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Abstract Formulary

Presentation type: **Oral** ☐ **Poster** ✔

Title: Moisture-indicating cellulose aerogels for multiple atmospheric water harvesting cycles driven by solar energy

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ABSTRACT (Space limited to 2200 characters)

Water scarcity has become an urgent global challenge intertwined with energy crisis and environment deterioration for a sustainable society. Many attempts including seawater desalination and wastewater reuse are being engaged to solve this problem. However, these methods are limited to coastal areas or complex processing equipment. According to a report, about 10^{21} L of water exists in the atmosphere constantly. Therefore, atmospheric water harvesting (AWH) is considered as a feasible strategy to address the problem of water scarcity. Despite the boom in techniques used in AWH, few studies focus on hygroscopic materials that can indicate a moisture change in real time. Here, a moisture-indicating hygroscopic aerogel working in a broad range of relative humidities and with fast sorption kinetics is designed for solar driven AWH by integrating ethanolamine-decorated $CoCl_2$ (E-$CoCl_2$), microfibrillated cellulose (MFC) and LiCl-decorated polypyrrole. The specimen can visually indicate the sorption process in real time, achieving a flexible response to changes in environmental humidity and solar radiation. Fabricating an open, interconnected skeleton in E-$CoCl_2$ using MFC can effectively shortens the diffusion length of moist air from the aerogel surface to the bulk and increases the number of accessible moisture-capturing sites leading to a fast sorption kinetics and also preventing the leakage of liquefied salt solution. The specimen has water sorption capacities of 0.39 -2.05 kg kg^{-1} under RH 25 -85% within 3.5 h and can quickly desorb within 1.5 h under 1 sun. It achieves visible real-time monitoring of moisture change along with fast sorption kinetics and makes it possible to realize multiple sorption/desorption cycles on a random sunny day. An AWH device can conduct 3 sorption/desorption cycles within 9 h during one day outdoors and produces 2.81 kg_{water} $kg_{sorbent}^{-1}$. This strategy is a promising approach to enable sustainable water delivery without geographical and hydrological limitations, especially for the landlocked communities and arid areas and provides a new direction for flexible and efficient AWH.