Effects of Industrial Pollution on Nano Bio Systems and Its Remedies

Rohit Agarwal\textsuperscript{1}, V.K.Katiyar\textsuperscript{2}, Manish Sachan\textsuperscript{3}

\textsuperscript{1}Department of Industrial and Production Engineering, DIT, Dehradun, India-248009
\textsuperscript{2}Department of Mathematics, Centre for Nano Technology, IIT, Roorkee, India-247667.
\textsuperscript{3}Pollution Control Research Institute (PCRI) BHEL, Haridwar, India-249403.

Abstract

The paper includes the basic impact of nitrogen oxides on the lung nano bio system. The effect of nitrogen oxides is generally seen in the workers of the industries working under nitrogenous environment. The mostly effected part of their body is nano bio system of lungs. The study of such effect of nitrogen on the lungs is done. Also the mathematical modeling of the complete nano bio system is done. The modeling of the nano sized granules will help to treat the various lung problems in future.

Keywords: Nano Biosystem, Lungs, Pollution, NO\textsubscript{X}, Treatment.

1. Introduction

The one of the most important reason for the life on the earth is the atmosphere of gases. The environment of earth consists of excess of gases, but nitrogen is mostly found in it. Nitrogen does not harm human beings while present in the environment because of various other gases. It becomes harmful when it creates compounds with other elements such as oxygen and hydrogen. Out of those compounds the NO\textsubscript{X} are most harmful to humans as well as other animals (Environ. Sci. Technol 2006). Here NO\textsubscript{X} implies to the various types of oxides of nitrogen. “X” is the number of atoms of oxygen bonded with one atom of nitrogen in the molecule of oxide of nitrogen. There are 2 main oxides of nitrogen, present in the air and harmful, NO & NO\textsubscript{2}.

Since times several theories and treatments are being researched and modified to prevent and treat the diseases that occur due to this gaseous pollution. Several studies have shown that continuous exposure of human biosystem to small concentration of oxides of nitrogen is very harmful. Major diseases that occur due to this are Bronchoconstriction, Throat irritation, etc. The researches have shown the effects of heavy metals on lung functioning as well as the effects of ozone have also been introduced.

In our day-to-day life we all are exposed to different kind of pollutants. Our body consists of different enzymes which help in converting the harmful chemical compounds into nitrogenous waste. But even then sometimes our body gets affected with these pollutants. Through this paper, our objective is to discover the basic impact of Nitrogen Oxides on the health of human workers living near the industries and to apply mathematical model to the functioning of nano granules so as to help in the treatment of lung infection (K.A.D. Guzman et al. 2004).

1.1. Lung’s Nano Biosystem

The lungs contain the alveoli and alveoli consist of alveolar cells. The space between the lung’s alveolar cells is of the nano dimensions. Moreover the alveolar sac consists of small, nano sized
granule like structures. These structures help in the transport of gases (E.D. Kuempel et al. 2006). Thus lungs of a human being act as a Nano Biosystem for the transport of gases, as shown in figure 1.

![Respiratory System](image)

Figure 1: Classification of lungs up to the nano sized spores.

2. Procedure

2.1 Mathematical Modeling

The reduction in the granule mass in dm filter charge is directly proportional to the amount of granules, m, and after combination the equation can be derived as (Rasa Vaiškunaitė et al. 2005):

\[ m = m_0 e^{-at} \]  \hspace{1cm} (1)

Replacing the mass of the granules with the concentrations we get:

\[ C = C_0 e^{-at} \] \hspace{1cm} (2)

Now, assuming that the process is constant, i.e., independent of time span:

\[ V \left( \frac{\partial C}{\partial x} \right) + D \Delta C + \alpha C = 0 \] \hspace{1cm} (3)

Where \( C = C(x,y,z,t) \) is the granule concentration, \( V \) is the flow rate of alveolar fluid in lung cavity.
As granules move in the lung cavity at a rather high rate in the direction \( x \), the diffusion coefficient \( D \) in the equation might be discarded:

\[
V \left( \frac{\partial}{\partial x} C(x, y, z, t) \right) + \alpha C(x, y, z, t) = 0
\]  

(4)

When this equation is integrated, we get:

\[
C(x) = C_0 e^{\frac{\alpha x}{V}}
\]

(5)

Applying the law of conservation of mass the following equation can be obtained:

\[
\frac{1}{\varepsilon} \left( VC_{x1} - VC_{x2} \right) S \Delta t = [(C + \beta)_{t2} - (C + \beta)_{t1}] \varepsilon Z \Delta x
\]

(6)

Taking into consideration the granule infusion and considering \( \beta \) as a constant since it represents the absorption capacity of the lung alveoli, we get:

\[
V \frac{\partial C}{\partial x} = -\varepsilon^2 \frac{\partial C}{\partial t} + D \frac{\partial^2 C}{\partial x^2}
\]

(7)

The Solution of these equations gives us the path of nano sized granules before and after their combination with oxides of nitrogen.

3. Results and Discussion

With the continuous exposure to pollutants such as NO\(_X\) the functioning of lungs decreases slowly-slowly and hence the human health gets affected. The flow equations of the nano sized granule particles tells that they got a sudden decrease in their efficiency. The effect on nano sized granules concentration in the lung cavity is shown in figure 2 as compared to the nano filter mechanism.

Observing the equation and considering the values of diffusion coefficient and concentration of granules as researched and obtained previously, we can obtain the relationship between time, concentration and distance traveled by them.

The physical concept from which equations are derived is based on the classical diffusion transport mechanism. The theoretical predictions should be compared to the experimental data obtained in this work.

The flow of nano capsules had been solved using mathematical modeling. Also the cost of treatment of various lung diseases using nano particles will get reduced. Thus the method of treatment will become more effective.
Fig 2: Effect on granules concentration in lung cavity along with distance and time.

4. Conclusion

The presence of nitrogen oxide particles in the lung cavity causes the decrease in the functioning of granules. These granules further block the nano sized pores in the lung cavity. The reduced concentration of the granules is responsible for the various kinds of diseases found commonly in the workers living near the industries. The disease sometimes takes a very huge and unavoidable size and may even cause death. The paper could easily help in the treatment of various diseases through nano particles, i.e., nano capsules or nano filters. The paper can also help various industries in their problem of industrial ergonomics.

References

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