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The mechanical consequence of ocean acidification - the application of finite element analysis

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Li Chaoyi[1] ; Chan VBS[1] ; Meng Yuan[1*] ; HE C[2] ; YAO H[2] ; SHIH H[3] ; THIYAGARAJAN V[1]
LI, Chaoyi[1] ; CHAN, Vbs[1] ; MENG, Yuan[1*] ; HE, C[2] ; YAO, H[2] ; SHIH, H[3] ; THIYAGARAJAN, V[1]

[1]Swire Institute of Marine Sciences and School of Biological Sciences, The University of Hong Kong, [2]Department of Mechanical Engineering, The Hong Kong Polytechnic University, [3]Department of Civil Engineering, The University of Hong Kong
[1]Swire Institute of Marine Sciences and School of Biological Sciences, The University of Hong Kong, [2]Department of Mechanical Engineering, The Hong Kong Polytechnic University, [3]Department of Civil Engineering, The University of Hong Kong

We studied the effects of low pH (near-future average pH 7.8) seawater on the structure and mechanical properties of the calcifying serpulid tubeworm, *Hydroides elegans*, compared to normal pH (current average pH 8.1).

We found that tubes produced at pH 7.8 altered tube ultrastructure, volume and density, and decreased the mean tube hardness and elasticity to a large extent by ˜80% and ˜70%, respectively. Specifically, mechanical properties of the outer and inner surfaces of the tube were curbed by pH 7.8, and the tube breaking force required to damage the tube was reduced by 64%.

Nano-indentation to spatially map the micromechanical properties of tubes built by the biofouling serpulid tubeworm, *Hydroides elegans*. The mechanical information was analyzed by computational model, finite element analysis (FEA). In order to study the details of strength properties of the shell, finite element analysis (FEA) was used to simulate the consequence of predatory attack in nature for both shells produced in the control and treatment seawater. The finite element analysis provided a reasonable answer to this phenomenon: altered mechanical properties shifted the stress development and distribution within the tubes and therefore resulting in mechanical weaker part of that were suffering from higher stress concentration.

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