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Research Article

TOXICITY IMPACT OF SILK DYE WASTE EFFLUENT INDUCED ON BLOOD PARAMETERS OF SWISS ALBINO MALE MICE MUS MUSCULUS

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ABSTRACT

The silk dye (Azo dye) waste is one of the most potential harmful chemicals liberated in the environment in an unexpected manner. Silk dye waste is widely used as a potent dyeing of yarn and fabrics in many countries and has been shown to produce some adverse health effects. The present study was undertaken to investigate the toxic effects of the silk dye waste on blood parameters. Three sets of animals i.e. Group-I (Control), Group-II (fed with 50% silk dye), Group-III (fed with 100% silk dye), have been taken for experiment. The dose of silk dye was 2ml/day to both groups II and III. The results show that the silk dye waste effluent when fed to Gr II and III mice, decreased significantly the RBC count ($p<0.05$,$p<0.01$), Hb ($p<0.05$) concentration, Neutrophil ($p<0.05$), PCV($p<0.05$), MCHC($p<0.05$) whereas marked increase in the WBC, Lymphocyte, MCV and MCH count ($p<0.05$) when compared with mice of Gr- I. This study suggested that the impact of silk dye waste was very toxic for blood parameters.

INTRODUCTION

The human are exposed to various type of environmental contaminants at different stage of their life span, widely held of them are harmful. Silk dye waste is one of the major sources of hazardous pollutants. Industrialization is a godsend of independent India but that is allied with hazardous effluents and discharges polluting the environment. Silk industry as textile provides an important economic stand to the artisans but the dye waste or spent wash arising from the manufacturing unit cause great menace ,if released in the open. Silk dye waste effluents are more toxic to environment than the domestic sewage. Bhagalpur (25°17'N latitude and 86°83'E longitude) is endowed with age old silk fabric and yarn production units. Here, the manufacturers use mostly synthetic dye such as azo dyes as colorant for their products. Azo dye forms the largest and most important Silk industry provides an important economic group of synthetic dyes (Mathur *et al*., 2005).

MATERIALS AND METHOD

***Animals*:** Experiment was performed on 6 to 8 weeks old healthy laboratory inbred male *Mus musculus* weighing about 30 -35 grams. The animals were obtained from University Department of Zoology, Bhagalpur. Mice were reared and maintained at the animal house of University Dept. of Zoology, T.M.Bhagalpur University, and Bhagalpur under standard conditions and fed with nutritional diet and water.

***Collection of silk dye waste*:** Silk dye waste effluents were collected directly from discharge point of silk dye industries of Nathnagar, Bhagalpur at regular interval.

***Experimental Design*:** The mice were divided into 3 groups of 10 animals each. Gr-I (control mice), Gr-II (mice treated with 50% silk dye waste), Gr-III (mice treated with 100% silk dye waste).

***Dosage*:** The control group was given normal food and water. Silk dye waste was administered orally 2ml/day (Chaurasia *et al,* 2005) group II and III for 30, 60 and 90 days duration.

***Biological assays*:** Haematological parameter determined were RBC count, WBC count, Hb concentration, Neutrophils, Lymphocyte, PCV, MCV, MCH and MCHC. Statistical analysis: Data were analyzed using a one way ANOVA followed with a post hoc test (least square division test) using the SPSS for comparison between different treatments. Results

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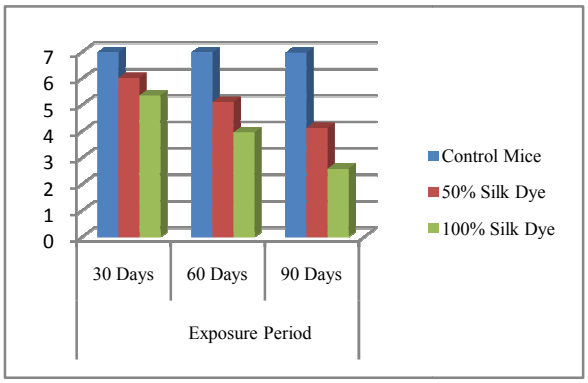
were presented as mean ± S.E and differences were considered as significant when $p<0.05$ and $p<0.01$.

RESULTS

The results show that the toxicity impact of silk dye waste effluent when fed to Gr- II and III mice, decrease significantly the RBC count($p<0.05,0.01$),Hb ($p<0.05$) concentration, PCV, Neutrophil and MCHC at 5% and 1% level where as marked increase in the WBC, MCH, MCV and Lymphocyte count ($p<0.05,0.01$) when compared with mice of Gr-I. This study suggested that the silk dye waste effluent may have toxic for haematological parameter.

Table 1 RBC Count (million/cmm) count in control and different treated groups mice.

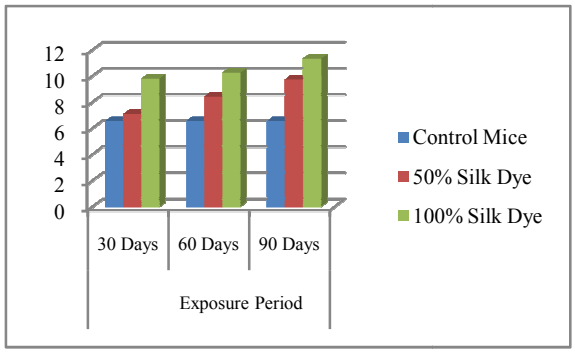
Experimental Group	Exposure Period		
	30 Days	60 Days	90 Days
Control Mice	6.98±0.01	6.98±0.01	6.97±0.00
50% Silk Dye	6.01±0.00	5.11±0.05	4.12±0.04
100% Silk Dye	5.35±0.02	3.95±0.00	2.58±0.11



Graph 1 RBC Count (million/cmm) count in control and different treated groups mice.

Table 1.2 WBC Count (thousand/cmm) count in control and different treated groups mice.

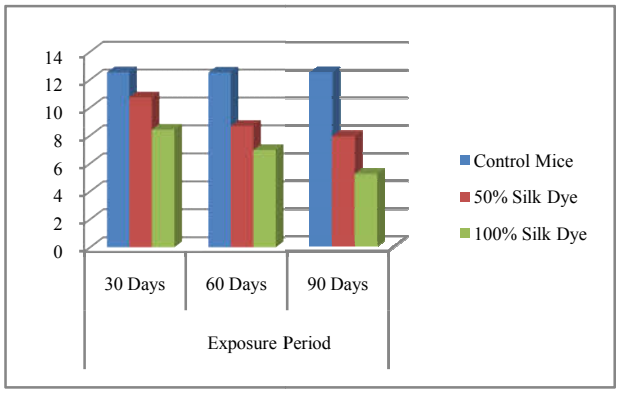
Experimental Group	Exposure Period		
	30 Days	60 Days	90 Days
Control Mice	6.56±0.02	6.56±0.03	6.56±0.02
50% Silk Dye	7.11±0.00	8.45±0.00	9.75±0.17
100% Silk Dye	9.82±0.01	10.26±0.00	11.34±0.02



Graph 1.2 WBC Count (thousand/cmm) count in control and different treated groups mice.

Table 1.3 Hb Count (g/dl) count in control and different treated groups mice

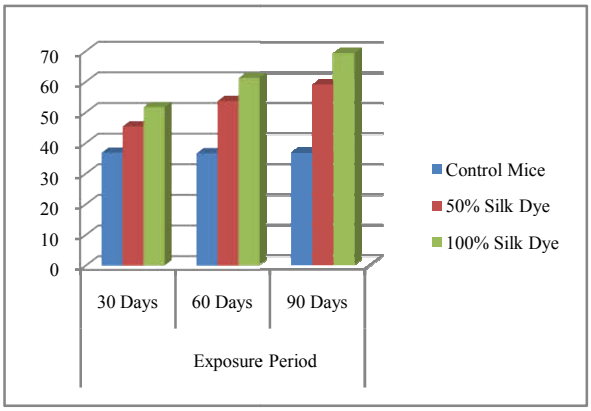
Experimental Group	Exposure Period		
	30 Days	60 Days	90 Days
Control Mice	12.54±0.07	12.53±0.02	12.54±0.03
50% Silk Dye	10.75±0.16	8.7±0.09	7.96±0.07
100% Silk Dye	8.44±0.05	6.98±0.19	5.25±0.00



Graph 1.3 Hb Count (g/dl) count in control and different treated groups mice.

Table 1.4 Lymphocyte (%) count in control and different treated groups mice.

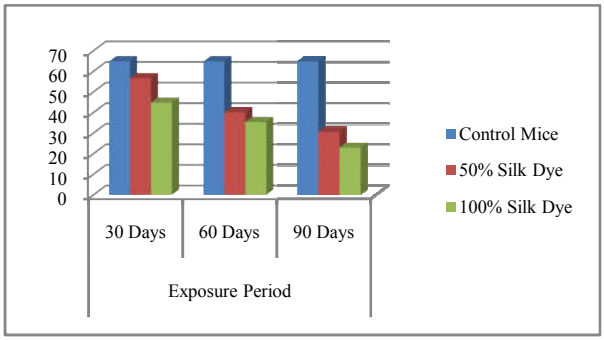
Experimental Group	Exposure Period		
	30 Days	60 Days	90 Days
Control Mice	36.9±0.00	36.7±0.01	36.8±0.00
50% Silk Dye	45.5±0.12	53.8±0.07	59.1±0.09
100% Silk Dye	51.8±0.08	61.3±0.00	69.5±0.03



Graph1.4 Lymphocyte (%) count in control and different treated groups mice.

Table 1.5 Neutrophil (%) count in control and different treated groups mice.

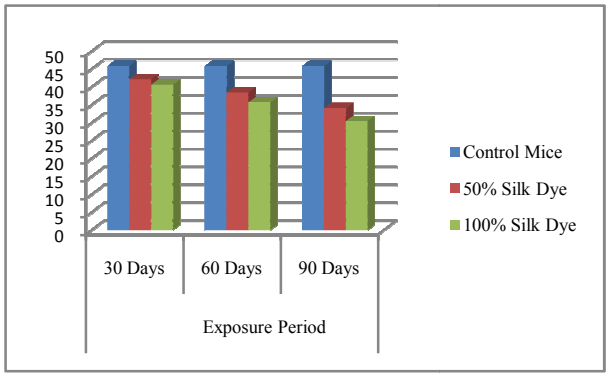
Experimental Group	Exposure Period		
	30 Days	60 Days	90 Days
Control Mice	64.9±0.01	64.9±0.02	64.8±0.01
50% Silk Dye	56.7±0.00	40.2±0.76	30.5±0.00
100% Silk Dye	44.8±0.07	35.4±0.00	22.8±1.25



Graph 1.5 Neutrophil (%) counts in control and different treated groups mice.

Table 1.6 PCV (%) count in control and different treated groups mice.

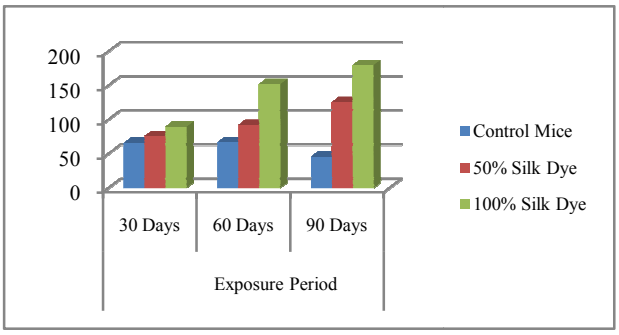
Experimental Group	Exposure Period		
	30 Days	60 Days	90 Days
Control Mice	45.89±0.01	45.88±0.02	45.89±0.01
50% Silk Dye	42.13±0.16	38.53±0.06	34.11±0.21
100% Silk Dye	40.73±0.19	35.71±0.09	30.45±0.68



Graph 1.6 PCV (%) count in control and different treated groups mice.

Table 1.7 MCV (µm³) count in control and different treated groups mice.

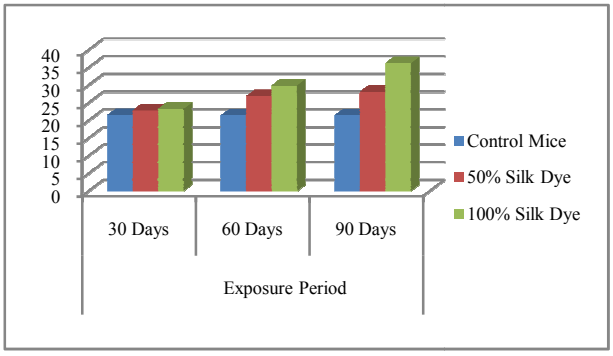
Experimental Group	Exposure Period		
	30 Days	60 Days	90 Days
Control Mice	66.23±0.01	67.07±0.01	45.89±0.03
50% Silk Dye	76.05±0.00	92.32±0.16	125.98±0.08
100% Silk Dye	89.94±0.05	152.22±0.75	179.85±0.02



Graph 1.7 MCV (µm³) count in control and different treated groups mice.

Table 1.8 MCH (Pg) count in control and different treated groups mice.

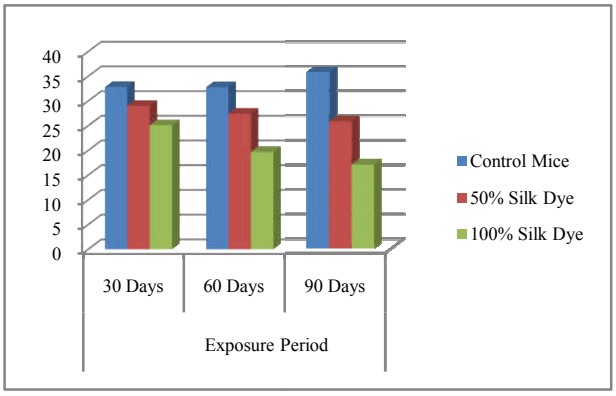
Experimental Group	Exposure Period		
	30 Days	60 Days	90 Days
Control Mice	21.56±0.21	21.49±0.20	21.48±0.23
50% Silk Dye	22.86±0.05	26.92±0.03	28.15±0.06
100% Silk Dye	23.31±0.9	29.89±0.01	36.25±0.11



Graph 1.8 MCH (Pg) count in control and different treated groups mice.

Table 1.9 MCHC (%) count in control and different treated groups mice.

Experimental Group	Exposure Period		
	30 Days	60 Days	90 Days
Control Mice	32.89±0.02	32.87±0.01	35.87±0.00
50% Silk Dye	29.06±0.06	27.49±0.98	25.87±0.07
100% Silk Dye	25.15±0.23	19.75±1.25	17.09±0.11



Graph 1.9 MCHC (%) count in control and different treated groups mice.

DISCUSSION

In the present study, the observed significant decrease in RBC, Hb, PCV, Neutrophil, MCHC whereas increase WBC, MCV, MCH, Lymphocyte count in silk dyes waste effluent induced (Gr- II and III) mice with different concentration after 30, 60 and 90 days exposure. The decrease in the RBC count and Hb concentration was mainly due to the damaging action of the silk dye waste on the erythropoietin tissue. The reduced RBC count and Hb concentration, as the deficiency of Hb results in inhibition of erythropoietin in bone marrow. Vitamin B_{12} and folic acid deficiency causes failure in maturation of erythrocytes. Lynch *et al*, 1969 reported that the non-availability of Vitamin B_{12} result in decrease RBC counts.

Effluent exposure decreases the RBC, Hb, Neutrophil, MCHC and PCV due to impaired intestinal absorption of iron (Joshi *et al*, 2002). Such type of observation was also reported by Srivastava and Kumar (1990) and Srivastava (2004) in Rattus norvegicus under the stress of dye. Liaquat *et al*, 2009 also found decrease in Hb, neutrophil, haematological indices and increase in lymphocyte and leucocytes under dye contamination. Sharma *et al*, 2007 reported decrease in RBC, Hb and PCV of rat treated with textile dye waste water. Easton and Klassen (1996) reported the toxic substance present in wastewater interacts with RBCs and may cause metabolic disorders decreasing their Hb carrying capacity. Kumar *et al*, 2011 also reported that haematological changes due to carpet dye Black T Supra in Rattus norvegicus. The decrease neutrophil concentration observed in the rats might have resulted from the suppression of leucopoiesis in the bone marrow which may have consequential effects on immune and phagocytic activity of the blood cells of the animals (Afolayan and Yakubu, 2009).Toxicity impact of silk dye waste effluent on biochemical estimations of Swiss albino male mice *Mus musculus* (Khatun *et al*., 2017). Serina Khatun and M. C. Varma in 2016, reported that silk dye waste effluent have very toxic for hematology and biochemical parameters.

The increase in the white blood cells of the exposed mice was as a result of immune response of the mice to the toxic components of the paint effluent (Oladele *et al*, 2013). Guyton, 1996 reported the decrease in the Hb content might be due to decrease rate of Hb synthesis due to dye poisoning. The rate of Hb synthesis decreases during all stage of maturation of erythrocytes when the supply of iron is not sufficient. Normally the globin portion of Hb is broken down into amino acids which return to the protein port, while porphyrin is metabolized and excreted as bile pigment. The reduction in Hb content may be due to inhibiting effect of toxic substances on the enzyme system responsible for synthesis of Hb. Due to effluent toxicity, the bone marrow lacks the capacity to manufacture Hb at the required rate, so the Hb content of the cell has diminished the MCHC value. Significant decrease in MCHC was observed in laboratory mammals when exposed to tannery effluent (Breathy *et al*, 2003).

Significantly decrease in the values of Hb, RBC, MCHC, Neutrophil and PCV was observed in mice upon treatment with Fellon (Webner; 2003), tartrazine (Miller; 1982), food colours (Mannel *et al*; 1958), Chemical dye (Chandra and Nag raja; 1987), artificial colour (Biswas *et al*; 1994), Sodium Benzoyl (Sinha and D'Souza; 2008), Fluoride (Chaudhry *et al*; 2008), Distillery waste (Varma and Pratap 2008) etc. The increase in WBC, Lymphocyte content may reflect the defensive mechanism against the pollution. Lymphocyte could be immunological defence due to the presence of toxic substance of waste.In the present study there is an increase in the concentration of lymphocyte following exercise due to the recruitment of lymphocytes NK, cell T and B from the periphery of the body (Bruunsgaard *et al*, 2000). Shanti and Jaganathan, 2001; Revathi *et al*, 2003 also observed increase value of WBC count on the Wistar albino rat, after treatment with tannery waste.

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