

There is no life without water, but the availability of sufficient drinking water is no longer secured in many regions of the world. In response to this problem, the United Nations has defined 17 Sustainable Development Goals to be achieved by 2030 in order to combat poverty and social inequalities and improve general wealth on this planet. Goal number 6, for example, states that all people should have sufficient water for drinking and daily personal hygiene. However, due to the climate crisis and the increasingly wasteful lifestyle of modern societies, this goal is increasingly becoming a distant prospect. Already today, more than 2 billion people do not have enough water to meet their daily needs and we in Europe will also have to deal with this problem in the coming decade.

In times of crisis and trouble, people often look to the sky for answers, but sometimes the sky itself is the solution. At any given time, our atmosphere contains six times more water than all the rivers in the world combined. However, although water is available in virtually unlimited quantities everywhere, it is difficult to extract and can often only be realised at high humidity levels and/or with considerable energy input. To tackle this issue, we have developed a highly porous material, which is able to adsorb water from the atmosphere on its surface even in the harshest environments on the planet, such as the Sahara Desert. Subsequently, the water can be effectively harvested with the help of sunlight, which represents a low-energy extraction method. Under optimal conditions, up to 0.8 litres of water can be extracted with one kilogram of the material per uptake-desorption cycle. Leveraging the almost unlimited availability of water in the air, as well as a fast and cost-effective production, which only requires cheap and readily available reagents, our technology represents a geographically non-restricted solution to one of the most pressing problems of the decade.

Our team, consisting of my professor Robert Woodward and myself, Paul Schweng, a PhD student at the Institute of Materials Chemistry and Research at the University of Vienna, has made significant progress in developing a low-cost, highly porous material for harvesting water from the air. We have extensively characterised the chemical and physical properties of the material, as well as its thermal stability, and identified key properties for excellent performance. We have investigated the water sorption capability of our material under various controlled conditions (i.e. temperature and relative humidity), demonstrating the versatility and robustness of our material in a variety of environments. Real-world testing with an early custom-built prototype demonstrated the potential for our material to be used in a variety of real-world conditions, and the material has shown stable performance over more than one hundred adsorption-desorption cycles without significant loss of efficiency or porosity. Comparison with leading materials published in the academic literature shows that our material is competitive with a wide range of existing adsorbents, while it could be produced at a fraction of the cost. In addition, the simple synthesis requiring only chemicals, which are currently produced on a multi-million tonne scale, makes it a viable option for mass production.