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ExxonMobil and Instituto de Tecnologia Quimica Discover New Material That Could Significantly Reduce the Amount of Energy and Emissions Associated with Ethylene Production

- Collaboration leads to discovery of a new material able to separate ethylene from ethane
- Targeting up to a 25 percent reduction in both process energy needs and carbon dioxide emissions
- Research published in nation's leading peer-reviewed journal *Science*

IRVING, Texas--(BUSINESS WIRE)-- Scientists from ExxonMobil and the Instituto de Tecnologia Quimica (ITQ) in Valencia, Spain have discovered a potentially revolutionary new material that could significantly reduce the amount of energy and emissions associated with the production of ethylene. Depending on the application, use of the new material, in conjunction with other novel separation processes, could result in up to a 25 percent reduction in both the energy needed for ethylene separation, as well as the associated carbon dioxide emissions. Results of the research have been published in the peer-reviewed journal *Science*.

ExxonMobil and ITQ researchers found that the new material, composed of a uniquely structured silica zeolite, can be used in gas separation processes, such as the recovery of ethylene from ethane, with an unprecedented degree of selectivity at ambient temperature. The new material could provide insights into the design of additional materials to be used as adsorbents or membranes in a variety of different gas separation applications associated with chemical manufacturing. Zeolites are porous materials frequently used as adsorbents and catalysts in chemical processes.

"Cryogenic distillation, the current commercial-scale process used for ethylene separation, is an energy-intensive process," said Vijay Swarup, vice president of research and development at ExxonMobil Research and Engineering Company. "If advanced to commercial scale, use of this new material could significantly reduce the amount of energy and emissions associated with ethylene production. This is another great example of collaboration between industry and a university that is focused on driving solutions for improving energy efficiency and reducing carbon emissions from industrial processes."

Ethylene is a critical component in producing chemicals and plastics. Finding alternative, low-energy technologies to separate ethylene from ethane has been a longstanding challenge due to their similar properties. While chemical manufacturers have evaluated a

number of alternatives to cryogenic distillation, including new adsorbents and separation processes, many of these technologies are hindered by low selectivity and an inability to regenerate when exposed to contaminants.

The patented new material, ITQ-55, is able to selectively adsorb ethylene over ethane as a result of its unique flexible pore structure. Built from heart-shaped cages interconnected by flexible elongated pore openings, the material allows the diffusion of the flatter ethylene molecules as opposed to the more cylindrical-shaped ethane molecules. The new material acts as a flexible molecular sieve.

“ITQ-55 is a very interesting material whose unique combination of pore dimension, topology, flexibility and chemical composition results in a highly stable and inert material that is able to adsorb ethylene and filter out ethane,” said Professor Avelino Corma of the Instituto de Tecnologia Quimica and co-author of the research. “We are excited about this discovery and look forward to continuing our fruitful collaboration with ExxonMobil.”

Additional research must be conducted before the material can be considered for larger-scale demonstration and commercialization. Fundamental research will continue focusing on incorporating the material into a membrane and developing additional novel materials for gas separation.

“Our ultimate goal of actually replacing cryogenic distillation is a long-term challenge that will require many more years of research and testing, in and out of the lab,” said Gary Casty, section head for catalysis at ExxonMobil Research and Engineering Company. “Our next steps will focus on better understanding the full potential of this new zeolite material.”

Chemical plants account for about eight percent of global energy demand and about 15 percent of the projected growth in demand to 2040. As global populations and living standards continue to rise, demand for auto parts, housing materials, electronics and other products made from plastics and other petrochemicals will continue to grow. Improving industrial efficiency is part of ExxonMobil’s mission to meet the world’s growing need for energy while minimizing environmental impacts.

ExxonMobil works with about 80 universities around the world to explore next-generation energy technologies. In 2016, ExxonMobil and the Georgia Institute of Technology announced the development of a potential new material focusing on liquids separation that could also reduce the amount of energy and emissions associated with manufacturing plastics. The results of this joint research were published by*Science*, as well.

About ExxonMobil

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and results of new technologies, including efficiency gains and emission reductions, could vary depending on the outcome of further research and testing; the development and competitiveness of alternative technologies; the ability to scale pilot projects on a cost-effective basis; political and regulatory developments; and other factors discussed in this release and under the heading “Factors Affecting Future Results” on the Investors page of ExxonMobil’s website at exxonmobil.com.

About the Instituto de Tecnologia Quimica

The Instituto de Tecnología Química (ITQ) is a joint research center created in 1990 by the Universitat Politècnica de València and the Consejo Superior de Investigaciones Científicas. The ITQ is an international reference center in the area of catalysis and new materials (especially zeolites) and also in photochemistry. Due to its excellent fundamental and oriented research level and to its multidisciplinary character, the ITQ has the possibility to develop research in different disciplines having an extraordinary flexibility and capability to adapt itself to new research challenges.

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