The Atmosphere's Invisible Detergent

The air you breathe may often be very polluted, which you can clearly understand from the burning sensation in your throat. So how does the air become polluted and, most importantly, how is it cleaned?

Particularly in densely populated areas, various substances are constantly released into the air. Factories emit smoke, poisonous gases are released from exhausts, gas accumulates in swamps, volcanoes erupt… As a result of all these, factors such as methane, carbon monoxide and large amounts of vapor continuously rise into the sky, while particles such as dust, soot and smoke also mix with the air. Some of these solid particles have a diameter smaller than 2.5 micrometers, meaning that they are approximately 20 to 30 times thinner than a strand of hair. These particles are so small that as their numbers increase, the air appears hazy. Moreover, since they can easily reach deep into our lungs (the alveoli) and travel through our bodies, they may be dangerous to our health.

Let us consider: What would happen if all these gases and pollutants simply accumulated one on top of another in the atmosphere? The air we breathe would gradually turn into poison, every breath would make us increasingly uncomfortable and eventually suffocate us. Yet this does not happen, and the air continues to remain clean. This means that even though we cannot see it and may never have thought about it, there is a system that silently cleans that air day and night and removes harmful molecules from the atmosphere. So how did this system come into being? By whom was it arranged, and what are its details? The answers to these questions lead us to the existence of an exciting protection, a very powerful design and a Creator.

When sunlight (UV) touches ozone and water vapor in the sky, a molecule that is too small to be seen with the naked eye and extremely prone to reaction emerges. This short-lived yet highly reactive molecule constantly reacts with harmful particles and gases and transforms them into a form that will remove them from the atmosphere through precipitation, namely water-soluble compounds, thus acting almost like a detergent and cleaning the air.

The name of this invisible detergent is the **"hydroxyl radical"**; OH for short…

The hydroxyl radical instantly oxidizes and transforms volatile compounds and gases such as methane, isoprene, carbon monoxide and carbon dioxide, and prevents them from harming the atmosphere. OH is present in the air in very small quantities and lives for only a tiny fraction of a second. The more active a radical is, the more rapidly and indiscriminately it attempts to bond with the molecules around it. OH is also highly active and attacks most of the pollutant gases in the air, begins to break them down and thus oxidizes these gases, enabling them to be removed from the atmosphere. For this reason, scientists have called OH **"the detergent of the atmosphere."**



The Sun, ozone and water vapor

How Do a Few Molecules per Trillion Clean the Air?

Let us carefully consider the measurement we will now give. OH is present in the air at the level of a few molecules per trillion and can exist for only a very small fraction of a second. How such a low-concentration and very short-lived molecule can accomplish a task on a planetary scale, and one of vital importance at that, is a subject that must be examined with amazement and care.

The way this molecule works is also admirable. It is produced instantly by sunlight; it performs its task and disappears. It does not accumulate anywhere. Its raw materials are three things already present in the sky: sunlight, water and ozone. It also adjusts its amount, as it were, by itself. When the workload increases in one part of the system, its production changes accordingly. In other words, a minute, short-lived, self-renewing cleanser is adjusted in such a way as to keep the quality of the air within the limits of life.

Let us think objectively. Man makes filters and catalytic converters, yet still has difficulty keeping the air of even a single city clean. The atmosphere, however, carries out purification on a planetary scale with a molecule that cannot be stored in any depot. Moreover, it reproduces that molecule at every moment by means of sunlight, everywhere at the same time, free of charge and ever since air and life have existed…

This admirable order leads people who know how to think to a very important question. How did this order come into existence?

An Order Preserved with a Delicate Balance

How is the atmosphere continuously cleaned by a substance that is self-produced and self-limiting? Such a magnificent and delicate setup requires a calculation too subtle for chance to accomplish. There is a very clear measure, artistry and purpose here. Every work of art introduces its own artist. Such magnificent orders that we see in nature also introduce us to God, our Creator,

Of course, the OH molecule is not unlimited either. When burdens such as methane and carbon monoxide increase excessively, this cleaning capacity is strained, but this limit has also been created for a reason. It shows that a balance and measure have been established in the system. Scientists continue to research this atmospheric multiphase oxidation chemistry.

The atmosphere's self-cleaning property is not the only example of balance in the sky. In the upper layers, the ozone layer filters the Sun's harmful ultraviolet rays and protects life on Earth; interestingly, that same ozone is the source of the formation of the hydroxyl radical in the lower layer. Through evaporation and precipitation, the water cycle both humidifies and washes the air.

Through photosynthesis, green plants absorb carbon dioxide and release oxygen, thus keeping the composition of the air we breathe stable. Although all these invisible processes appear to operate separately, they unite in a single harmony and make our planet habitable.



Precipitation and the atmosphere

As far as we have summarized here, the air we will take in with our next breath is cleaned for us, as if by an invisible hand, by a molecule that makes use of sunlight and water, continuously and without our ever being aware of it. It is Almighty God Who established this perfect system, protects us at every moment, makes the sky a well-guarded canopy above us and created everything. Our Lord has created the sky both as a protective roof for us and as an incomparable setting for the many balances that sustain our lives. What we must do is look at this subtle artistry with every breath, comprehend His greatness and that He has no equal, and give thanks to God.

> "We made the sky a preserved and protected roof yet still they turn away from Our Signs." (Surat al-Anbiya, 32)

Sources

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