博 士 論 文 の 内 容 の 要 旨
Abstract of Doctoral Dissertation

氏名 Full Name	ZHANG YI
学位名 Name of Degree	博士 Doctor of（工学／ENGINEERING）
学位授与年月日 Date of The Degree Conferral	2024 年　3 月 20 日/March 20th
論文題目 Dissertation Title	Study on optimizing water harvesting through bioinspired nanocomposites （バイオインスパイアされたナノ複合材料による水採取の最適化に関する研究）

（博士論文の内容の要旨　Abstract of Doctoral Dissertation）

Water is the lifeblood of our planet, and the adage "No water today, no tears tomorrow" underscores the profound importance of this invaluable resource. The rapid expansion of modern society and human civilization has further exacerbated the global water resource crisis, underscoring the pressing need for solutions. In this research, the focus has shifted not only to securing a direct source of clean water that is fog but also to the efficient utilization of existing water resources.

The turning point in our pursuit of innovative solutions came in the previous century when scientists stumbled upon a serendipitous discovery – the remarkable water collection abilities of beetles thriving in the arid Namib Desert. This revelation ignited a surge of research in the field of fog water harvesting, with the seminal article "Water capture by a desert beetle" published in Nature in 2001 acting as a catalyst. These unassuming desert dwellers unwittingly set off a wave of scholarly interest in biomimetic water collection. Their intricate behaviors and natural structures became a wellspring of inspiration, propelling extensive research and innovation in the realm of clean water production. Simultaneously, atmospheric water harvesting (AWH) has emerged as a promising solution for mitigating the global clean water shortage by extracting fresh water from abundant airborne moisture. Capitalizing on the ubiquity of atmospheric moisture, AWH transcends geographical constraints, facilitating decentralized applications. AWH thus takes its place as a vital parallel or supplementary freshwater production method alongside conventional liquid water resource-based technologies.

Within the vast reservoir of atmospheric moisture, seawater, a fundamental component of Earth's water resources, has also garnered significant attention. Insights derived from studying the water collection strategies and mechanisms employed by plants and animals have informed the development of materials engineered for efficient water harvesting. This, in turn, has steered our research toward materials designed to harness water resources in diverse and extreme conditions.

In this comprehensive study, we embarked on a multifaceted exploration that transitioned from developing biomimetic materials tailored exclusively for fog water collection to the creation of versatile materials capable of obtaining clean water in various scenarios. This evolution saw the shift from 2D membrane structures, as discussed in Chapter 2 and 3, to the intricate 3D hydrogels explored in Chapter 4.