Sustainable, economical, and scalable processing of mesoporous silica

Technology invention

The University of Sheffield (TUoS) has developed a technology (*GNRG-02*) that can unlock the potential for mesoporous silica for a wide range of current and emerging industrial applications.

Context

The key barrier to progression of MCM-41 is its manufacturing process, specifically in terms of activation of the pore structure after synthesis. This is commonly achieved through calcination to thermally decompose surfactant molecule, however this increases the overall cost of production. As a result MCM-41 production on the kg-scale or higher is currently impossible economically. Indeed, multiple silica manufacturers (both small-scale and large multinationals) have identified this as a critical barrier towards their development in these areas, therefore industrial adoption of this technology once protected is highly likely.

Market Potential

These materials exhibit a diverse range of surface chemistry and (meso)pore geometry, enabling the materials to host chemical reactions, separations, and guest molecules. This has led to potential applications of mesoporous materials as CO_2 sorbents for large point sources (e.g. power plants), use as next-generation targeted drug delivery systems, and as (bio)catalyst supports enabling shape-selective or cascade reactions. However, despite these many areas of potential application (leading to ca. 14,000 citations for the paper describing its initial synthesis), no commercialisation of MCM-41 or other mesoporous silicas has been achieved to date at large scales.

Technology Description

The *GNRG-02* technology involves a room-temperature solvent extraction for MCM-41 activation and it can enable scale-up in a sustainable and economical fashion. A controlled extraction of the template is possible using this method.

Advantages

- A room-temperature solvent extraction technique for MCM-41 activation is inherently sustainable and economical by design (reported for the first time).
- It avoids all drawbacks of calcination-based techniques.
- Fully removes the surfactant from as-made MCM-41 frameworks.
- This is the first report of an extraction technique that does not require large energy inputs typical of solvent reflux, irradiation or ultrasonication, or supercritical extraction using CO_2.
- Our technique involves only common industrial chemicals and processes, avoiding all of common practical issues.
- Costs of purification can be reduced by up to 97% compared to calcination, greatly improving the prospects of MCM-41 as an industrial material going forward.

Technology Status

This technology currently operating at technology readiness level 2.

Know-how is available to support the exploitation of the invention and any subsequently produced IP in collaboration with the chosen industrial partner.

Contact

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