

Health and Environmental Effects of Sulphur Oxides- A Review

Pratibha Gawande¹, Dr. Jayant Kaware²

¹Datta Meghe College of Engineering and Technology, Airoli, Navi Mumbai, Akola Maharashtra, India

²Sant Gadgebaba Amravati University, Amravati Maharashtra, India

Abstract: *As our country dependable on fuels for energy uses which causes harmful effects on the environment, such as global warming, ozone, smog, and acid rain. In this paper there is review on causes of sulphur dioxide formation and their harmful effects on environment and human health. This study focuses on to overview the harmful effect of sulphur and sulphur dioxide on human health. Air pollution is one of the major health problems confronting humans today.*

Keywords: Air pollution, sulphur dioxide, acid rain, global warming

1. Introduction

Sulfur dioxide is one of a group of highly reactive gases known as sulfur oxides. Sulphur oxides are emitted from locomotives, ships, wood pulping, paper manufacturing, petroleum and metal refining metal smelting and fossil fuel combustion. Adverse respiratory effects including leads to difficulty in breathing, asthma. Negative impacts of SO₂ gas on humans include irritation of the skin, tissues and mucus membranes of the eyes, nose, and throat. Sulphur dioxide is one of the important components causing acid rain which leads to acidification of water reservoirs, damages to tree and soil. Sulfur dioxide is a colorless gas having pungent odor. Density of Sulfur dioxide with respect to air is 2.26 g/L. It has solubility of 10 g/L in water at 20°C and is soluble in alcohol, acetic acid, and sulfuric acid. Sulfur dioxide is corrosive to organic materials. SO₂ pollution is more harmful when particulate and other pollution concentrations are high. The World Health Organization recommends a concentration of no greater than 0.5 parts per million over 24 hours for maximum exposure. Reducing the sulphur content in fuels which has a direct effect on the emission of sulphur to the air to the benefit of natural ecosystems.

2. Review on Health and Environmental Effects of Sulphur Oxides

Yousef was studied Gaseous Pollutants Formation and Their Harmful Effects on Health and Environment. The scientific reasoning for the gaseous pollutant formation and their harmful effects on human health and environment, including biological effects of thermal pollution relevant to combustion processes was discussed by author [1]. Sergey Ushakov et.al. Effects of high sulphur content in marine fuels on particulate matter emission characteristics. Authors were studied and presented results on the effect of high sulphur content in marine fuels on particle emission characteristics, as measured on diesel engine exhaust, and revealed a high correlation between fuel sulphur levels and the number and mass of emitted particulates [2]. Chinese Sulphur Dioxide Emissions and Local Environment Pollution was reviewed by Haradhan Kumar Mohajan. Author was studied on effect of Environment Pollution on Chinese health and surrounding. He was noticed that at

present China becomes the highest SO₂ emitter in the world due to its reliance on coal for energy generation [3]. Anita Singh et.al reviewed on Acid rain and its ecological consequences. Authors were reviewed on Effects of acid rain on materials and building Effects of acid rain on lower plants Control of acid rain [4]. An emission inventory of sulfur from anthropogenic sources in Antarctica was reviewed by Shirsat and Graf. Authors were reviewed on results of a comprehensive emission inventory of chemical species from anthropogenic activities like aircraft, vehicles, ships, power generation in Antarctica, from period of 2004–2005 on the basis of estimated emission rates of fuel consumption provided by some of the Antarctic research stations [5].

A.K. Dwivedi and B. D. Tripathi were studied on. Pollution tolerance and distribution pattern of plants in surrounding. They were investigated the vegetation composition around coal-fired industries i.e. brick industries. Authors were reported Higher concentration of SO₂ and particulate matters in surrounding areas of coal-fired industries which influences the distribution pattern of plants [6]. Review on effects of Particulates, Sulfur Dioxide and Nitrogen Dioxide on Human Health was reviewed by Rahila Rahman Khan and M.J.A. Siddiqui. Authors were studied the hazardous effect of air pollutants like particulate, sulfur dioxide and nitrogen dioxide on human health which cause different adverse health effect [7]. Andrew Read reviewed on Sulphur Dioxide and its effects on Health in Canada. Author was done research on the basis for setting a Canadian Ambient Air Quality Standard for SO₂ to improve air quality and reduce health risks [8].

Control of sulfur oxides was reviewed by S. Zandaryaa and A. Buekens. Authors were reviewed on various technologies available for controlling emissions of sulfur oxides and processes for reducing SO_x emissions like clean fuels, cleaning sulfur-containing fuels, and flue gas desulfurization techniques [9]. Occupational health and safety risks associated with sulphur dioxide was studied by C.J. Badenhorst. Author was studied health effects of exposure to SO₂ and protection against its ill health effects [10]. Lawan Gana Ali, Abubakar Haruna were studied on Effects of Primary Air Pollutants on Human Health and Control

Volume 6 Issue 6, June 2017

www.ijsr.net

Licensed Under Creative Commons Attribution CC BY

Measures-A Review Paper. Authors were discussed on the effects of air pollution upon human health with emphasis on primary air pollutants. They were also reviewed on air pollution problem due to sources like primary air pollutants, nitrogen oxides Carbon monoxide Particulate material, Sulphur dioxide, Volatile organic compounds, Radon and Lead and their upon human health [11]. Ecological consequences of the Acid rain was reviewed on Dr. Sunita Bhargava and Sharad Bhargava. Authors were studied on most serious environmental problems caused by Acid rain and causes of acid rain [12].

M. Nyborg J. Crepin, D. Hocking, J. Baker, was studied the effect of sulphur dioxide on precipitation and on the sulphur content and acidity of soils in Alberta, Canada. Authors were studied and reviewed on acidification of soil and amount of sulphur deposition by dry fallout ph and SO₄-S in wet fallout and other ways of deposition of SO₂ emission[13]. Khan, M. K, S. R. Gilani, K. P. Bhatti was reviewed on Polluted Air Quality Component Analysis from Stack Emission and its Hazardous Consequences on Human Health. They were designed to monitor for estimation of Nitrogen Oxides, Sulphur oxides and Particulate Matter. Then they were correlates that with climate parameters and check its hazards effect on human health[14]. Dragan Ljevaja was studied Impact of emissions of marine diesel engines to air pollution on the example of the yugoslav river shipping. Author was studied actual condition of the fleet, as well as the impact it has on air pollution in Serbia, as a country which plans to become a member of the European Union[15].

Jerzy Merkisz, Milosław Kozak, Piotr Bielaczyc, Andrzej Szczołka were investigated influence of diesel fuel sulphur content on particulates emissions from direct injection common rail diesel vehicle. Authors were carried out research on particulate emissions from direct-injection common- rail diesel vehicle fuelled with research fuels of differing sulphur content [16]. Liu Guijian, Peng Zicheng, and Yang Pingyue carried out review on Sulfur in Coal and Its Environmental Impact from Yanzhou Mining district, china. On the basis of this authors were analysed distribution and concentrations of sulphur and they also described the variation of sulphur and its impact on the environments when coal was used [17]. Liblik, Kaasik, Pensa, Ratsep, Rull, Tordik were studied on reduction of sulphur dioxide emissions and transboundary effects of oil shale based energy production. Authors were investigated a new combustion technology of oil shale circulating fluidized bed process in the Estonian and Baltic Power Plants in an efficient way to reduce the emissions of SO₂ from electric energy production in Estonia[18]. Health Effects Of Sulfur Oxides was reviewed by David P. RaI. Authors were studied the pollution in the air. Authors were reviewed on cause and effect relationship between exposure to sulfur oxides and adverse health consequences and the relationship between sulfur oxides exposure and coats in terms of impaired health[19]. Vehicular Pollution, Their Effect on Human Health and Mitigation Measures was studied by Shivaji Bhandarkar. Author was concluded that The pollution level can be minimized by the use of innovative and technical methods as well as the alternative fuels[20].

Marilena Kampa and Elias Castanas were studied human health effect of air pollution. Authors were also studied the beneficial effect of mediterranean type diet on human health[21]. Carl Setterstrom was studied Effects of Sulfur Dioxide on Plants and Animals. Authors were studied the Effect of Low Concentrations of Sulfur Dioxide on Yield of Alfalfa and the Factors Influencing Susceptibility of Plants to Sulfur Dioxide Injury, Effects on Animals of Prolonged Exposure to Sulfur Dioxide[22]. J. Heyder, I. Beck-Speier, B. Busch, G. A. Ferron, E. Karg, W. G. Kreyling, A.-G. Lenz, K. L. Maier, H. Schulz, S. Takenaka and A. Ziesenis were studied the health effects of sulphur-related environmental air pollution and the role of acidic aerosols. Authors were concluded that acidic aerosols may be less hazardous than suspected and a final interpretation of the response pattern induced by sulphur IV and hydrogen ions can only be given when the pulmonary response pattern induced by hydrogen ions was known[23]. Mechanisms and Effects of Acid Rain on Environment was studied by Wondyfraw M. Author was studied mechanisms and effects of air pollution on atmosphere. He was observed that sulphur oxides and gas oxides reacted with water throughout rain and as gases or fine particles[24]. Human Health Effects of Air Pollution was studied by Lawrence J. Folinsbee. Authors were studied air pollution and its effects on human body. Author was observed that air pollutants have been shown to cause responses ranging from reversible changes in respiratory symptoms and lung function, changes in airway reactivity and inflammation [25].

Biochemical and cytological effects of sulphur dioxide on plant metabolism was reviewed by S.S. Malhotra and D. Hocking. Authors were studied biochemical effects of sulphur dioxide arise from its unique ability to act as an oxidizing or a reducing agent [26]. Effect of sulphur dioxide on growth, chlorophyll and sulphur contents of tomato was investigated by S. K. Padhi, M. Dash and S. C. Swain. Authors were studied the direct toxic effect of atmospheric pollutant such as sulphur dioxide on plants. They were find out the possible extent of adaptability of tomato in SO₂ emission of our state [27]. Vehicular Pollution, Their Effect on Human Health and Mitigation Measures was studied by Shivaji Bhandarkar. Authors were concluded that the pollution level can be minimized by the use of innovative and technical methods as well as the alternative fuels. If so, the health ailments caused by these pollutants can be reduced significantly[28].

3. Conclusion

It has been seen from various literatures that primary air pollutants have serious effects on human health such as cardiovascular problems like asthma, emphysema and other life-threatening ailment like cancer. Air pollution also causes acid rain, green house effects so adversely affect on environment. So the practices which can minimize air pollution should be used. In view of these problems, stringent legislations and enforcement of the use of emissions filtering devices by governments and world nations can help in minimizing air pollution effects to the minimum.

References

- [1] Yousef S. H. Najjar, "Review Article Gaseous Pollutants Formation and Their Harmful Effects on Health and Environment", *Innovative Energy Policies* Vol. 1, pp.1-8, 2011.
- [2] Sergey Ushakov, Harald Valland, Jorgen B Nielsen & Erik Hennie, "Effects of high sulphur content in marine fuels on particulate matter emission characteristics", *Journal of Marine Engineering & Technology*, Volume 12, pp.30-39, 2013.
- [3] Haradhan Kumar Mohajan "Chinese Sulphur Dioxide Emissions and Local Environment Pollution", *International Journal of Scientific Research in Knowledge*, 2(6), pp. 265-276, 2014.
- [4] Anita Singh and Madhoolika Agrawal, "Acid rain and its ecological consequences", *Journal of Environmental Biology*, 29(1) pp. 15-24, 2008.
- [5] S. V. Shirsat and H. F. Graf, "An emission inventory of sulfur from anthropogenic sources in Antarctica", *Atmos. Chem. Phys.*, 9, pp.3397-3408, 2009.
- [6] A.K. Dwivedi and B. D. Tripathi, "Pollution tolerance and distribution pattern of plants in surrounding area of coal-fired industries", *Journal of Environmental Biology*, 28(2) ,pp.257-263, 2007.
- [7] Rahila Rahman Khan and M.J.A. Siddiqui, "Review on effects of Particulates; Sulfur Dioxide and Nitrogen Dioxide on Human Health ", *International Research Journal of Environment Sciences*, Vol. 3(4), PP.70-73, 2014.
- [8] Andrew Read, "Sulphur Dioxide and Health", Summary of recent findings from Health Canada, pp.1-5, 2016.
- [9] S. Zandaryaa and A. Buekens, "Control of sulphur oxides", *Pollution control technologies* Vol. II, pp.124-152.
- [10] C.J. Badenhorst, "Occupational health and safety risks associated with sulphur dioxide", *Journal of The Southern African Institute of Mining and Metallurgy*, Volume 107, pp.299-303, 2007.
- [11] Lawan Gana Ali, Mai Idris Aloomaa, "Effects of Primary Air Pollutants on Human Health and Control Measures- A Review", *Journal of Innovative research and development*, pp.45-55, 2015.
- [12] Dr. Sunita Bhargava, Sharad Bhargava, "Ecological consequences of the acid rain", *Journal of Applied Chemistry* Volume 5, Issue 4, PP 19-24, 2013 .
- [13] M.Nyborg and Crepin, "Effect of sulphur dioxide on precipitation and on the sulphur content and acidity of soils in Alberta, Canada", pp. 767-777.
- [14] Khan, Gilani, Bhatti, "Polluted Air Quality Component Analysis from Stack Emission and its Hazardous Consequences on Human Health", *Pakistan Journal of Meteorology* Vol. 12, Issue 23: Jul, pp.13-24, 2015.
- [15] Dragan Ljevaja, "Impact of Emissions of Marine Diesel Engines to Air Pollution on the Example of the Yugoslav River Shipping", *International Journal for Traffic and Transport Engineering*, 1(3): 149 - 157, 2011.
- [16] Jerzy Merkisz, Miłostaw Kozak, "An investigation of influence of diesel fuel sulphur content on particulates emissions from direct injection common rail diesel vehicle", *Journal of Kones Internal Combustion Engines* No. 3-4 ISSN 1231 - 4005, pp 214-223, 2002.
- [17] Liu Guijian, Peng Zicheng, Yang Pingyue, "Sulfur in Coal and Its Environmental Impact from Yanzhou Mining District, China", *Chinese journal of geochemistry*, Vol 20 No. 3, pp274-281, 2001
- [18] Liblik, Kaasik, Pensa, Ratsep, Rull, Tordik, "Reduction of sulphur dioxide emissions and transboundary effects of oil shale based energy production", *Oil Shale*, Vol. 23, No. 1, pp. 29-38, 2006 .
- [19] David P. Rall "Review of the Health Effects of Sulfur Oxide ", *Environmental Health Perspectives* Vol. 8, pp. 97-121, 1974.
- [20] Simona Petruzzi, Barbara Musi, Giorgio, Bignami, "Acute and chronic sulphur dioxide exposure an overview of its effects on humans and laboratory animals", *Ann, 1st super sanita*, volume 30, no. 2, pp. 151-156, 1994.
- [21] Marilena Kampa, Elias Castanas, "Human health effects of air pollution", *Science Direct, Environmental pollution*, 151, pp. 362-367, 2008.
- [22] Carl Setterstrom, "Effects of Sulfur Dioxide on Plants and Animals", *Industrial, and engineering chemistry* vol. 32, no. 4, pp. 473-479, April, 1940
- [23] J. Heyder, I. Beck-Speier, B. Busch, G. A. Ferron, E. Karg, W. G. Kreyling, A.G. Lenz, K. L. Maier, H. Schulz, S. Takenaka and A. Ziesenis, "Health effects of sulphur-related environmental air pollution the role of acidic aerosols", *Ann. occup. Hyg.*, Vol. 41, Supplement 1, pp. 39-42, 1997.
- [24] Wondyfraw, "Mechanisms and Effects of Acid Rain on Environment", *J Earth Sci Clim Change*, pp.1-3, 2014.
- [25] Lawrence J. Folinsbee "Human Health Effects of Air Pollution", *Environmental Health Perspectives* Vol. 100, pp. 45-56, 1992.
- [26] S.S. Malhotra, D. Hocking, "Biochemical and cytological effects of sulphur dioxide on plant metabolism", *New Phytol*, pp. 227-237, 1976.
- [27] S. K. Padhi, M. Dash, S. C. Swain, "Effect of sulphur dioxide on growth, chlorophyll and sulphur contents of tomato", *European Scientific Journal*, edition vol. 9, No. 36, pp 465-471, December 2013
- [28] Shivaji Bhandarkar, "Vehicular Pollution, Their Effect on Human Health and Mitigation Measures", *Vehicle Engineering (VE)* Volume 1 Issue 2, pp 33-40 June 2013.