New, Energy Efficient Method to Extract Noble Gases from Air

By Alex Berezow, PhD — August 3, 2016

Located on the far right-hand side of the periodic table, the noble gases krypton and xenon serve practical and important purposes. Both are used in lighting, for instance. Xenon is the more useful of the two, having additional applications in medicine and nuclear technology.

Unlike natural gas, which is abundantly found in the ground, krypton and xenon make up just a tiny fraction of Earth's atmosphere. To harvest them, the gases must undergo multiple rounds of an energy intensive process called cryogenic distillation, in which air is trapped and cooled to about -300 degrees F. This extreme refrigeration separates the gases based on their boiling points.

A new technique to harvest krypton and xenon that would save energy, and hence money, is highly desired. Now, researchers believe they have found just such a technique, and their method is detailed in the Journal of the American Chemical Society.

The team synthesized silicoaluminophosphate (SAPO), a crystal that contains very tiny pores. Serendipitously, the size of the pores is midway between the size of krypton atoms and xenon atoms. The smaller krypton atoms can easily sneak through the pores, while the larger xenon atoms get stuck. In this way, SAPO acts as a molecular sieve. (See figure.)
Using their new tool, the authors showed that krypton diffused up to 45 times faster than xenon, demonstrating its efficacy at separating these noble gases at room temperature. Further experiments revealed that not only did xenon have a harder time squeezing through the tiny pores, but it also tended to adsorb to the SAPO crystals.

In an interview with ACSH, the authors say that analyses they have conducted previously suggest that their technique could reduce the energy required to harvest krypton and xenon by about 30%. If that is true, then both industrial scientists and fluorescent light enthusiasts will have much to celebrate.

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