted in current study.[4]

Despite a considerable difference between exposures to total tobacco dust in some locations, the current study showed no significant difference between mean respirable particle concentrations in different locations. It can be explained that the coarse particles readily settle out or impact on surfaces, therefore their life time in the workplace atmosphere is short and so a higher concentrations was found near source. In contrast fine particles' life time is longer, so their concentrations are monotonous in all locations.

In conclusion, this study showed that workers' exposure and indoor tobacco dust in most locations were higher than standard. Therefore dust control methods such as good maintenance of existent dust emission control systems, insulation of dust sources and designing suitable local exhaust ventilation should be applied to maintain workers' health.

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