Zeolites play an important role in a cleaner and safer environment

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ASX:ZEO

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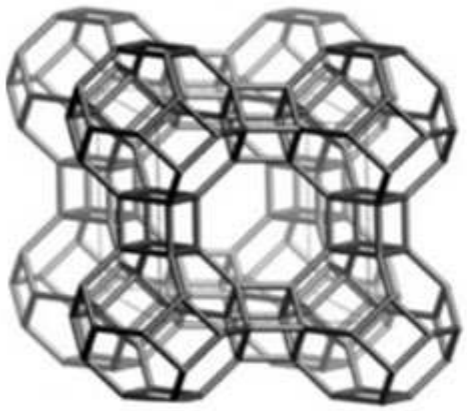
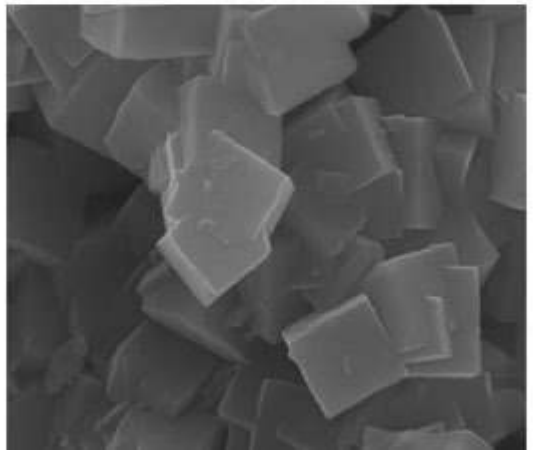
What are synthetic zeolites?

Synthetic zeolites are manufactured aluminosilicate minerals with a sponge-like structure (frameworks), made up of tiny pores that make them useful as adsorbents, catalysts and ultrafine filters.

They can be designed to selectively adsorb molecules or ions dependant on their unique construction and have the ability to be regenerated over and over again for re-use (recycled).



uniform / porous framework



zeolite type A
LTA / 4A

molecular sieve
powder

molecular sieve
beads / pellets

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Synthetic zeolite uses?

Zeolites act much like a magnet that can hold cations, like heavy metal, ammonia, low level radioactive elements, toxins, petrochemicals, many different types of gases and a multitude of various solutions.

Zeolites are remarkable materials, which are used in a wide range of commercial / industrial applications.

Diverse commercial applications:

- Energy sector
- Environmental management solutions
- Sustainable food production

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Zeolites can capture and release CO_2

Zeolites work by adsorbing 'basically sticking to' carbon dioxide molecules similar to the way odours can be captured by charcoal filters in our refrigerators.

Zeolites can capture 'adsorb' CO_2 while allowing other substances through and then under certain conditions release "desorb" CO_2

Zeotech (UQ) Carbon Capture Program:

- Evaluating different types of zeolites on adsorption and selectivity of CO_2
- Build a database on properties of adsorbents (porosity, microporous structure and specific surface area)
- Obtain information for the development / design of the DAC process flow
- Apply Zeotech patent-pending low-cost zeolite synthesis technology to deliver commercial CO_2 Gas Separation products, which are in use today
- Explore direct air capture solution / potentially linking into a range of (existing) CO_2 storage solutions
- Explore the catalytic capabilities of synthetic zeolites, to promote conversion of CO_2 into useable / commercial gases

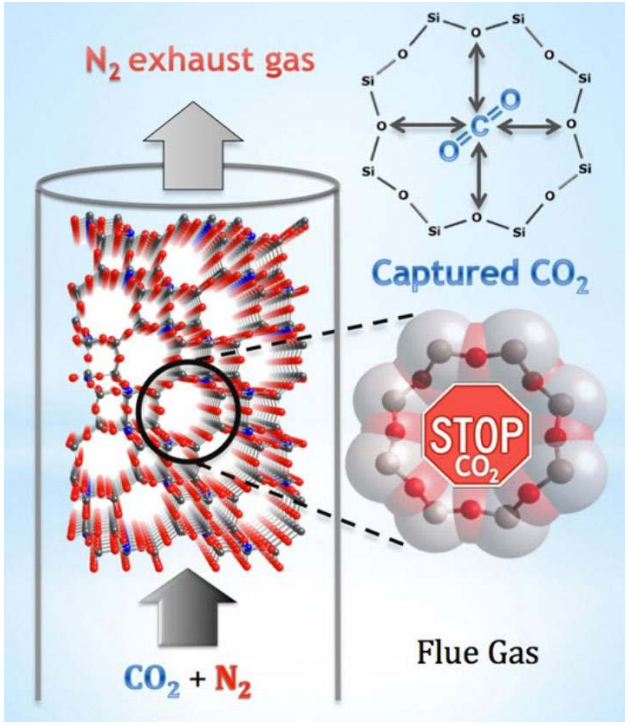

image source: phy.org news
https://phys.org/news/2012-02-octagonal-window-opportunity-carbon-capture.html

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Cleantech for the lithium refinery sector

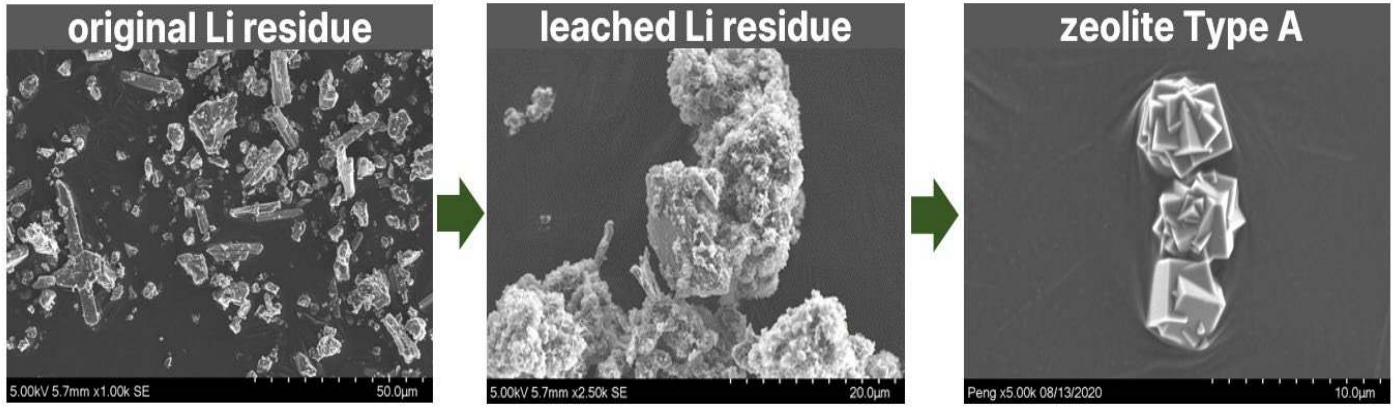
As lithium battery demand grows its anticipated that the lithium refinery sector will produce significant amounts of lithium process residue, hence innovative cleantech solutions are needed.

Zeotech has successfully produced pure Linde Type A zeolite (LTA) under a novel patent-pending process flowsheet from leached spodumene residue.

Zeotech has produced commercial grade

- zeolite Type 4A
- molecular sieve 3A

from lithium process residue



Leached spodumene residue treatment
Australian Provisional Patent Application
(lodged 20 October 2020)

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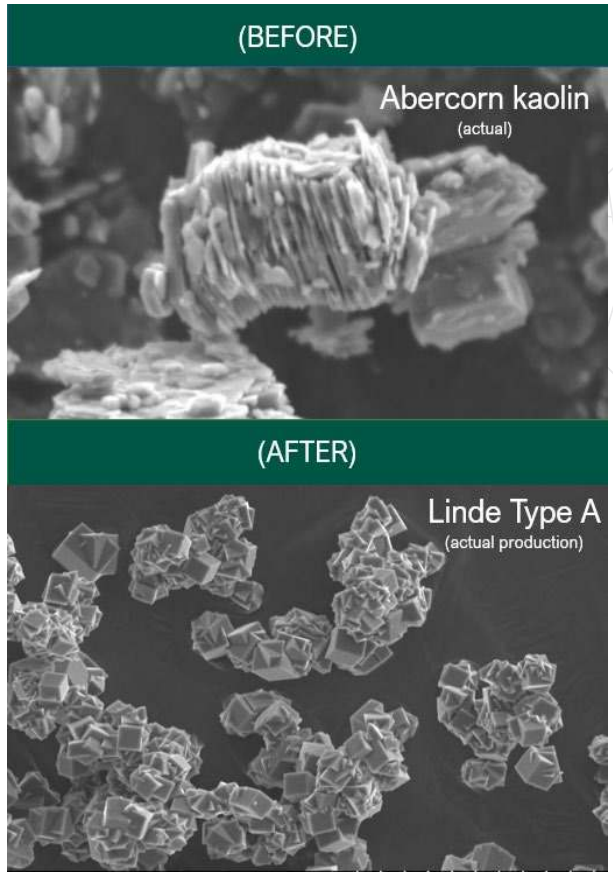
Patent-pending technology (low-cost synthetic zeolite production)

Simply, a novel patent-pending mineral process for the **low-cost production of synthetic zeolites**

The UQ Chemical Engineering team has demonstrated (under lab-scale conditions):

- Up to 70% reduction in energy consumption - thermal activation stage
- Up to 80% reduction in production time - subsequent zeolite precipitation steps
- Significant reduction in by-product waste
- Originally developed as a remediation solution for mine tailings
- Primary commercial plant P&E remains ‘conventional’ = low CapEx
- UQ Pilot Plant research program underway

Commercial grade Type A zeolite and molecular sieve grade zeolite produced



Images: Dr. Hong (Marco) Peng, The University of Queensland

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The Type A synthetic zeolite market

A mature established market valued at >A$2.6Bn:

Detergent grade zeolite manufactured for 30+ years

- 4A detergent grade = A$600-700/t
- 4A PVC heat stabiliser grade = A$725-785/t

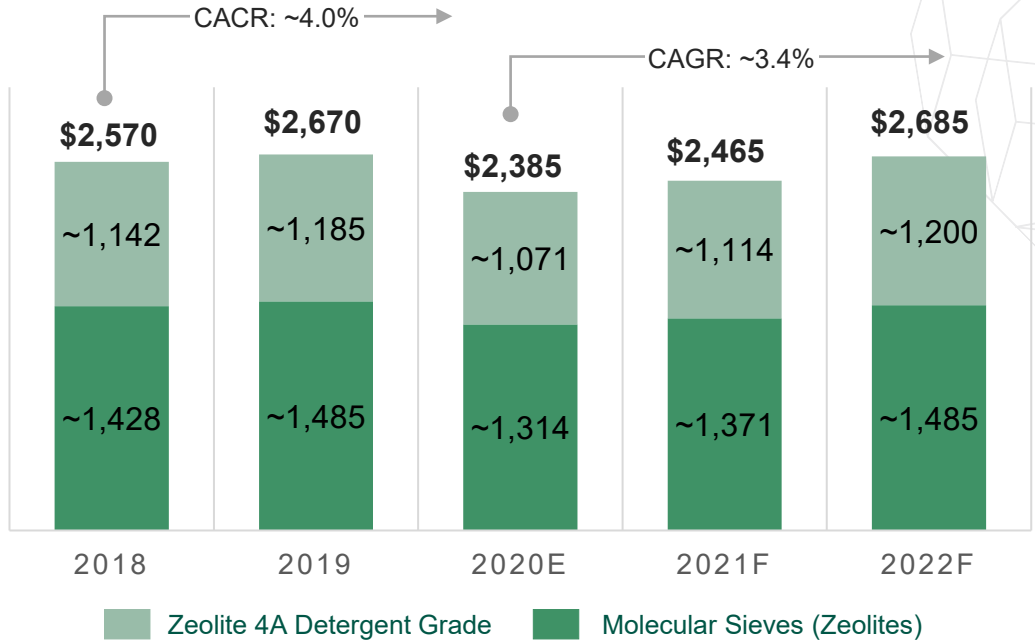
Targeting high value Type A Molecular Sieves

3A , 4A and 5A molecular sieve grade

- A$2,850-4,000/t (beads)
- A$3,000-3,785/t (pellets)

UQ has synthesised Type 3A zeolite which represents >40% of the global molecular sieve grade market

Global **Type A** synthetic zeolites market, by grade (A$ million)



AUD = USD 70c (FX)

Aranca – Global Analysis 4A Detergent and 3A, 4A and 5A molecular sieves grade Nov 2020 (market data)

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Zeolites play an important role in a cleaner and safer environment

- zeolites are an effective substitute for harmful phosphates in powder detergent, now banned in many parts of the world because of blue green algae toxicity in waterways;
- as catalysts, zeolites increase process efficiencies = decrease in energy consumption;
- zeolites can act as solid acids and reduce the need for more corrosive liquid acids;
- zeolites adsorbent capabilities see them widely used in water treatment i.e., heavy metal removal including those produced by nuclear fission; and
- as redox catalyst sorbents, zeolites can help remove exhaust gases and CFC's

image source: ScienceDirect
https://www.sciencedirect.com/science/article/pii/S2451929417304370

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Thank you

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