Research Paper CHEMISTRY

Ozone Depletion And Montreal Protocal

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ABSTRACT

Ozone depletion is an international issue of concern for the environmental system that directly affects the ecolological process. Ozone depletion occurs when the natural balance between the production and destruction of stratospheric ozone is tipped in favour of destruction.

Man-made compounds such as CFCs are now accepted as the main cause of this ozone depletion. Important measure were the need of the hour, so Montreal protocol was adopted in 1987 as an international treaty to eliminate the production and consumption of ozone-depleting chemicals namely, Chlorofluorocarbons (CFCs), Halons, other fully Halogenated CFCs.

KEYWORDS : OZONE LAYER, OZONE DEPLETION AND MONTREAL PROTOCAL

INTRODUCTION

The ozone layer is a layer in Earth's atmosphere which contains relatively high concentrations of ozone (O3). This layer absorbs 93-99% of the sun's high frequency ultraviolet light, which is potentially damaging to life on earth. Over 91% of the ozone in Earth's atmosphere is present here. It is mainly located in the lower portion of the stratosphere from approximately 10 km to 50 km above Earth, though the thickness varies seasonally and geographically. The ozone layer was discovered in 1913 by the French physicists Charles Fabry and Henri Buisson. Its properties were explored in detail by the British meteorologist G. M. B.Dobson, who developed a simple spectrophotometer (the Dobson meter) that could be used to measure stratospheric ozone from the ground. The buildup of oxygen in the atmosphere led to the formation of the ozone layer in the upper atmosphere or stratosphere. This layer filters out incoming radiation in the "cell-damaging" ultraviolet (UV) part of the spectrum. Thus with the development of the ozone layer came the formation of more advanced life forms. Ozone is a form of oxygen. The oxygen we breathe is in the form of oxygen molecules (O2) - two atoms of oxygen bound together. Normal oxygen which we breathe is colourless and odourless. Ozone, on the other hand, consists of three atoms of oxygen bound together (O3). Most of the atmosphere's ozone occurs in the region called the stratosphere. Ozone is colourless and has a very harsh odour. Ozone is much less common than normal oxygen. Out of 10 million air molecules, about 2 million are normal oxygen, but only 3 are ozone. Most ozone is produced naturally in the upper atmosphere or stratosphere. While ozone can be found through the entire atmosphere, the greatest concentration occurs at altitudes between 19 and 30 km above the Earth's surface. This band of ozone-rich air is known as the "ozone layer (Sivasakthivel & reddy 2011).

CAUSES OF OZONE DEPLETION

Ozone depletion occurs when the natural balance between the production and destruction of stratospheric ozone is tipped in favour of destruction. Although natural phenomena can cause temporary ozone loss, chlorine and bromine released from man-made compounds such as CFCs are now accepted as the main cause of this depletion (Angell &. J. Korshover 2005). It was first suggested by Drs. M. Molina and S. Rowland in 1974 that a man-made group of compounds known as the chlorofluorocarbons (CFCs) were likely to be the main source of ozone depletion. However, this idea was not taken seriously until the discovery of the ozone hole over Antarctica in 1985 by the Survey. Chlorofluorocarbons are not "washed" back to Earth by rain or destroyed in reactions with other chemicals. They simply do not break down in the lower atmosphere and they can remain in the atmosphere from 20 to 120 years or more. As a consequence of their relative stability, CFCs are instead transported into the stratosphere where they are eventually broken down by ultraviolet (UV) rays from the Sun, releasing free chlorine. The chlorine becomes actively involved in the process of destruction of ozone. The net result is that two molecules of ozone are replaced by three of molecular oxygen, leaving the chlorine free to repeat the process:

$Cl + O3 = ClO + O2$

$ClO + O = Cl + O2$

Ozone is converted to oxygen, leaving the chlorine atom free to repeat the process up to 100,000 times, resulting in a reduced level of ozone. Bromine compounds, or halons, can also destroy stratospheric ozone. Compounds containing chlorine and bromine from man-made compounds are knownas industrial halocarbons. Emissions of CFCs have accounted for roughly 80% of total stratospheric ozone depletion. Thankfully, the developed world has phased out the use of CFCs in response to international agreements to protect the ozone layer. However, because CFCs remain in the atmosphere so long, the ozone layer will not fully repair itself until at least the middle of the 21st century. Naturally occurring chlorine has the same effect on the ozone layer, but has a shorter life span in the atmosphere.

MONTREAL PROTOCOL

The Montreal Protocol on Substances that Deplete the Ozone Layer was adopted in 1987 as an international treaty to eliminate the production and consumption of ozone-depleting chemicals namely, Chlorofluorocarbons (CFCs), Halons, other fully Halogenated CFCs, Carbon Tetrachloride, Methyl Chloroform, Hydro-chlorofluorocarbons (HCFCs) and Methyl Bromide, over a period of 50 years (starting from the mid '90s to the year 2040). The Montreal Protocol identified both first generation and second generation ozone- depleting substances .The treaty was designed to restore the ozone layer by ending production of ODSs and by encouraging alternative substitutes through a systemic phase- out. Globally, there has been equally significant progress, and a complete phase- out (including within developing countries) of ODSs is expected to occur by 2040. Assuming the current trajectory is maintained, scientists project that the Antarctic ozone layer may revert to pre- 1980 levels somewhere between 2060 and 2075 (EPA, 2007). 1985 the Vienna Convention established mechanisms for international co-operation in research into the ozone layer and the effects of ozone depleting chemicals (ODCs). 1985 also marked the first discovery of the Antarctic ozone hole. On the basis of the Vienna Convention, the Montreal Protocol on Substances that Deplete the Ozone Layer was negotiated and signed by 24 countries and by the European Economic Community in September 1987. The Protocol called for the Parties to phase down the use of CFCs, halons and other man-made ODCs. The Montreal Protocol represented a landmark in the international environmentalist movement. For the first time whole countries were legally bound to reducing and eventually phasing out altogether the use of CFCs and other ODCs. Failure to comply was accompanied by stiff penalties. The original Protocol aimed to decrease the use of chemical compounds destructive to ozone in the stratosphere by 50% by the year 1999. The Protocol was supplemented by agreements made in London in 1990 and in Copenhagen in 1992, where the same countries promised to stop using CFCs and most of the other chemical compounds destructive to ozone by the end of 1995. Fortunately, it has been fairly easy to develop and introduce compounds and methods to replace CFC compounds. In order to deal with the special difficulties experienced by developing countries it was agreed that they would be given an extended period of grace, so long as their use of CFCs did not grow significantly. China and India, for example, are strongly increasing the use of air conditioning and

cooling devices. Using CFC compounds in these devices would be cheaper than using replacement compounds harmless to ozone. An international fund was therefore established to help these countries introduce new and more environmentally friendly technologies and chemicals. The depletion of the ozone layer is a worldwide problem which does not respect the frontiers between different countries. It can only be affected through determined international co-operation.

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