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Effects of Raw Oil Deposits upon Occupationally Exposed Workers

Sedik A.K. Al-Hiyaly
Environmental Research Center, University of Technology/ Baghdad
Email:uotechnology.edu.iq/dep-chem-eng/mtor2013.htm
Layla L. Alwan
Petroleum Technology Department, University of Technology/ Baghdad

ABSTRACT

Consumption raw oil may cause different pollutants which may have various environmental and health effects upon those occupationally exposed workers in industrial activities that used this energy.

A total of 60 workers from Qubiasa cement factory and 10 individuals from well away sites were examined during this work for vanadium blood content after being subjected to personal interview using questionnaire sheet consisting information health background and any signs that may be accounted for certain organic and psychological syndromes.

The results have found that vanadium blood content in occupationally exposed sample was varied from 9.07 ± 3.73 µg/cm³ to 16.89 ± 7.79 µg/cm³ and in environmentally exposed sample was 6.82 ± 1.69 µg/cm³ while in control sample was 4. 42 ± 0.7 µg/cm³. This, blood vanadium content was significantly ($P \geq 0.05$) related to the exposure periods.

Also, this work has shown that several health symptoms such as teeth decay , hair fallen , weight fluctuation and vision impairment in most of those occupationally exposed workers while such signs were not found in both environmental and control samples Interestingly, the number of health syndromes that tested workers had, were found to be due ($P \geq 0.05$) to exposure times and not to the worker age.

However, the most occupationally examined workers have shown several psychological problems such as stress, depression and malaise. Finally, this study may need further investigations on similar samples to support a conclusion that these signs may be accounted for early diagnosing of any health sever or even lethal diseases to avoid such various diseases infections by different air contaminants caused by raw oil consumptions.

Key words: Raw Oil, Qubiasa Cement Factory, Occupational Exposure, Early Indicators.

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2412-0758/University of Technology-Iraq, Baghdad, Iraq
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تأثير مخلفات النفط الخام على المتعرضين مهنيا

الخلاصة

ان مخلفات النفط الخام الناتجة من عملية الاحتراق قد تحدث تأثيرات صحية متنوعة على العمال المتعرضين مهنيا مسببة امراض عضوية في اجهزة التنفس و الهضم و الجلد فضلا عن اخرى مميتة .

صممت الدراسة الحالية للبحث في امكانية العثور على بعض العلامات الفيزياوية التي يمكن ان تظهر على هولاء العمال والتي يمكن اعتمادها كمؤشرات مبكرة لتأثير مخلفات النفط على صحة العاملين بغية اعتماد اجراءات و قائية تمنع او تقلل من فرص ظهور امراض عضوية و نفسية تشكل خطورة على صحة العاملين.

تم اجراء الدراسة في معمل سمنت كبيسة / محافظة الانبار من خلال اختيار عينة عشوائية مؤلفة من 60 عاملا موزعين بين 50 عاملا من المتعرضين مهنيا (بواقع 25 عاملا من كل من موقعي الافران و الطواحين) و 10 افراد من الادارين المتعرضين بيئيا. العينة الضابطة تم تحديدها من 10 افراد من القاطنين على مسافات بعيدة تماما عن المعمل.

جميع افراد العينات خضعوا لمقابلات فردية على ضوء استمارة استبيان تشتمل على معلومات تتعلق بالعمر و الجنس وتواريخ العمل و فترات التعرض و المشاكل الصحية فضلا عن بعض العلامات الفيزياوية المقترنة باحتمالات التأثر بالملوثات. تبع ذلك سحب عينة دم من كل فرد لتحديد مستويات الفناديوم في الدم و الذي يشكل الاكثر انبعاثا من النفط الخام.

النتائج التي تم الحصول عليها تشير بوضوح الى ظهور تأثيرات صحية متنوعة تتعلق بالتنفس و الهضم و الجلد و اخرى ذات صلة بالقوى الهيكلية (عضلات و عظام). ان التحليل الاحصائي لهذه النتائج اشار الى ارتباط ظهور الاعراض المرضية بفترات التعرض و مستويات الفناديوم المنبعثة و لم يتضح جليا اهمية عمر العاملين في حالات الاصابة بالامراض .

من جهة ثانية تم التوصل الى وجود بعض العلامات الفيزياوية العارضة كسقوط الشعر ، نخر الاسنان ، تراجع البصر ، وعدم استقرار وزن الجسم على عدد مهم من العاملين ووجدت ان هذه العلامات مرتبطة بفترات التعرض و مستويات الفناديوم و لا تأثيرواضح لعمرافراد عينة التعرض المهني على حالات ظهور هذه العلامات.

كذلك وجدت الدراسة بأن غالبية المتعرضين مهنيا و في كلا موقعي الدراسة (الافران و الطحن) يعانون من حالات اكتئاب و هوس و ضجر.

ان الدراسة الحالية، على اية حال قد تمثل خطوة بسيطة من دراسات تستهدف الحصول على عدد من العلامات و العوارض الفيزياوية في فترات تسبق حدوث التأثيرات الشديدة لغرض اعتمادها كؤشرات مبكرة قد تساعد في تشخيص مستويات تأثر المتعرضين مهنيا في ميادين العمل المختلفة.

INTRODUCTION

It is well known that raw oil forms most important resource of environmental contamination through industrial and consuming processes which may significantly resulting in generating and emission several pollutants that could have health and environmental effects [1,2,3,4].

Much attentions were focused on oil industry due to significant emission levels of various contaminants particularly in oil refineries [5,6,7] and different industrial bodies that consume large oil quantities such as electrical power plants, cement & constructing materials, glass & ceramic factories, and others [8,9].

Apparently, the consumption of raw oil is causing deposits consisting various pollutants such as gas oxides (COx, NOx, SOx) and polycyclic aromatic hydrocarbons (PAH) in addition to hydrogen sulfide (H_2S). Also, certain volatile organic compounds (VOCs) may involve in producing secondary pollutants in the ecosphere through photochemical oxidation of benzene to form ozone [10, 11] which known to have sever health impacts.

Such raw oil deposits may contain different heavy metals at elevated concentrations in form of air born particulates such as nickel, iron, vanadium and others.

Available data have shown that vanadium is the most common released heavy metal recording emitting rate exceeding 94% of total deposits [8] where significant concentrations of vanadium were extracted from fired fly ash released into atmosphere as a result of using raw oil in different industrial process [1,3,12,1415,16] .

It is well known that these air pollutants caused by raw oil consumptions may cause human physiological and psychological disorders upon those people exposed to such contaminants in addition to environmental impacts [2, 16, 17, 18, 19, and 20].

Levels of several contaminants released from raw oil consumption that cause severe health impacts would be affected by certain variables such as route and level of exposure in addition to worker age, gender, and genes [2,9] . However, prior health symptoms would be seen on those occupationally exposed workers as effective levels need relative time to be accumulated in various organic systems which accounted for the chance to prevent sever impacts before being occurred by changing and reducing levels of exposure.

Data of different studies can be analyzed to conclude some physical health symptoms to act as early indicators to such levels of exposures. Available studies have shown that vanadium and PAH may cause damage in cestine of hair, nail, and teeth [1, 21, 22] and others may alter shape, size and number of leukocytes [2, 24, and 25], furthermore some psychological symptoms may be displayed as consequence of exposure to certain pollutants such as vanadium [26].

MATERIALS AND METHODS

Sixty workers were taken from Qubasa cement factory; 25 from furnace site and similar number from grinding place to represent occupationally exposed sample. Also, ten employs were selected from other non-working sites to be environmentally exposed sample and further 10 ordinary people living far away from factory were employed as a control sample.

All experimental samples were randomly collected and subjected to personal survey using well prepared questionnaire consisting various items such as ages, gender, working date, exposure time, and health history in addition to the most common health disorders that the workers suffering from , and other physical health symptoms.

Blood sample was taken from each person and examined for Blood vanadium content (BVC) using wet oxidation chemical test following (16) and vanadium blood content was determined in each sample by using ultra-violet spectrophotometer at absorption level of 450 nm.

All obtained data were subjected to statistical analysis using various valid methods.

RESULTS

Means of total blood vanadium content, exposure period, number of syndromes, and number of other adverse health physical signs of occupationally exposed workers of both working sites of Furnace (Fr) and grinder (Gr) in QCF were given in Table 1. Also the table includes these data of both environmental (E) and control samples.

Table (3)Mean ± SD of different variables of all tested Samples related to QCF.

Variable	Mean ± standard deviation			
	Occupational Sample (n=50)		Environmental. Sample (n=10)	Control Sample (n=10)
	Fr. Worker (n=25)	Gr. Worker (n=25)		
Blood Vanadium content µg/cm³	16.89 ± 7.79	9.07 ± 3.73	6.82 ± 1.69	4. 42 ± 0.7
Exposure period yrs	11.64 ± 5.83	9.98 ± 5.25	11. 7 ± 6.04	-----
Working age yrs	39.8 ± 8.32	37.44 ± 5.46	40.0 ± 9.49	-----
No. of syndromes	1.8 ± 0.96	0.52 ± 0.77	Nil	-----
No. of physical symptoms	2.18 ± 1.34	0.9 ± 097	0. 7 ± 0.48	-----

Mean blood content of examined samples has shown significant differences between those three samples ($P \leq 0.01$), where the highest value (16.89 ± 7.79 µg/cm³) was recorded in furnace workers, followed by that of grinding workers (9.07 ± 3.73 µg/cm³) while the lowest value (4.42 ± 0.7 µg/cm³) was detected in control sample, followed by those of environmental (6.82 ± 1.69 µg/cm³) samples.

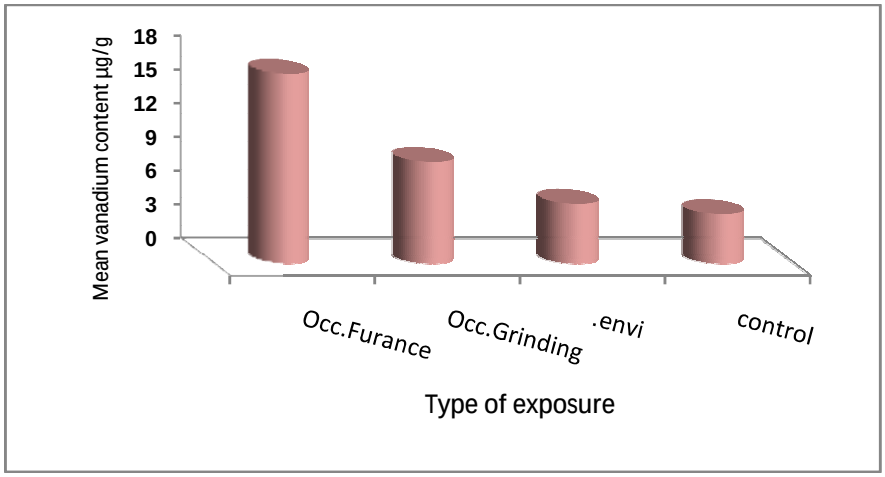

Figure (1) Mean blood vanadium content in occupational, (furance & grinding workers) enviromental, and control samples.

Mean of syndrome number found among furnace workers was almost four times (1.8 ± 0.96) greater than that of grinding employees (0.52 ± 0.77) and both means are differed significantly ($P \leq 0.01$) from each other Figure (2).

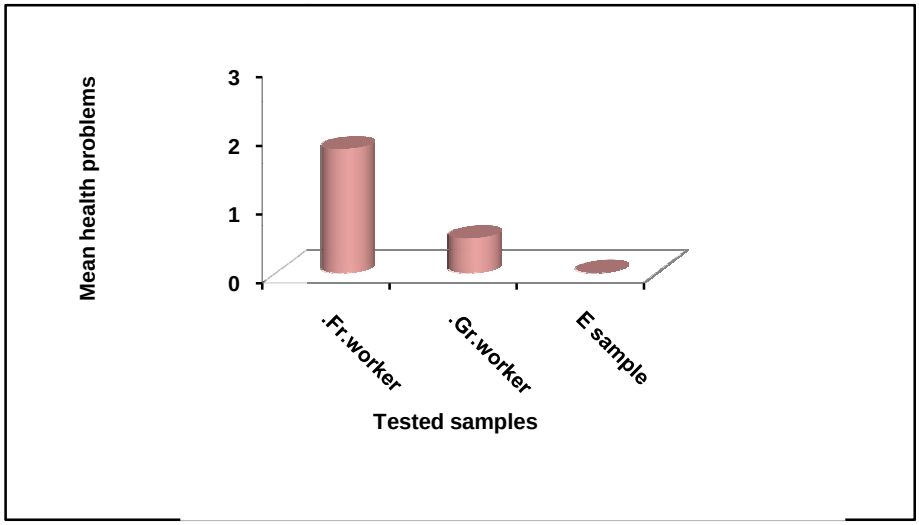

Figure (2) mean health problems in occupationall (Furnace & grinding workers) andEnvironmental samples (QCF).

In case of adverse physical health signs, the differences between means of both furnace and grinding workers were also found to be significant ($P \leq 0.01$) Figure (3).

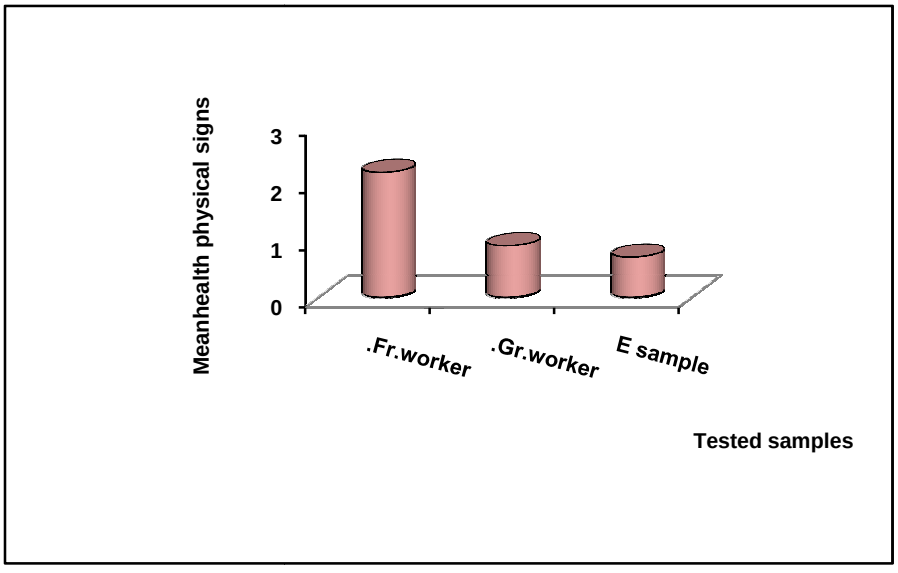

Figure (3) mean physical health signs found in occupational (furance & grinding workers) and environmental samples (QCF).

Table (2) shows all possible relationships between examined variables which, in general have been found to be influenced by each other except in case of the correlation between syndrome number and worker age in addition to that of adverse physical health signs and worker age.

Table (4) Correlation analysis between all variables used in current study (QCF).

Correlated variables	Furnace sample		Grinding sample	
	r value	Probability	r value	Probability
Vanadium blood content versus exposure period	0.93	$P \leq 0.01$	0.974	$P \leq 0.01$
Syndrome no. versus exposure period	0.52	$P \leq 0.01$	0.515	$P \leq 0.01$
Syndrome no. versus worker age	0.201	$P > 0.05$	0.175	$P > 0.05$
Syndrome no. versus physical symptoms	0.738	$P \leq 0.01$	0.532	$P \leq 0.01$
physical symptoms versus exposure period	0.59	$P \leq 0.01$	0.492	$P > 0.05$
physical symptoms versus worker age	0.195	$P > 0.05$	n.d.	----

Figure (4) shows number of workers and number of diseases that each worker exercised within occupational samples. Highest percentage (60%) of furnace workers showed two syndromes and only four workers, giving percentage of 16%, did not complain from any disease. By contrast, the situation was quite different in case of grinding workers, where 60% (15 workers) were healthy and only 32% (8 workers) suffered from a single disease.

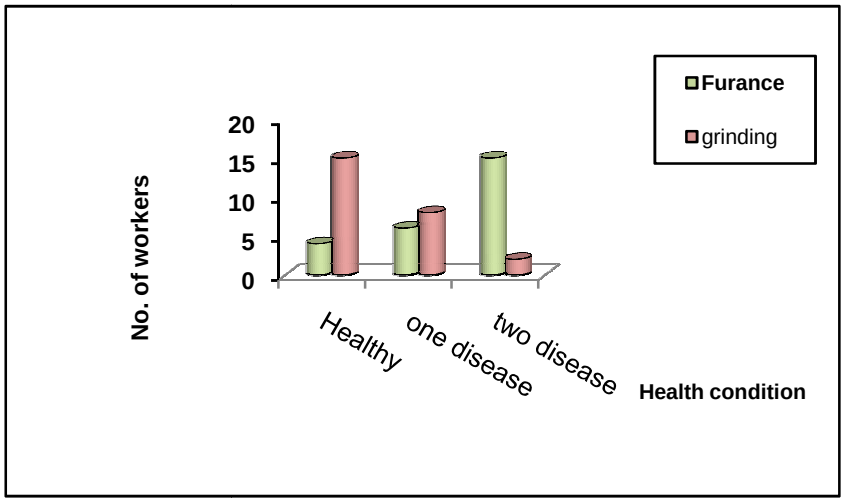

Figure (4) Health conditions of both furance and Grinding workers (QCF).

Figure (5) describes the most found syndromes among workers of both working sites. These were digestive, inhaling, dermal, and others related to muscles and bones. In case of furnace workers, the highest percentage (36.65%) related to the respiratory system. However, similar higher percentage (38.5%) has been found in case of grinding workers but to be related to the digestive system.

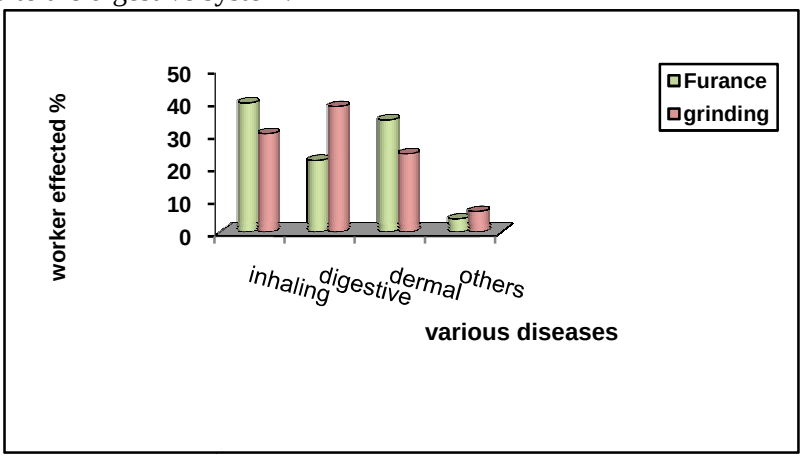

Figure (5) Percentage of occupational workers (furance& grinding sites) suffering from various diseases (QCF).

However, dermal problems in both occupational samples had almost similar percentage (26.8% & 23.0% for furnace and grinding workers respectively). Interestingly, the health troubles concerning gluteus and bones in furnace workers were found to be three times (22%) greater than those (7%) of grinding workers.

Figure (6) shows the mean of healthy adverse signs that found among workers of both furnace & grinding sites. It was found to form a percentage of 1.8± 0.96 in furnace workers while in grinding workers it was 0.52± 0.77.

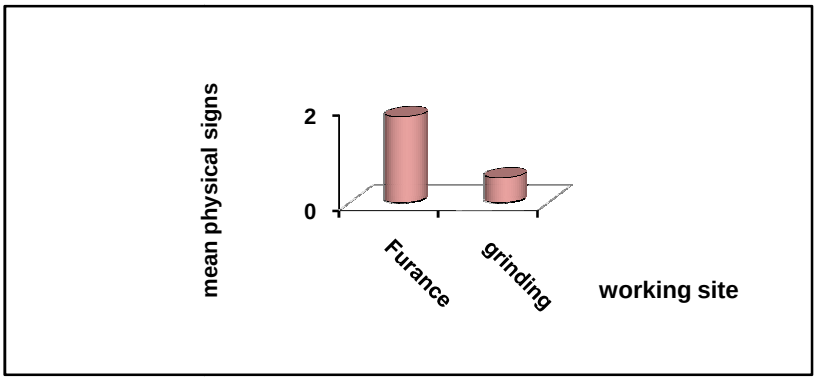

Figure (6) Mean physical signs displayed among workers of both Furnace & grinding sites. (QCF).

Furthermore, only three individuals, among those furnace employees did not show any adverse physical symptom, but this number was three times greater in grinding workers. However, the highest number (11 individuals) has displayed a single physical sign in furnace sample Figure (7).

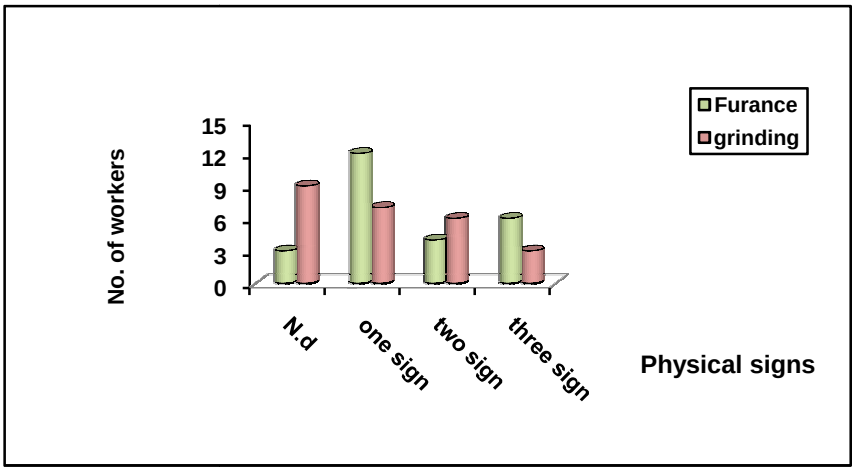

Figure (7) number of workers displaying a number of Physical signs (QCF).

Figure (8) explains the physical health adverse signs (physical indicators) which were fallen hair, teeth decay, vision impairment and weight fluctuation.

Fallen hair sign forms a percentage of 18.75% in furnace sample, whilst not detected in grinding sample. Interestingly, vision impairment was most common physical sign among grinding workers showing a percentage of 52.94%, while it was found to be two and half (21.87%) times less in furnace employees.

The percentage of teeth decay was found in grinding sample (11.76%) forming the third (34.88%) of furnace sample.

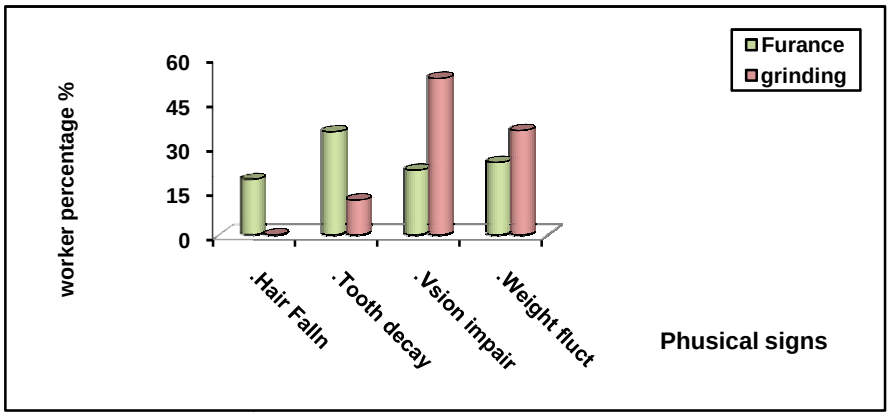

Figure (8) adverse physical signs (indicators) found in both Furnace & grinding workers (QCF).

DISCUSSION

It seems clearly from current study that raw oil emissions caused several health effects on occupational workers of QCF.

Blood Vanadium Content

This work has shown elevated blood vanadium content in all occupational workers tested in QCF, which were significantly higher than those of environmental and control samples.

Greater values were found in QCF furnace workers, grinding workers had similar vanadium levels but significantly much less.

As it has been much known, blood vanadium concentrations may be affected by several factors such as type and level of exposure, work nature, the way raw oil used, emitted deposits behavior, and other characters related to the workers such as age, sex, exposure period, and health condition[1, 2, 4, and 27].

In a recent work (16) has assessed blood vanadium content in occupational workers of Al-Ramadi glass producing factory and reported almost similar findings. He however explained elevated vanadium concentrations being due to released vanadium from raw oil burning process.

Similar explanation may be followed for current results since QCF furnace is using raw oil as burning fuels resulting in emitting significant vanadium quantities.

Health Adverse Effects

It has been found that occupational workers of (QCF) displaying several health problems.

The workers of QCF have shown various diseases such as those affecting inhaling, digestive, dermal and others resulting in joint sores, muscle, and bones. These health influences were statistically correlated to the exposure periods and not to the worker ages. These findings however are in agreement with the results those available studies [1, 2, 4, 16, and 28].

Interestingly, these health syndromes that displayed upon workers of both study cases, showed similar frequency patterns. In both situations, the highest percentage was found to be related to respiratory system and the lowest percentage was linked to digestive system, whilst the remaining diseases (dermal & others) had almost similar percentages.

It is well known that the adverse health effects depend upon the pollutant species, concentration, and behavior [2, 3, 21, and 27]. For instance, people exposed to emitted vanadium, it was found that more than 80 % of absorbed vanadium quantities via digestive canal would be excreted [1,4] and this may be the cause beyond the lowest percentage of digestive troubles. By contrast, the case is different for PAH, VOC, and various inorganic oxides, where most inhaled concentrations will be held inside human body and only limited quantities are expelled.

In general, any contaminant that enters human body via inhaling process or intravenous injection will be transmitted through blood stream to preferable tissues or organs and would start imposing its influences once effective levels being accumulated.

Early Physical Health Signs

Most frequent adverse physical health symptoms that this study has detected, upon occupational workers of both experimental cases, were vision impairment, tooth decay, fallen hair and weight fluctuations.

QCF occupational samples showed tooth decay to be the most frequent physical symptom and less abundant sign was fallen hair.

On the other hand, these physical signs were significantly correlated to exposure periods rather than the age of the workers.

Virtually, any physical symptom originates from biological materials (Biomarker) such as hair, tooth, nail, and others would be more realistic to be applied as early signs (indicators) in monitoring environmental pollutants since these materials are widely used in assessing various chemical influences [27,29]. So that, it seems reasonable to consider such physical symptoms as early signs that can help in diagnosing pollutant effects prior occurrence of lethal impacts. Nevertheless, such conclusion requires intense medical and clinical works.

It is obviously that various chemicals released from different industries that use raw oil, would have notable health impacts ranging from minor to lethal effects particularly upon those occupationally exposed workers since they are subjected to intake different pollutants via various routes such as inhaling, digesting, contacting, and intravenous injecting [4, 21].

Thus it seems very important to assess worker exposure to the pollutants using biomarkers [2, 21, 30, and 31] such as hair, tooth, nail, and other biological fluids and materials. However any physical damage on these biological specimens would be account for monitoring such contaminants prior occurrence of sever or lethal diseases.

The available data have shown that such physical symptoms displayed on peoples after being exposed to environmental pollutants such as lead, mercury, cadmium, and chromium [29, 32, and 33].

It seems true that there are sincere scientific attempts in monitoring environmental pollution via different exposure levels and routes. Nevertheless, intense investigations towards finding adverse physical indicators are quiet necessary and urgent.

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