Journal of Membrane Science & Technology
ISSN: 2155-9589
OPEN ACCESS Freely available online
Editorial

The Use of Hydrogel Beads to Immobilise Active Ammonia-Oxidizing Archaea

Ruby John*

Editorial office, Journal of Membrane Science and Technology, Spain

EDITORIAL NOTE

One of the most common clades of mesophilic and thermophilic *Thaumarchaeota* are ammonium-oxidizing archaea. They play an important part in the global nitrogen cycle and can be found in terrestrial, marine, and geothermal habitats. Their existence in activated sludge reactors and wastewater treatment plants suggests that they, like their bacterial counterparts, play a role in ammonium removal. Ammonia-Oxidizing Archaea (AOA) combines with anaerobic ammonium oxidising bacteria in the Oxygen Minimum Zones (OMZ), causing up to 50% of the ocean's nitrogen loss.

AOA converts ammonium to nitrite under a wide range of temperatures and pH values, exerting dominant control over ammonia oxidation at very low ammonia and oxygen concentrations. Low microbial yields and growth rates come from this lifestyle, which is near to the thermodynamic edge of net energy gain. With the discovery of the first AOA, *Nitrosopumilus maritimus*, new avenues for research into the physiology and biotechnological potential of this remarkable archaeal group were opened. However, because of their slow growth and limited ability to form biofilms, they are difficult to enrich and investigate in continuously fed reactor systems, where product inhibition and retention are a problem.

Cell immobilisation which has previously been used in the food, pharmaceutical, and environmental domains, is one method for enhancing cellular retention duration. Adsorption or adhesion of cells to inert surfaces, self-aggregation of cells via flocculation, and cell entrapment in polymer gels or other forms of matrix material are all examples of cell immobilisation methods. Cellular entrapment of active cells in hydrogels generated by crosslinking a synthetic polymer matrix is a well-documented general utility technique among current techniques. Small compounds can diffuse through hydrogels, sustaining biological activity and growth while keeping cells in a stable network.

As a result, hydrogels have various advantages over suspended growth environments, including high cell density, washout prevention, solid/liquid separation ease, reusability, and the matrix material's protection of cellular integrity. Cell entrapment in hydrogels has been utilised to build sophisticated wastewater treatment technologies and to investigate complicated microbial communities such as those found in the gut and hydrothermal vents.

Main goal in this study was to establish immobilisation of active ammonia-oxidizing archaea in isolation in hydrogels generated by mild ionic connections (calcium and barium) or physical interactions, as *Anammox* bacteria have previously been shown to thrive in hydrogels. We conducted complementary analyses of the stabilisation and diffusivity of key nitrogen species (ammonium, nitrite, and nitrate) for distinct gel formulations, in addition to emphasizing the retention of viable cells with gel encapsulation, to aid in the layout of more active and rigorous hydrogels, and provide practical information to help select the appropriate formulation for future implementation. Hydrogels had 2 to 3 times higher diffusion coefficients than granules, with ammonium diffusivity being around 35 percent higher than nitrite and nitrate. Although a prolonged latent period in discrete particles, embedded AOA maintained a high per volume rate of ammonia oxidation, suitable for research and wastewater treatment processes.

We believe that this method of bead production, which is ideal for retaining a high level of activity in the slow-growing and picky AOA, will have broader applications in the research of AOA physiology in continuous flow systems and enhanced ammonium treatment of conventional wastewater.

Correspondence to: Ruby John, Editorial Office, Journal of Membrane Sciences and Technology, Spain, Email: biologscience@escienceopen.com

Received: September 16, 2021; **Accepted:** September 25, 2021; **Published:** October 1, 2021

Citation: John R (2021) The Use of Hydrogel Beads to Immobilise Active Ammonia-Oxidizing Archaea. J Membr Sci Technol. 11:250.