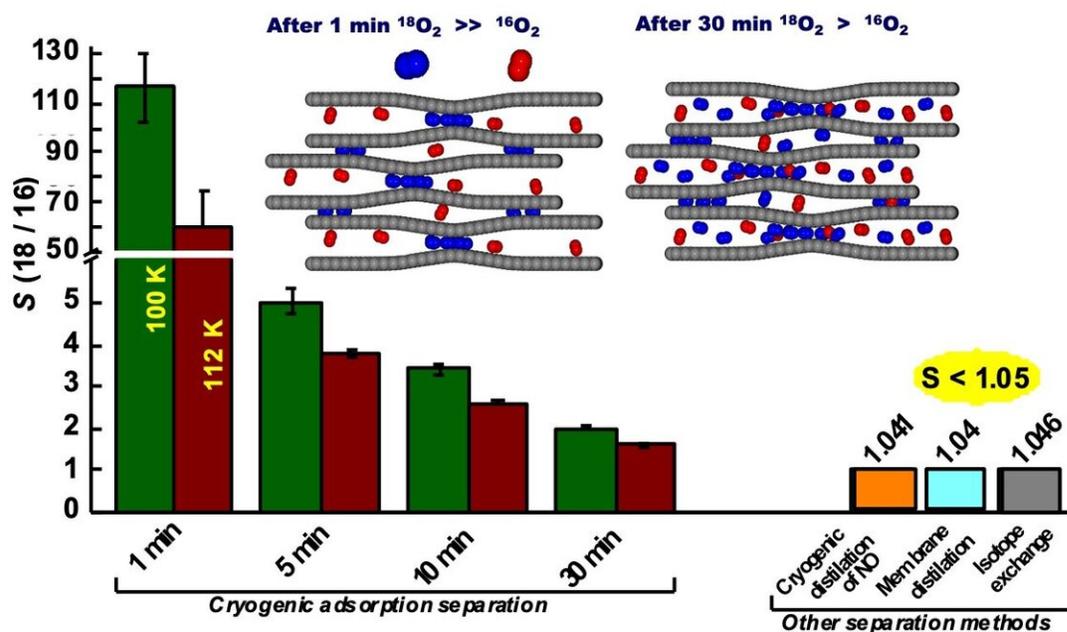


An efficient method for separating O-18 from O-16, essential for use in cancer treatment

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Time Dependence of Selectivity ($^{18}\text{O}_2/^{16}\text{O}_2$) for CDC at 100 K and 112 K



Comparison of S at different times at 100°K and 112°K for the CDC in this work with other separation methods from the literature. The inset shows illustrative models for the pore filling of CDC by O_2 -16 and O_2 -18 molecules after 1 min and 30 min. Credit: Copyright 2021, *Nature Communications*,

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Positron Emission Tomography (PET) plays a major role in the early detection of various types of cancer. A research group led by Specially Appointed Professor Katsumi Kaneko of the Research Initiative for Supra-Materials (RISM), Shinshu University have discovered a method to separate oxygen-18 from oxygen-16, an essential isotope for PET diagnosis, at high speed and high efficiency. The results of this research were recently published online in the journal *Nature Communications*.

The novel method for the rapid and efficient separation of ^{18}O from $^{16}\text{O}_2$, which is abundant in the atmosphere, was carried out with nanoporous carbon, which is made of pores smaller than 1 nanometer. When a mixture of $^{16}\text{O}_2$ and $^{18}\text{O}_2$ is introduced into the nanoporous carbon, the $^{18}\text{O}_2$ is preferentially adsorbed and is efficiently separated from $^{16}\text{O}_2$. The experimental separation of $^{18}\text{O}_2$ from $^{16}\text{O}_2$ was also conducted using the low-temperature waste heat from a natural gas storage facility.

^{18}O plays a major role in the early detection of cancer. Taking advantage of the property of cancer cells which take up much more glucose than [normal cells](#), doctors inject a drug called ^{18}F -FDG (fluorodeoxyglucose), which is an index of glucose metabolism and uses a PET machine to clarify which part of the body has cancer. ^{18}F -FDG is a drug in which fluorine-18 (^{18}F), which emits positive electricity, is attached to glucose. ^{18}F -FDG is produced by a [nuclear reaction](#) in which ^{18}O is introduced before the protons are injected. Therefore, ^{18}O is an important substance indispensable for PET diagnosis but was difficult to procure because only 0.2% of naturally occurring oxygen is O-18. In order to separate ^{18}O from the majority of ^{16}O found in the atmosphere, it was necessary to distill ^{18}O from ^{16}O , even though they have very

similar boiling points. This distillation required precise technology and took more than 6 months to complete.

The novel method using nanoporous carbon to distill ^{18}O can be used not only for PET diagnosis but for research on dementia, and this novel method can be applied to the separation of [carbon](#) and nitrogen isotopes, and other molecules useful for isotopic analysis methods and therapeutic [cancer](#) drugs. The group expects more demand for this method and substance in the future.

More information: Sanjeev Kumar Ujjain et al, Adsorption separation of heavier isotope gases in subnanometer carbon pores, *Nature Communications* (2021). [DOI: 10.1038/s41467-020-20744-6](https://doi.org/10.1038/s41467-020-20744-6)

Provided by Shinshu University

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