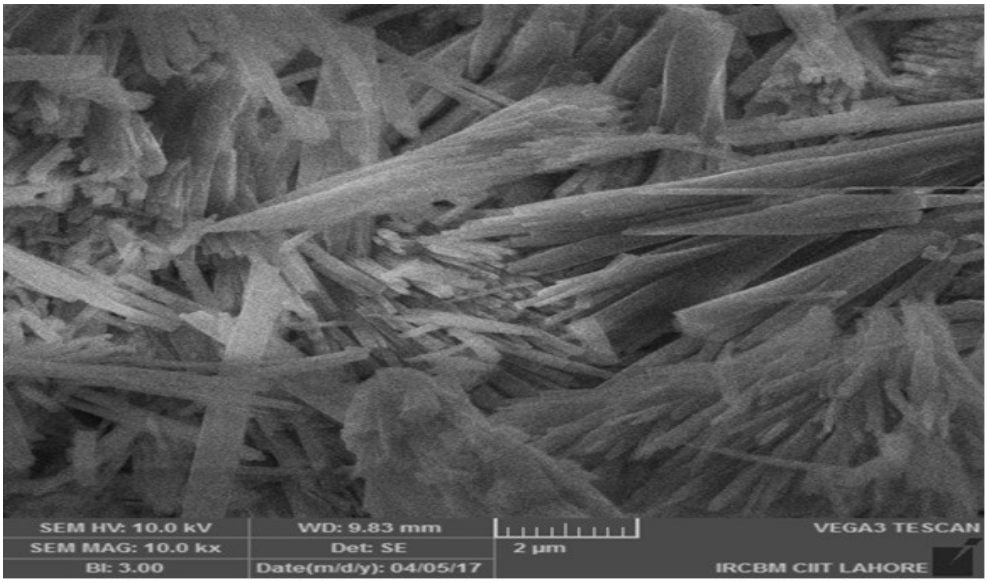
Combating Global Warming with Metal Organic Frameworks



The team created flakes like BioMOF-1 for CO_2 capture.

Researchers from Chemical Engineering Dept, CUI Lahore Campus and Lahore School of Economics have generated membranes, consisting of metal ions held together by organic ligands, namely BioMOFs, that have the potential to efficiently capture atmo carbon dioxide.

Carbon dioxide is one of the major contributors to global warming that has serious long-term consequences for our planet. It is projected that with current emissions level, the global average temperature will rise between 1.1°C and 6.4°C in this century. The subsequent adverse impacts of this increase in global temperature include rising sea levels causing heavy floods and global food crisis. Pakistan is among the top ten countries that are going to experience the worst effects of global warming.

"Membrane technology is one of the most sustainable routes to capture CO_2 emissions due to their inherent advantages and operation on green principles" says CUI team lead Dr. Asim Laeeq Khan. The 'Membrane Lab' at the Department of Chemical

Engineering, CUI Lahore is equipped with state-of-the-art facilities for the fabrication and testing of membranes for numerous applications including gas separations.

The current technologies for CO_2 capture are energy intensive, involve high costs and have large ecological footprint. Replacing these technologies is a key aim of Membrane Systems Research Group at CUI. A potential replacement examined by Dr. Khan and his team are metal organic frameworks based mixed matrix membranes, which can have significantly less environmental impact than organic solvents.

"Bio-MOFs are the MOFs constructed with the incorporation of simple biomolecules and are very attractive candidate for molecular gas application due to their permanent microporosity with narrow pore dimension, high surface areas, and chemical stability" says Sudeeha Ishaq, Mphil student at Lahore School of Economics who carried out her Mphil thesis in Dr. Khan's lab. The study published in 'Separation and Purification Technology' shows that these MOFs are also associated with some exceptional CO_2 adsorption capacity due to the presence of basic bio-molecule building units.

One remaining hurdle is the high cost involved in the upscale of these MOFs compared to conventional organic solvents. "The production of these MOFs involve the use of green and cheap solvents, hence production costs will be reduced and the process would be even more eco-friendly," Dr. Khan says.

Reference: S. Ishaq, R. Tamime, M. R. Bilad, **A. L Khan***, Mixed Matrix Membranes comprising of Polysulfone and Microporous BIO-MOF-1: Preparation and Gas Separation Properties, *Separation and Purification Technology*, 210 (2019) 442.