Bubble Curtains: Exploring How Bubble Density and Water Temperature Affect Underwater Sound Propagation

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Bubble curtains have a wide range of important applications, ranging from underwater gear protection to sound pollution reduction and oil spill control, and increasing numbers of offshore projects (such as offshore wind construction) and changes in water temperature with climate change may impact their use and productivity. Bubble curtains work by creating a variance in density between water and the bubbles which reduces the speed and increases the attenuation of sound waves. Research into how bubble curtains are affected by water temperature and bubble density that would contribute to the most effective bubble curtain design for minimizing noise would help improve the effectiveness and cost efficiency of such tools. This project investigated the effect of temperature of water and density of bubbles on noise reduction using a single row and double row bubble curtain (airline tubing with 1 cm slits to allow for bubble formation) attached to a 70 L/min air pump. Varying frequencies were played from an underwater speaker and decibel levels were measured before and after the bubble curtain with a hydrophone for water temperatures of 20 degrees Celsius and 30 degrees Celsius. Python was used for analysis. After experimentation it was found that the most effective bubble curtain for sound attenuation was the 2-layer (denser bubbles) bubble curtain in 30 degrees Celsius water due to increased density variance and less dense water that slows sound speed. Therefore, it is suggested that dense bubble curtains be used for maximum effectiveness and bubble curtains will continue to be valuable tools as ocean temperatures change. Continued experimentation with varying bubble size, temperatures, and frequencies would be beneficial.

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