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Toxicity of Dust of Dismissed Complex of Steel Annaba on Some Hematologic Parameters of Rabbit (*Européus*)

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Abstract: Since the fog of London of 1952, in which more than 4000 people were killed in 4 days, the combined efforts of the scientists of several disciplines of disciplines, including those of environmental health, private clinics and biomedical, serious concerns concerning the impact of the pollutants of the air raised on human health. These environmental pollutants quickly are identified as important and independent factors of risk for several diseases such as respiratory affections, the cancer of lung, the atherosclerosis, the cardiovascular diseases and the disturbances of the blood parameters. In our study one was interested in the harmful action of the atmospheric pollutants on the human organism particularly on the blood parameters. Annaba, capital industrial of the Algerian east is subjected since many years to the aggressiveness of a polluted environment, in particular with the dust of dismissed complex of steel. An experimental research on rabbits (*Europeus*) exposed to these dust was considered. Samples of blood are taken after 3, 7 and 21 days daily exposure to 2 g of dust collected of the steel complex for a hematological study. The results of the studied parameters show a reduction in the hematocrit and haemoglobin, a disturbed evolution of the lymphocytes and leucocytes an increase in number of blood plates and a smear presenting of red blood corpuscles with a roughcast membrane.

Key words: Toxicity of dust, dismissed complex, rabbits, hematologic parameters

INTRODUCTION

Pollution is a problem that affects everyone, Algeria immune to this problem indeed all cities are polluted. Annaba industrial capital of eastern Algeria is considered among the most polluted cities: air, sea and land is polluted by a variety of emissions from various industrial complexes located in the region. In our study, we are interested in Annaba steel complex and its refusal to dust in the atmosphere.

The industry is at the origin of specific emissions due to processing or manufacturing employees. In varying amounts, depending on the industry, it is issuing monoxide and carbon dioxide, sulfur dioxide, nitrogen oxides, dust, Volatile Organic Compounds (VOCs), heavy metals (Bard, 1999; Pellissier *et al*., 2000; Solodowska, 2004).

Breathing through the mouth and nasally facilitates the passage of pollutants into the trachea, bronchus and lung, particularly in the case of physical exertion that increase ventilation. However, the nasally hand is an effective filter for both particles and gases. The particles with a diameter greater than 10 microns are used in the nasal passages, finer particles (diameter of less than 2.5 microns) cross this barrier and penetrate even further in the airways that their diameter is smaller (Testud, 1997; Zmirou, 1997; Alain, 1998; Bard, 1999; Pellissier *et al*., 2000).

Through cellular membranes, whose size is very small, the air comes in contact with the blood that carries after fixation with hemoglobin, to the various tissues of the body, What facilitates the transition from pollutants carried by particles in the blood and lymph flow (Driscoll, 1997).

This research aims to identify the one hand, the chemical composition of dust emitted by the ironworks and to assess the impact of these dust on some blood parameters rabbit.

MATERIALS AND METHODS

Biological material: It was using the rabbit hare of the species (*Europeus*) the number is 20 rabbits adult males, divided into conventional cages at the rate of 5 per rabbit cage. The rabbits are fed lettuce, carrots and barley flour.

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The rabbits were acclimatized to the conditions of the facility for a week before the start of the experiments.

The rabbits were exposed to an amount of 2 g of dust, gathered at the steel complex, each day at the same time for 20 min. The cages of rabbits during exposure to dust are covered entirely to be sure that rabbits have inhaled dust. However, the caged rabbits witnesses is covered without undergoing treatment.

The ironworks of annaba

Activity: Production of metals and alloys.

Geographic features: The steel complex is located 15 km south of the city of Annaba and spreading air pollution over a radius of 6 km, the complex rejected annually in the atmosphere:

Dust	:	36.890 tons.
Nitrogen Oxides (Nox)	:	845 tons.
Carbon Monoxide (CO)	:	30.895 tons.
Sulfur Dioxide (SO2)	:	2.260 tons.
Nitrate (NO3)	:	3.093 tons.

Blood-levy: A sample of 2 -3 mL of blood will be taken from each rabbit and 3.7 after 21 days of exposure to dust rejected by the complex. The blood collected is placed in tubes filled an anticoagulant EDTA is then analyzed.

Determination of blood parameters: Blood parameters measured are the white blood cells, red blood cells, hematocrit, hemoglobin and lymphocytes.

The evaluation of respectful parameters is carried out thanks to COULTEUR COUNTEUR S880. At the same time, it makes a blood smear

Statistical survey: The statistical review of the different results obtained is determined by test ANOVA.

RESULTS

Chemical analysis of complex steel releases: Prior to research the effects of dust rejected by the steel complex, the study first concerned the chemical analysis of these dust. This was determined by the technique of atomic absorption and the results are grouped in the Table 1.

The overall results showed that true air pollution is generated by the complex. The levels recorded are very high compared to international standards, the levels greatly exceed existing standards (WHO, 2000).

Effect of dust on the blood smears: The blood smear rabbits treated, this deformation of the red blood cell membrane, which lost its regular shape and becomes fraught with spicules.

Evaluation of blood parameters: According to the obtained values, the white blood cells (GB) show a significant increase after three days of treatment (9.51) and significantly lower still for periods of 7 and 21D (7.80 and 7.29), however, these rates are significantly higher than those of controls (6.83).

The forecast rate of Red blood cells (GR), Hematocrit (HT) and Hemoglobin (HB) during the study period, shows a significant decrease compared to the witness during the period the dust exposure rejected by the steel complex shows in Table 2.

According to the obtained values, we can see that the percentage of Lymphocytes (LY) during the 3 periods of treatment were significantly higher than the witnesses. The highest percentages were observed in rabbits after treatment 7 days.

Regarding blood platelets, there is a continuous during the period of treatment.

This increase is observed on the 3rd day after treatment with dust rejected by the complex shows in Table 3.

Table 1: Chemical composition total dust rejected by the steel complex

Elements rejected	Aciérie1 (ppm)	Aciérie2 (ppm)	Total (ppm)
Zn	240.0	480.0	720.0
Pb	24.0	62.4	88.4
Cr	10.0	12.0	22.0
Ni	1.2	1.3	2.5
Mn	320.0	540.0	860.0
Fe	3000.0	3600.0	6600.0

Zn = zinc, Pb = Pb, Cr = Chromium, Ni = nickel, Mn = manganese, Fe = iron

Table 2: Numerals cell hemoglobin level and hematocrit rabbits following treatment to dust rejected by the steel complex

	GB million mm^{-3}	GR million mm^{-3}	HB g L^{-1}	HT (%)	LY (%)
TEMOIN	6.83 (0.404)	6.42 (0.603)	12.17 (0.385)	38.98 (2.155)	66.71 (8.25)
3 JOURS	9.51 (0.1243)	5.24 (0.383)	10.43 (0.675)	30.15 (2.108)	77.47 (2.98)
7 JOURS	7.80 (0.324)	4.73 (0.2424)	8.31 (0.607)	24.77 (2.406)	80.02 (6.40)
21 JOURS	7.29 (0.359)	4.59 (0.1393)	7.31 (0.765)	22.67 (2.72)	76.49 (4.45)

(Mean, standard deviation, n = 20), GB = White blood cells, Red blood cells = GR, HB = Hemoglobin, hematocrit HT = LY Lymphocytes

Table 3: Variation in blood platelets rabbits following treatment Dust rejected by the steel complex

	PT mille mm^{-3}
TEMOIN	317.00(60.66)
3 JOURS	447.71 (76.51)
7 JOURS	509.14 (28.47)
21 JOURS	651.42 (53.44)

(Mean, standard deviation, n = 20), PT = blood platelets

DISCUSSION

The hematologic perturbations induced by air pollutants are closely dependent on the action of the biotic Xenophobia on the blood cells that it erythrocyte, leukocyte or platelets.

The metals have been very studied and their effects on health have been regularly reviewed by international bodies such as O.M.S. Exposure to metals continues and increasing in some parts of the world, particularly in less developed countries (Jarup, 2005).

Several studies have been made on the assessment of the impact of air pollutants on the various blood parameters and showed an increase of chromosomal aberrations and the rates of incidence of anemia primarily by the decline in the value globular (Scheneider *et al*., 1990). Several studies on particulate (particles of silver and carbon) administered intra-tracheal or inhalation have demonstrated that the shift of particles in the flow was very quickly (Driscol *et al*., 1997; Jarup, 2005).

Our results highlight a disturbance parameters after the third day of exposure to dust rejected by the steel complex in Annaba. It is also noted a decrease in the rate of hematocrit, hemoglobin and red blood cells in relation to the witnesses with a significant increase in the rate of white blood cells and lymphocytes in particular; Proving that the dust rejected by the steel complex possess the ability to alter cell functions and induce a pro-inflammatory response.

There has also been an increase in blood platelets during the period of treatment, this increase can thicken the blood and change the viscosity of the plasma (Peters *et al*., 1997; Pekkanen *et al*., 2000; Jarup, 2005).

CONCLUSION

Heavy metals are environmental pollutants is known for its effects particularly dangerous to human health. Because of their widespread use in many industries, they are everywhere in the air, in water and in soil. Exposure to contaminants can alter the immune, increasing this made the susceptibility of the disease; However, the immune system of mammals is important for maintaining health (Testud, 1997; Alain, 1998; Bard, 1999).

Previous studies done elsewhere in the world on laboratory animals have established a relationship between exposure causative air pollutants and respiratory diseases (Seaton *et al*., 1995; Atkinson *et al*., 1998; Bard, 1999; Schwartz, 1999; Pekkanen *et al*., 2000; Pelissier *et al*., 2000; Solodowska, 2004; Bai *et al*., 2007). The epidemiological association between exposure to lung ambient Particulate Matter (P.M.) and cardiovascular dysfunction is well known, but the systemic mechanisms that lead this effect remains unclear.

The epidemiological association between exposure to lung ambient Particulate Matter (P.M.) and the cardiovascular dysfunction is well known, but the systemic mechanisms that lead this effect remains unclear. Multiple studies on a wide range of geographical locations to indicate that an increase from 10 mg m^{-3} to ambient Particulate Matter (P.M.), the daily mortality rate is increased approximately 1-5% (Pope *et al*., 2002). A major concern is that despite the continued growth of the populations most likely, the mechanisms of increased morbidity and mortality related to particulate matter are largely unknown.

Several hypotheses have been advanced to explain how exposure to lung P.M. Can get a cardiovascular response. The most obvious proposes that the P.M. Filed in the lung is launching a local inflammatory response that develops in inflammatory response, characterized by changes in factors of blood and tissue cells associated with inflammation (Pekkanen *et al*., 2000; Brook *et al*., 2004; Nemmar *et al*., 2002; Oberdorster *et al*., 2004).

Metals represent a class of molecules. Some are purely toxic to living beings, other essential to the organization and maintenance of biological functions, generate toxic effects on the body, past a certain threshold concentration. In both cases, their accumulation within an organization is likely to trigger a reaction defense, which serve as a bio-marker for this type of contamination (Segale and Deloraine, 2001; Formigari *et al*., 2007).

Particulate pollution is a risk factor for mortality specific cause of cardiovascular disease through mechanisms that include probably pulmonary inflammation and accelerated atherosclerosis (Bai *et al*., 2007).

But the mix of metal concentrations in living beings, which is more akin to chemical analysis techniques used in conventional environmental monitoring, remains an indispensable step in a study in ecotoxicology (Ostro and Rothschild, 1989; Lu, 1992; Duke *et al*., 1997; Kodavanti *et al*., 1998; Desqueyraux, 2001; Solodowska, 2004).

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