G- Journal of Environmental Science and Technology

(An International Peer Reviewed Research Journal)

Available online at http://www.gjestenv.com

Analysis of Environmental factors in Rice Mill workers of Uttar Pradesh, India

Ahinsa Tripathi[1], N.B.Singh[2] and R.K.Singh[3]

[1]Gautam Buddh Technical University, Lucknow, U.P. INDIA
[2]Civil Engineering Department, IET , Lucknow, U.P. INDIA
[3]Divisions of Toxicology, Central Drug Research Institute, Lucknow, U.P. INDIA

ARTICLE INFO

Received: **24 Jun 2015**
Revised : **17 July 2015**
Accepted: **18 Aug 2015**

***Key words*:**
Seed Rice mill Workers, hematology, waste water, rice husk dust

ABSTRACT

This study was carried out in the Barabanki District,of Uttar Pradesh. In this study a group of 50 healthy workers and another group of (100exposed) labours working in rice mill workers were randomly selected with ages ranging from 20-35, 35-50, 50-65 years. The blood samples were taken from them and estimation of haemoglobin (Darkbins method), total Leukocyte counts were analysed. The result shows the% of haemoglobin of exposed labours from different age groups 20-35, 35-50, 50-65 are non-significant (P>0.05) Total leukocyte counts in labours of different age groups 20-35, 35-50, 50-65 are insignificant (P<0.05) Results were compared in a mean, and on the basis of period exposure. Considering the hazards of exposure to rice husk dust, this study incorporated the basic haematological parameters, erythrocyte sedimentation rate and the total leukocyte count. The idea was to identify a simple, readily available and cost effective screening test that could help in identifying the presence of disease, its severity, in rice mill workers potentially related to their workplace[5]. The findings of this study recognized the role of rice husk dust for a longer duration in decline of haematological parameters as per tests conducted among rice mills workers. The present work was undertaken to study the health problems related to the workplace environment of rice mill workers. Diseases of the respiratory system induced by occupational dusts are influenced by the duration of exposure The aim of the study is to investigate the impairment due to environmental factors in rice mill workers. In addition, the amount of dust particle at this station is greater than the standard value of allowance. All workers have restrictive lung conditions related to breathing filled with dust during the milling process every day [3].

1) INTRODUCTION

India is second largest rice growing country. There is a significant proportion of the population working in this agriculture sector. The Rice milling is the process that helps in removal of hulls and bran's from paddy grains to produce polished rice. Rice is rich in genetic diversity with thousands of varieties grown throughout the world. Rice has been one of man's most important foods[9]. Today, this unique grain helps sustain two-thirds of the world's population. It is life for thousands of millions of people. It is deeply embedded in the cultural heritage of their societies. About four-fifths of the world's rice are produced by small-scale farmers and are consumed locally. The cultivation of rice is done in irrigated fields. The crop is harvested, dried and milled. A large amount of dust is generated, especially during the milling activities[13]. Rice mill workers are potentially exposed to organic and inorganic dusts and synthetic chemicals that may have adverse effects on respiratory health. There have been many reports on health effects of grain dust exposure. Grain dust has a long history of association with disease, and its adverse effects on various organs such as eyes, nose, skin, and lung and on haematological parameters have been described[1]. However, few studies have been reported on the effect of rice husk dust exposure. Rice husk is known to have high silica content. This biogenic silica may cause effect on haematological parameters[11].

The human hematopoietic system is extremely sensitive to some environmental influences because of rapid synthesis and destruction of cells with consequent heavy metabolic demand. Toxic effects of airborne pollutants on human include damage of eyes, respiratory and nervous systems and a number of teratogenic, carcinogenic and mutagenic effects Studied and reported that rice husk dust caused indirect haematological damage resulting in abnormal blood cell count[4]. From this study, we have been inspired to study the haematological parameters of rice mill workers exposed to hazardous environment. Therefore, the purpose of the present study is to assess, evaluate and predict the risk of haematological abnormalities of rice mill workers. The idea was to identify a simple, readily available and cost effective screening test that would help in identifying the presence of disease, its severity in the rice mill workers potentially related to their workplace[8].

2) MATERIALS AND METHODS

Type of study: - cross – sectional
Study design: - Field based by questionnaire, standard manual for Environmental factors used of NEERI

Air Quality parameters-

Local rice mills producing dust particles during the milling

* Corresponding Author: **Ahinsa Tripathi**
Email address: at.tripathi30@gmail.com

process was affecting the community of nearby area. So a cross sectional study was conducted on Effect of Dust Particles in Rice Mill on Human Respiratory System. Size and amount of dust particles are two observed variables to distinguish the key difference between two structure types of local rice mills[2]. Ten workers in the local rice mills are monitored and tested for performance of the respiratory system. They found that all ten workers have restrictive lung conditions related to breathing filled with dust during the milling process every day. The results show that the paddy pouring station is the riskiest place in local rice mills which may cause a problem to human's respiratory system. Moreover, all workers under studied are restrictive lung conditions. The outcome of this study is expected to use for preventive plan in order to reduce risk from working activities for local rice mill workers[12].

Chemical characterization of PM10 and PM2.5. PM10 and PM2.5 samples were subjected to detailed chemical speciation comprising analysis of ions, elements, organic & elemental fractions of carbon, and molecular markers. The sources identified through detailed field visits in each city, were categorized as general and city specific sources. The markers, specific to these sources, were identified based on detailed literature survey and consultations with Experts. Chemical species including molecular markers identified for analysis.

Table: Target Physical and Chemical components (groups) for Characterization of PM.

PM10/ PM2.5	Teflon or Nylon filter paper. Pre and postExposure conditioning of filter paper is mandatory	Gravimetric
Elements (Na, Mg, Al, Si, P, S, Cl, Ca, Ti, V, Cr, Mn, Fe, Co, Ni, Cu, Zn, Ga, As, Se, Mo, and Pb)	Teflon filter paper	ED-XRF, GT-AAS or ICP-AES or ICPMS
Carbon Analysis (OC, EC and Carbonate Carbon)	Quartz filter. Prebaking of quartz filter paper at 600 ºC is essential	ED-XRF, GT-AAS or ICP-AES or ICPMS
Ions (F-, Cl-, Br-, NO2-, NO3-, SO4- -, K+, NH4+, Na+, Ca++, Mg++)	Nylon or Teflon filter paper (Same Teflon filter paper can be utilized if ED-XRF is used for elements analysis	Ion chromatography with conductivity detector
Carbon Analysis (OC, EC and Carbonate Carbon)	Quartz filter. Prebaking of quartz filter paper at 600 ºC is essential	TOR/TOT method

Water Quality parameters- The use of industrial wastewater in agriculture has received considerable attention in recent years . Since each type of industrial effluent has a specific character, it may or may not be beneficial to crop-soil-animal subsystem.

The Winkler method with Azide modification Procedure: Collect sample in BOD bottle. 2 ml MnSO4+ 2 ml Alkali iodide-azide+close stopper Mix well + allow the ppt to settle Add 2 ml concentrated H2SO4 + mix well till ppt dissolves Take 203 ml (Correspond to 200 ml) sample in a conical flask+titrate against Sodium thiosulphate (0.025 N) till pale yellow colour + starch + titrate till blue to colourless[4].

pH test : The pH is determined by measurement of the electromotive force (emf) of a cell comprising of an indicator electrode (an electrode responsive to hydrogen ions such as glass electrode) immersed in the test solution and a reference electrode (usually a calomel electrode). Contact is achieved by means of a liquid junction, which forms a part of the reference electrode. The emf of this cell is measured with pH meter[6].

Hardness by calculation

• Calcium can be estimated by AAS, ICP and EDTA titrimetric methods

• Magnesium can be estimated by AAS, ICP and Gravimatric method

Total Hardness by Calculation : mg CaCO3 / L = 2.497 [Ca mg/L] + 4.118 [Mg mg/L]

Table-1 Rice mill wastewater characteristics Reported in literature Our measurements

Parameters	Reported in literature	Our measurements
pH	4.5 –5.0	3.7
COD mg/l	2200-2600	2600 -3500
Suspended solids mg/l	120	300
Colour	Yellow/brown	brown
Silica mg/l		260
TKN mg/	4 - 100	90

Statistical analysis: All data are expressed as mean ± SD. The data are subjected to independent `t' test by SPSS package (version16. 0) in order to determine the significant differences where $p < 0.05$ is considered as significant. Statistical analysis (by Sigma Plot 8 software) was conducted using paired t-test and $p<0.05$ is considered as significant.

Sample size: - A set of 150 workers (50 samples normal, 100 samples exposed) from rice mill occupational were studied regarding collection of Blood sample from the different age group of workers (20-35, 35-50, and 50-65). Collection of blood sample Blood samples of 150 rice mill workers of age range 20 to 60 years were collected from Barabanki district of Uttar Pradesh. Blood sample was collected at least two hours after taking meal.

Blood (5 ml) was drawn from anti cubital vein in 5cc disposable syringe of which 2.5 ml was dispersed in a 5 ml sterile glass test tube containing 3.75mg of dipotassium salt of EDTA as an anti-coagulant for the analysis of different hematological parameters. These samples were transported to the laboratory within 45 minutes in the cool box with minimum vibration. The blood samples were centrifuged for 30 minutes. Each bottle was labelled with the subject identification code number.

The various haematological parameters, such as haemoglobin (Hb) concentration, total red blood cells (TRBC) count, total white blood cells (TWBC) count, different count of WBC,

platelet count, packed cell volume (PCV), mean corpuscular volume MCV), mean corpuscular haemoglobin (MCH), mean corpuscular haemoglobin concentration (MCHC), were determined according to the procedures given in Dacie and Lewis. Haemoglobin was estimated according to Van Kampen and Zijlstra.

3) RESULT

Haematological studies: The mean values of haematological (Hb% and TLC) parameters for 100 cases of rice mill workers and 50 controls are presented in Table1 & 2. According to results, rice mill workers show a statistically Non significant increase in the mean values of Hb% ($p>0.05$) and TLC significant ($p<0.05$).Considering the effects of exposure to rice husk dust, this study incorporated 2 basic haematology parameters, haemoglobin estimation and the TLC. The idea was to recognize a simple, readily available and cost effective screening test that could help in identifying the presence of disease or its severity in rice mill workers, or both. Estimation of the haemoglobin percentage used in clinical practice and is a useful screening test in routine medical check-up. The most frequently reported symptoms in rice mill workers were cough and phlegm production, dyspnoea, chest tightness, impairment of lung function, sinusitis, and bronchial asthma

Environmental Studies: - On the basis of the above findings we suggested that rice mill waste water should not be used as such for agricultural purpose. The treatment of the wastewater be made to render the waste water suitable for irrigation in agricultural lands. Air parameters also affected by rice milling process. this harmful for human being as well as animals, many respiratory disease can occur due air pollution in rice mill near by area. This study would be helpful in preventing longstanding harmful effects of such exposures of rice husk.

Table-2: Hematological Complications in Rice Mill Workers of District Barabanki, UP.

Sr. No.	Parameters	Control	Treated
1	Hemoglobin(gm/dl)	13.21±0.81	8.73±0.7
2	T-RBC ($x10^6/mm^3$)	4.81±0.15	1.73±0.21
3	TLC($x10^3/mm^3$)	6.83±0.52	14.81±0.75
4	Polymorph(%)	59±2.0	47±2.0
5	Lymphocyte(%)	26±3.0	36±2.0
6	Monocyte(%)	6±1.0	5±1.0
7	Eosinophil(%)	6±1.0	8.0±1.0
8	Basophil(%)	1±1.0	1±1.0
9	MCV ($micron^3$)	103±2.0	97±3.0
10	MCH(pg/ml)	8.72±0.77	6.81±0.74
11	MCHC(g%)	22.71±0.83	16±0.71
12	Platelets($x10^3$/mm)	307±22.0	237.0±24.0

A significantly greater proportion of rice millers were found to have conjunctivitis, pterygium, eosinophilia, and leucocytosis. The detail results are shown in Table -1 where red blood cell parameters were decreased. Haemoglobin, T-RBC, MCV, MCH and MCHC decreased 33.91 %, 64.03%, 5.83%, 21.90% and 29.55 % respectively as compared to controls. Significant leukocytosis of 116.84 % was observed.

4) DISCUSSION

Findings from the present study have shown significant associations of various clinical signs and symptoms and haematological changes with occupational exposure to rice husk The clinical and haematological findings suggest that the harmful effects may be linked to both non-specific irritation and allergic responses to rice husk dust.Under the electron microscope, the rice husk is shown to be covered with small needle like hairs that project outwards as sharp, elongated spines . These spikes are about 200-300 ,u in length, and about 30-40 , in diameter at the base, tapering into sharp ends. The structure of these spikes suggests that they may be responsible for the irritant effects of the rice husk dust exposure, Hematological parameter studied in the present work to confirm the involvement of rice husk dust in changing the blood picture[3]. High TLC count represents a primary disorder of leukocyte production or may reflect a secondary response to some disease process or toxins. This may indicate an inflammatory change in the lungs of rice mill workers as described. A search revealed no such study that could describe the effective of rice husk dust exposure in rice mill workers. The most frequent symptoms in rice mill workers were cough and phlegm production, chronic bronchitis, impairment of lung function. On the basis of such relation, our results suggest that rice mill dust effecting different systems including respiratory systems and thus, involving blood parameters to deviate from their normal values[6]. A rise in the mean values of TLC has been demonstrated and it has been suggested that, the rise in the above hematological parameters is most likely due to ongoing effect of rice husk dust but the parameters did not reveal significant difference between three age groups on the basis of period of exposure. The peripheral blood leukocyte count is a marker of inflammatory activity and ongoing tissue inflammation from whatever underlying cause. It thus might be viewed as a bio-marker of inflammatory response. In the present study TLC was found to be significantly higher in rice mill workers compared to healthy controls. However, a significant rise was observed on the basis of duration of exposure in three age groups. Various occupational exposures cause lung injury and initiate a chronic inflammatory process that may either progress to initiate fibrosis or result in repair. Alternatively, it is also possible that chronic exposure to irritating material might lead to adaptation process, which resists inflammation and leukocytosis. From this study , it seems that there is an impairment of the hematological parameters for the rice millers and it indicate further extensive epidemiological and pathological studies for the health and safety of the rice mill workers[10].

5) CONCLUSSION

We recommended that industries pertaining to rice mill workers should regularly use appropriate personal protective equipments at their work site namely apparel, mask, goggles, and should get periodic medical surveillance including hematological profile. These measures would help to decrease the effects of occupational hazards of rice mill dust and detect the disease in initial stage when treatment is achievable to rice mill industrial worker. This study would be helpful in preventing longstanding harmful effects of such exposures of rice husk in mill workers.

REFERENCES

1) Abou Taleb, A.N., Musaiger, A.O. and Abdelmoneim, R.B., 1995. Health status of rice mill workers in the United Arab Emirates. J. R Soc Health, 2, 378-383.
2) Al-Rajhi, M.A., Al-Shayeb, S.M., Seaward, M.R.D. and Edwards, H.G.M. 1996. Particle size effect for metal pollution analysis of atmospherically deposited dust. Atmospheric Environment, 30(1), 145-53.
3) Coates, T.D. and Baehner. 1991. Leukocytes and leucopenia. In: Hoffman R, Benz EJ, Shattil SJ, Furie B, Cohen HJ, editors. Hematology Basic principles and practice. 1st Ed. New York (NY): Churchill Livingstone p. 552.
4) Deacon, S.P. and Paddle, G.M. 1998. Respiratory symptoms and ventilatory performance in workers exposed to grain and grain based food dusts. Occupational Medicine (Oxford), 48(4), 227-230.
5) Elems and Gordon. 2000. Effects of Occupational dust exposure on the respiratory health of Port Land Rice mill workers J. Toxically Environment Health, 49, 581-588.
6) Fairhurst, E.J., Mohanty, G.P., Harrison, C.V. and Negelschmith, G. 1997 .The action of different form of pure silica on lungs of rats, Br. J-Ind,med,10,9-17.
7) Friedman, G.D. and Fireman, B.H. 1991. The Leukocyte Count and Cancer Mortality. American Journal of Epidemiology, 133, 376-380.
8) Grimm, R.H., Neaton, J.D. and Ludwig W. 1985. Prognostic importance of the white blood cell count for coronary cancer and all-cause mortality, 254, 1932-1939.
9) Hauser, R., Elreedy, S., Hoppin, J.A. and Christiani D.C. 1995. Upper airway response in workers exposed to fuel oil ash: Nasal lavage analysis. Occup Environ Med, 52, 353-358.
10) Oleru, U.G. 1984. Pulmonary function and symptoms of Nigerian workers exposed to rice mill dust. Environ Res 33, 379-385.
11) Redlich, C.A. 1996. Pulmonary fibrosis and interstitial lung diseases. In: Harber P, Schenker MB, Balmes JR, editors. Occupational and environmental respiratory disease. London (UK): Mosby; p. 216-222.
12) World Academy of Science, Engineering and Technology. Kiattisak Batsungneon and Thanatchai Kulwora wanich pong, Effect of Dust Particles in Local Rice Mills on Human Respiratory System. Available from: http://www.waset.org/journals/waset/v80/v80-50.pdf.